

[54] COMPRESSED AIR CLEANING TOOL

[76] Inventor: William F. Aberilla, 45-111 E.
Waikapoki Road, Kaneohe, Hawaii
96744

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[58] Field of Search 15/409, 414; 285/235

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Primary Examiner—Harvey C. Hornsby

Assistant Examiner—C. K. Moore

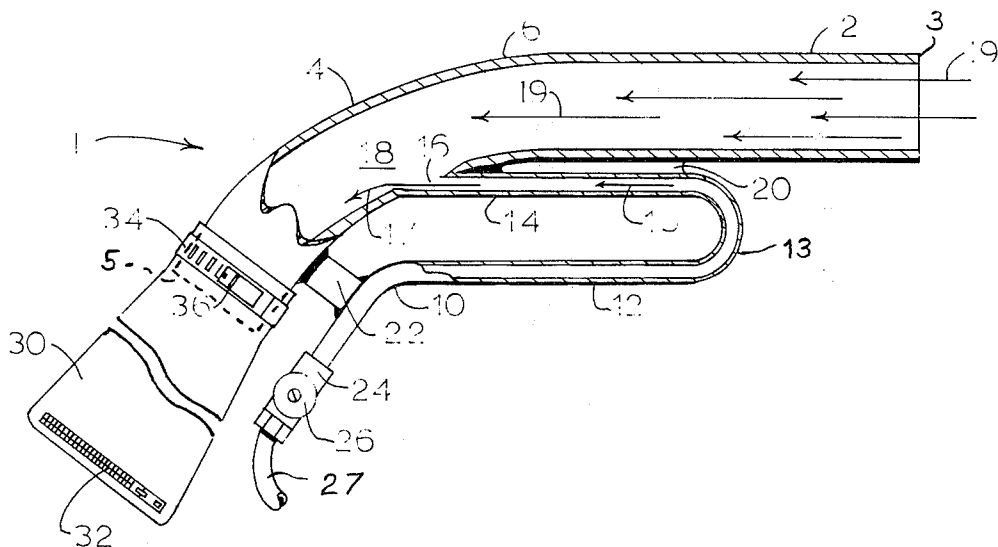
Attorney, Agent, or Firm—James C. Wray

[57] ABSTRACT

A compressed air cleaning tool has a curved tube

formed of a straight portion opening at a distal end and a curved portion extending downward from the straight portion remote from the distal end. An air supply tube is connected with the curved tube portion beneath the straight portion for flowing high pressure air into the curved portion in a direction generally parallel to the straight portion. High pressure air impinges against the opposite side wall of the curved portion, forming a cone, producing a relatively large pressure differential, entraining air and materials through the distal end into the straight tube and curved tube portions, and flowing the compressed air and the entrained air and materials out of the proximal end of the curved tube. The air supply tube is re-entrantly bent to form a long laminar flow promoting position, and to form a loop beneath the curved tube for inserting the fingers to aid in holding the tool. Air supply is controlled by a valve at the end of the rigid air tube near the proximal end of the curved tube. A collection sleeve with a resealable closure at a remote end is clamped to the proximal end of the curved tube. Extensions and attachments are connected to the distal end by stretchable sleeves which fit over the distal end and which fit over collars or short pieces of cylindrical tubing having an outer dimension commensurate with that of the distal end. Long extension tubes or attachments are mounted within the collars. Several extensions having short pieces of tubing welded or bonded to opposite ends may be connected together using stretchable sleeves.

10 Claims, 5 Drawing Figures



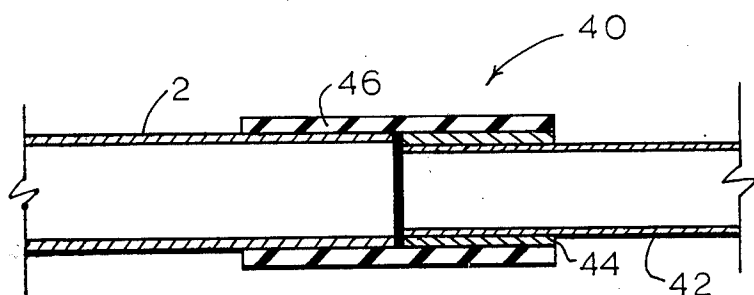
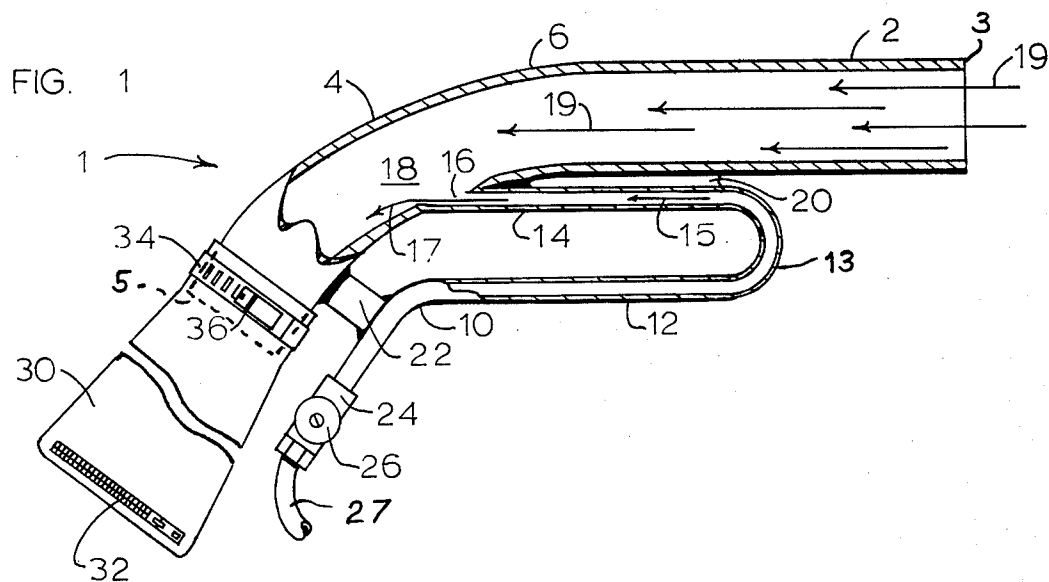


FIG. 2

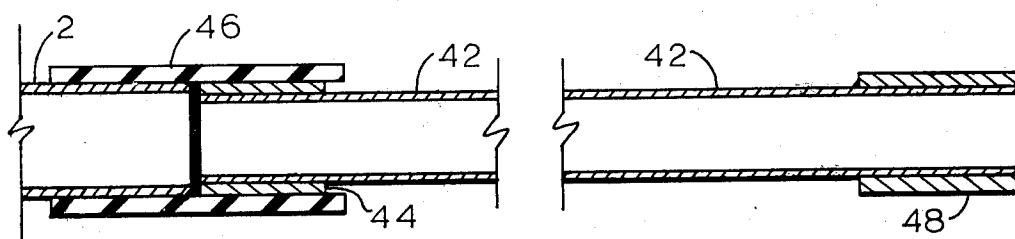


FIG. 3

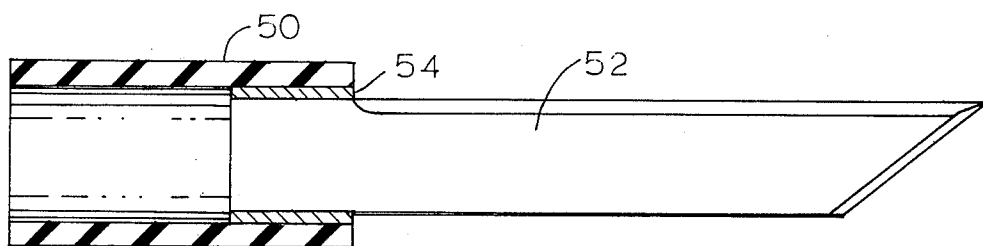


FIG. 4

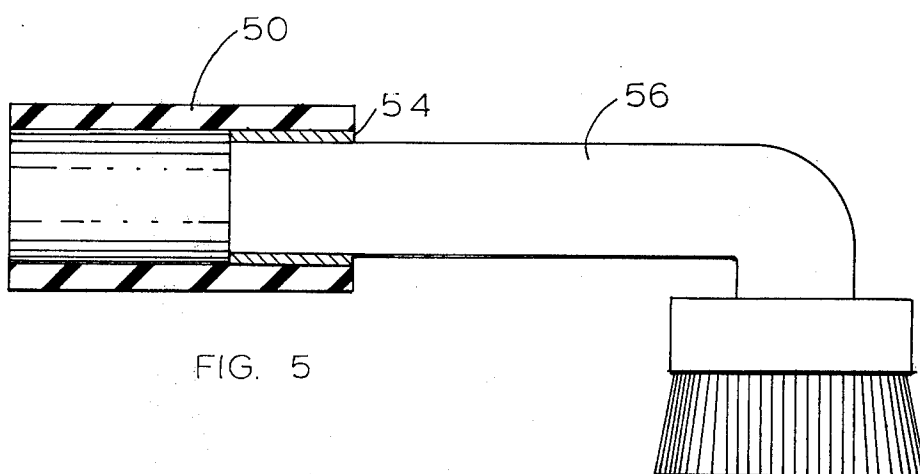


FIG. 5

COMPRESSED AIR CLEANING TOOL

BACKGROUND OF THE INVENTION

Factories and shops are conventionally supplied with different power sources. Usually electric power lines are installed with many outlets for convenient attaching of permanent fixture tools and smaller portable tools. Often, air supply lines are mounted around a plant with several outlets for operating permanent installations such as large lifts and for attaching portable and movable equipment through long flexible lines.

It is substantially universal to have such compressed air supply service lines readily available throughout vehicle repair activities such as aircraft, truck and automobile shops.

A large group of permanently installed equipment and portable machines and tools operated by compressed air is available. It has been found by one working in factories and shops that it is extremely convenient to have a small, compact, hand-held suction cleaning tool. It is particularly important that such a tool have a high degree of suction for picking up great quantities and weights of particulate material as well as fluids including heavy liquids. It is extremely important that such a tool be sufficiently compact to fit in a small tool box, without sacrificing the suction qualities of the tool. The tool should be readily adaptable to different configurations and lengths to perform varied tasks. The tool must be convenient to hold and use.

Heretofore no equipment has been available to fulfill all of these requirements.

A collection of air operated suction equipment is found in Class 15, subclass 409 of the U.S. Patent Office Official Classification. Examples of patents in that classification which are pertinent are U.S. Pat. Nos.: 2,856,205; 2,324,422; 2,923,959; 3,444,584; 2,605,043 and 1,477,118.

U.S. Pat. No. 2,856,205 illustrates and describes a hand-held air operated vacuum device. Pressurized air is released straight down a second tube portion at an angle to a pickup tube portion. Features and advantages of the present invention are not found in this or other prior art devices.

SUMMARY OF THE INVENTION

The present invention provides a small compact high vacuum, hand-held vacuum cleaner device which is operated from a compressed air source. The system of the present invention employs a curved tube having a straight portion and a curved portion. Compressed air is ejected into the curved portion beneath the straight portion in a direction parallel to the straight portion, and the compressed air impinges on the opposite wall, forming a concave sheet of air rushing toward the proximal end of the curved tube, which is remote from the straight tube portion, thereby creating a reduced pressure within the curved tube, and drawing air at a high velocity in through the distal open end of the straight tube portion, entraining particulate matter and fluids. The rigid air supply line which is attached to the curved tube has an extended straight section beneath the straight section of the suction tube for insuring laminar flow into the curved tube to produce the large pressure differential.

The rigid air supply tube is re-entrantly bent so that it curves beneath a central portion of the straight tube.

The rigid supply tube then continues parallel to its outlet leg at a position spaced from the curved tube. The loop thus formed provides a handle for securely holding the vacuum apparatus tool.

A valve is provided at the end of the air supply tube near the proximal end of the curved tube for controlling air inlet to the vacuum tube and vacuum formed in the tube. The valve is associated with a quick connect coupling of a conventional design which connects the valve to a related coupling on a flexible air hose.

A debris collection sheath is provided at the proximal end of the curved tube. The sheath has a restricted opening which is placed over the distal end of the tube. A clamp secures the sheath to the tube. The opposite end of the sheath is closed by a resealable closure such as a slide fastener for closing the sheath in use and for opening the sheath to remove debris therefrom.

Included in the apparatus of the present invention are extensions and attachments which comprise elongated tubes having welded at ends collars of short lengths of tubing commensurate in size with the distal end of the curved tube. A collar on one end of the attachment or tubing has a flexible stretchable sleeve for sliding over the distal end and gripping the distal end, holding the attachment or extension tightly against the distal end and sealing the connection against pressure loss.

One object of the invention is the provision of a compact high vacuum producing hand tool for use with an air supply line which has a curved pickup tube with a relatively long straight portion and an integrally formed curved portion with a high pressure air inlet in the curved portion beneath the straight portion for forming a high velocity sheet in the curved portion directed toward an open proximal end of the curved portion, thereby forming a reduced pressure zone in the pickup tube for drawing air, particles and fluids into the pickup tube and entraining the air and particles and fluids in the high velocity stream and expelling the materials through the proximal end of the tube.

Another object of the invention is the provision of a compact cleaning apparatus for use with high pressure air systems has an elongated parallel air supply tube mounted beneath an elongated parallel pickup tube for injecting air into a curved tube portion beneath the straight tube portion to produce a large pressure differential.

Another object of the invention is the provision of a re-entrantly curved air supply tube below a pickup tube of a hand held cleaning device which operates on air pressure for providing a handle to the cleaning device.

Another object of the invention is the provision of attachment means for air operated cleaning devices which include elongated tubes, collars of short tubing welded or bonded to ends of the tubes and stretchable sleeves overlying the collars and extending outward to overlie commensurate sized ends of tubes for rigidly joining the tubes and sealing the tubes against pressure loss.

These and other objects and features of the present invention are apparent in the disclosure which includes the drawings, the foregoing and ongoing specification, and the claims which are a part thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially cutaway, partially foreshortened representation of the compressed air operated cleaning apparatus of the present invention.

FIG. 2 is a detail of a tube length.

FIG. 3 is a detail of an extension shown in cross-section.

FIG. 4 is a detail of an attachment for the cleaning device of the present invention.

FIG. 5 is a detail of an attachment, shown partially in cross-section.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to the drawings an air operated vacuum cleaning tool is generally referred to by the numeral 1. The tool has a curved tube which has an axially elongated straight portion 2 terminating outwardly in a distal end 3. A curved portion 4 extends downward to a proximal end 5.

Curved portion 4 and straight portion 2 are integrally joined at intersection 6.

A rigid air supply tube 10 is joined to the main section tube with a horizontal leg 12 of tube 10 spaced generally parallel to straight portion 2 of the main tube. A re-entrant bend 13 provides a straight section 14 of the air inlet tube to create laminar flow 15 of the compressed air before it enters the suction tube. As the compressed air enters curved portion 4 at an opening 16 just below the straight portion 2, the compressed air spreads out in a sheet, impinges against the opposite inner wall of curved portion 4 and moves downward toward the proximal end 5 cone-like shaped, creating a reduced pressure in space 18. Ambient fluid 19 is drawn in and entrained in the compressed air 17 as it flows out the proximal end 5.

A bead 20 of welded or bonded material is formed between straight portion 2 of the main tube and straight section 14 of the air supply tube for creating a rigid connection between the two tubes. A spacer 22 is bonded between the two tubes beneath the curved portion 4 so that the rigid loop of the air supply line forms a convenient grip in which fingers may be inserted.

Valve 24 and controller 26 mounted on the end of the supply line 10 near proximal end 5 of the tube control the flow of the compressed air into the tube. A flexible air supply line 27 is connected by a quick connect coupling universally used with air tools.

A sheath 30 of a porous material has one end connected to proximal end 5 of the tube by a clamp 34 and clamping screw 36. A slide fastener 32 closes the remote end of sheath 30 so that debris can be removed.

Referring to FIG. 2, an attachment or extension generally indicated by the numeral 40 is connected to a distal end of the straight portion 2 of the main tube. The extension 40 has a tube 42 of slightly smaller diameter than the main tube. A collar 44 which is a short length of tubing, is bonded to an exterior of one end of tube 42 and a resilient stretchable sleeve 46 tightly grips collar 44 and the wall at the end of tube 2. The sleeve 46 holds the extension and tube 2 in rigid connection and seals the joints against pressure leakage.

In FIG. 3 an extension 42 is shown in foreshortened form. The extension has a collar 44 at a first end and a similar collar 48 formed of a short cylindrical tube at its opposite end.

In FIG. 4, a gripping sleeve is generally indicated by the numeral 50. A specially designed hollow cleaning implement 52 has a collar 54 mounted at one end, and the collar abuts a similar collar on an extension or the end of the straight portion 2 of the main suction tube.

A hollow tubed implement 56 is shown in another modification with a similar end structure in FIG. 5.

While the invention has been described with reference to specific embodiments, it will be obvious to those skilled in the art that various modifications and variations may be made without departing from the spirit or scope of the invention. The scope of the invention is defined in the following claims.

I claim:

1. A vacuum cleaning tool apparatus for attachment to a compressed air supply comprising a curved tube having an open distal end, a relatively straight and relatively long axially extending portion leading inward from the distal end, a curved portion extending downward from the straight portion remote from the distal end, the curved portion terminating in a proximal end, an air supply line connected to the tube at an inside of the curved portion near an intersection with the straight portion for directing compressed air from a supply into the tube toward the outside of the curved portion in a direction away from the distal end and toward the proximal end for forcing the compressed air from the supply through the proximal end of the tube, entraining fluid within the tube and carrying entrained fluid out through the proximal end, thereby creating a reduced pressure near an intersection of the curved and straight tube portions for causing fluid to flow into the straight tube through the open distal end, thereby entraining materials and flowing materials into the curved portion and out of the proximal end.

2. The apparatus of claim 1 further comprising axially oriented and radially expanded collection means attached to the proximal end.

3. The apparatus of claim 2 wherein the collection means comprises a porous debris-catching sheath having a narrow portion surrounding the proximal end of the tube, and clamping means surrounding the narrow portion and securing the narrow portion of the sheath to the proximal end of the tube.

4. The apparatus of claim 3 further comprising an opening in a side of an end of the sheath remote from the narrow portion and a resealable closure connected to the opening and closing the opening during use of the apparatus.

5. The apparatus of claim 2 wherein the air supply tube comprises a rigid tube extending generally parallel to the straight portion and opening into the distal end curved portion beneath the straight portion for directing air into the curved portion, parallel to the straight portion and impinging air on the opposite wall of the curved portion, thereby forming a cone which draws air through the straight portion down into the curved portion and out through the proximal end.

6. The apparatus of claim 5 wherein the rigid tube further has a curved portion, curving downward beneath the straight portion and a lower portion spaced further downward from the straight portion, and wherein the tube is anchored to the straight portion and to the curved portion of the main tube, thereby forming a loop for inserting fingers when holding the tool.

7. The apparatus of claim 6 further comprising a downward extending portion of the supply tube extending generally parallel to the main curved tube and control valve means connected to the downward extending portion for controlling supply air to the air supply tube.

8. The apparatus of claim 7 further comprising a flexible air supply line connected to the control valve.

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9. The apparatus of claim 1 further comprising a stretchable, flexible sleeve fitting over the distal end, and extending outward therefrom, a short cylinder of tubing having an outer dimension commensurate with an outer dimension of the distal end, the short tubing being positioned within the sleeve and an extension tube connected within the short tubing and extending

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outward therefrom away from the distal end.

10. The apparatus of claim 9 further comprising a short cylindrical tubing mounted on the extension tube at an end remote from its first end, for receiving a sleeve for connecting further extensions and attachments.

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