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2,475,832

SUCTION APPARATUS ACTUATED BY AIR PRESSURE

Filed Feb. 25, 1946

2 Sheets-Sheet 1

Fig. 1

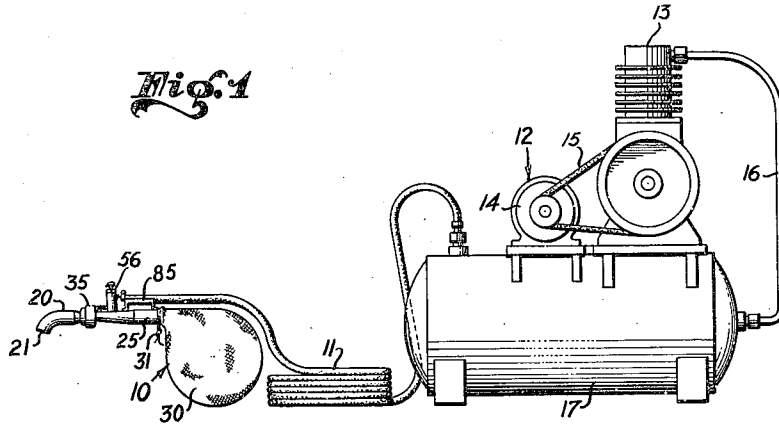


Fig. 2

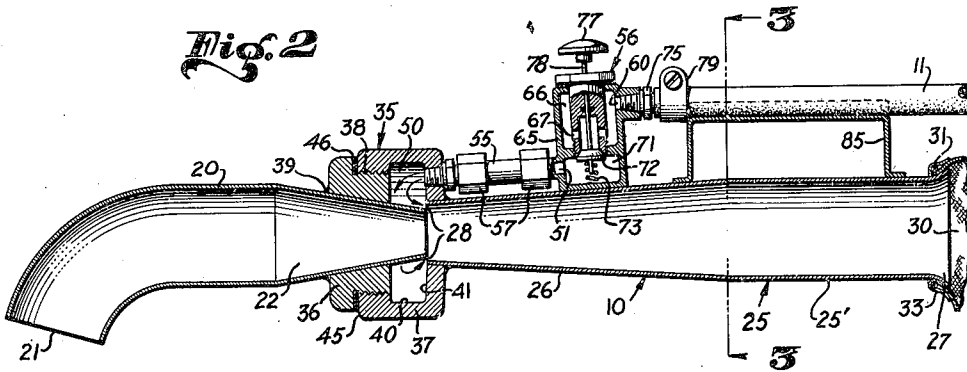
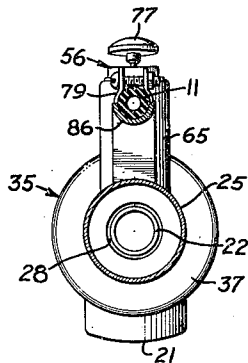


Fig. 3



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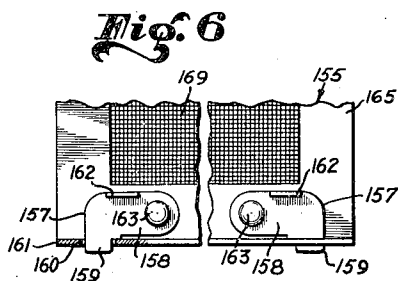
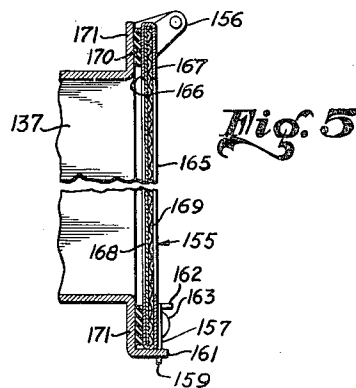
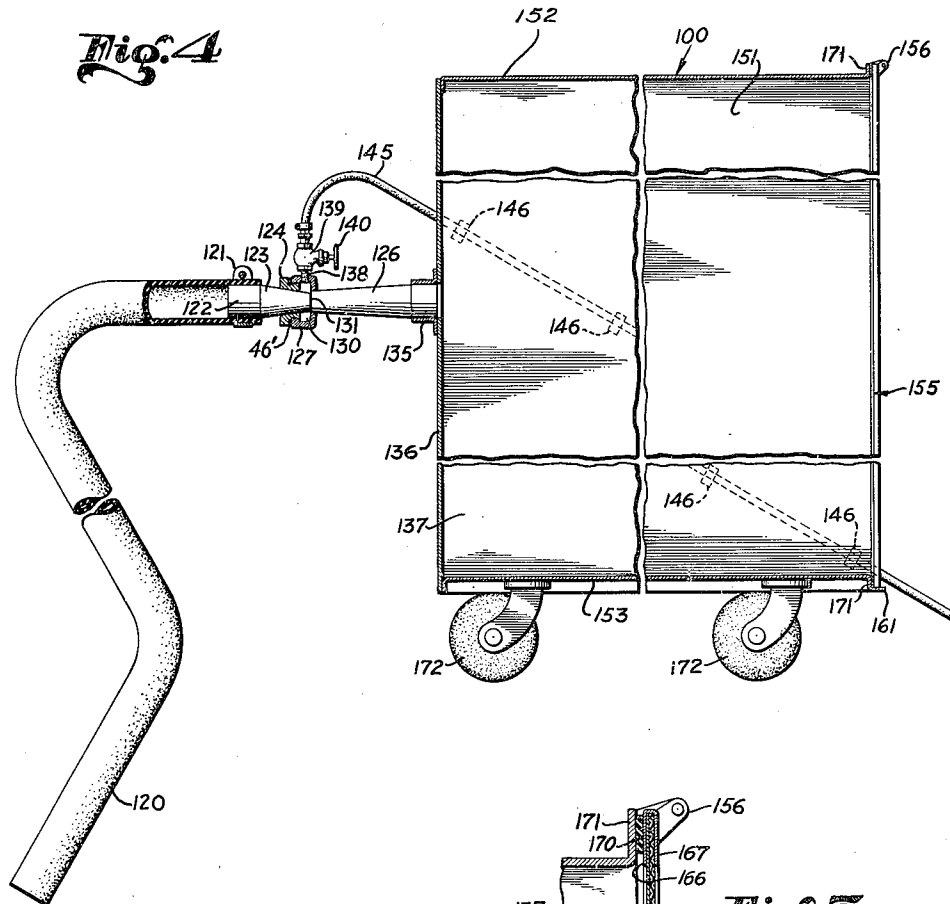
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SUCTION APPARATUS ACTUATED BY AIR PRESSURE

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2 Sheets-Sheet 2



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SUCTION APPARATUS ACTUATED BY AIR PRESSURE

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1 Claim. (Cl. 230—95)

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This invention relates to vacuum cleaning apparatus and more particularly to air suction apparatus energized by compressed air for sucking up refuse from floors or from machinery and the like.

Many times it is desirable to equip garages, gasoline stations, wood working shops, machine shops, factories and the like with suction cleaners to remove debris as it is produced by wood working or machine tools, and also from floors, corners or other areas of accumulation. Such commercial establishments are frequently equipped with air tanks and compressors which could be readily converted into vacuum cleaning apparatus according to the teaching of this invention. The necessary apparatus need comprise no more than a portable hand unit or a mobile wheeled unit which may be readily affixed to the outlet side of a compressor or compressed air tank by means of a hose or the like, and may thus utilize and add to the utility of existing shop equipment without the substantial expense of additional equipment.

Conventional commercial suction apparatus is cumbersome and is ill-adapted for sporadic use, chiefly because a motor, wheel, vane or other mechanical device must be set in motion. My invention on the other hand may be turned on and off instantly without the necessity of setting a mechanical apparatus in motion to create a vacuum.

It is often an objection to conventional vacuum equipment that the blades, motor and other moving parts become fouled or coated with dust, saw-dust and other debris so that breakdowns in the equipment is common. For example, electric motors which drive vacuum machinery frequently become clogged with fine saw-dust, arc and burn out.

It is therefore an object of this invention to provide a new and improved device by use of which a source of compressed air may be used to create a vacuum.

Another object of this invention is to provide a new and improved suction apparatus for shops, factories and the like which will overcome the above named difficulties and fulfill the requirements of a suction apparatus devoid of moving parts.

Another further object is to provide a new and improved mobile or portable suction apparatus of light weight, simple construction, which is readily and economically manufactured.

An additional object is to provide a new and useful means for economical and efficient re-

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moval of debris from a factory, shop or filling station.

Another object is to provide a suction apparatus which is positive and instantaneous in operation, and the motive power of which is remote and unconnected to the vacuum lines so as to avoid becoming fouled.

This invention also has for an object the elimination of disadvantages in connection with prior art apparatus of this general character.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the apparatus whereby the objects contemplated are attained as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevational view of a suction apparatus embodying my invention.

Figure 2 is a fragmentary longitudinal sectional view of the controls and operative mechanism associated with the left hand portion of Figure 1, drawn to a larger scale.

Figure 3 is a cross sectional view on the line 3—3 of Figure 2.

Figure 4 is an elevational view, in section, of a modified form of the invention, incorporating a debris separator.

Figure 5 is a detailed sectional view of the upper and lower right hand corners of the debris separator illustrated in Figure 4.

Figure 6 is a detailed fragmentary view of a latching mechanism and associated structure as seen from the lower left hand side of Figure 5.

Referring more particularly to the drawings I show a suction apparatus generally denoted by the numeral 10 connected by means of a compressed air line 11 to a compressed air unit, generally denoted by the reference numeral 12. The compressed air line is preferably of flexible hose.

The suction apparatus 10 generally comprises a nose tube 20 preferably curved downwardly at its terminal extremity 21, forming a suction inlet and formed at its other end with a nozzle 22 converging in a direction away from the inlet and terminating at the small end of a diverging nozzle 26 formed in a tail pipe 25. The converging nozzle 22 preferably extends slightly into the small end of the diverging nozzle but in laterally spaced relation defining an annular jet orifice 28 therebetween.

The tail pipe preferably comprises a cylindrical section 25' belled out at an outlet end 27 for the purpose of removably securing a debris receptacle

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30 having in this embodiment the form of a closed foraminous bag or the like. For closing the bag around the outlet a draw string 31 may be utilized preferably extending through a loop 33 formed around the mouth of the bag. By use of a draw string the bag may be readily removed for cleaning and replaced.

Surrounding the adjoining adjacent end portions of the nozzles is a coupling 35 comprising a male fitting 36 and a female fitting 37 making a threaded connection 38 with one another. The male fitting may be secured as by welding, brazing, or the like at 39 to the periphery of the nose tube, while the female fitting may be similarly joined to the tail pipe.

The female fitting is formed with an axial bore 40, an inner wall 41 of which is approximately flush with the tip of the diverging nozzle 26. When coupled with the male fitting, an end 45 of the female fitting preferably abuts one face of a series of adjusting shims 46 bearing upon an annular shoulder formed in the male fitting, thereby forming an air-tight joint and at the same time spacing the inner end of the male fitting from the inner end of the female fitting. Positioning the fittings in the manner described fixes the size of an expansion chamber 50 to suitable size and properly spaces the nozzles one relative to the other.

An outlet port 51 of an air control valve 56 is connected with the air expansion chamber by means of a metal conduit 55 provided with couplings 57 to permit it to be removed whenever desired. At its inlet port 60 the valve may be threadedly connected with the flexible air hose 11.

The valve comprises a body 65 defining an inlet chamber 66 and parts 67. An outlet chamber 71 is continuous with the outlet port 51 and is sealed off from the inlet ports by a properly seated valve element 72 normally urged into a closed position against the seat by a spring 73. The valve may be opened by pressing a button 77 affixed to a valve stem 78.

A male fitting 75 of conventional design has one end threaded into the inlet port 60 of the valve and the other end clamped in place within the hose 11 by means of a clamp 79.

For convenience in transporting and using the apparatus a handle 85 is provided, formed with a transversely curved upper portion 86 for partially receiving the hose. By this device the hose is readily supported in aligned position, curving the handle for greater comfort, convenience and strength. The handle as well as the valve may be welded or otherwise secured to the tail pipe.

The compressor unit 12 comprises compressor 13 driven by a motor 14 as by means of a belt 15 and delivers air under pressure through a pipe 16 to a compressed air storage tank 17.

In the use of my improved suction apparatus, when the valve is manually opened by pressing down the button 77, compressed air from the tank 17 passes through the hose through the valve 56 and enters the gas expansion chamber 50 by way of the conduit 55. The compressed air expands with great force through the annular orifice 28 in the direction of the arrows, thence through the nozzle 26 and tail pipe 25 into the receptacle 30.

As the compressed air rushes into the tail pipe through the annular orifice, a pressure drop at the tip of the converging nozzle 22 draws air rapidly into the inlet end 21 of the nose tube carrying any debris adjacent the end into the

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tube, thence through the tail pipe and into the receptacle 30. The constant jet of air through the orifice 28 is thereby effective both to create a partial vacuum within the tube 20 and to cause a flow along the tail pipe into and through the pores of the receptacle 30, depositing the debris therein. The preferred embodiment illustrated in Figures 1 through 3, may be readily transported by means of the handle 85.

As a result of high air pressures that can be maintained in the tank 17, a very powerful, effective and immediate vacuum may be created whenever desired, merely upon opening the valve 56.

A modified form of the invention illustrated in Figures 4 through 6 discloses a mobile suction unit generally designated by the numeral 100 comprising a flexible hose piece 120 of substantial length secured by a clamp 121 tightened by means of a bolt to a cylindrical mouth portion 122 of a converging nozzle 123. The nozzle is secured by a male fitting 124 in a position adjacent to and in axial alignment with nozzle 126. A female fitting 127 secured to the male fitting contains an air expansion chamber 130 communicating with the nozzle 126 through an annular orifice 131 surrounding the tip of the converging nozzle.

The above described assembly may be slidably or rigidly mounted in a collar 135 adapted to fit over the end of the tail pipe, and affixed to a wall 136 of a debris receptacle 137.

Threaded to the female fitting 127 by means of a nipple 138 is a manually operable valve 139 provided with a stem and handle 140. The valve is connected at its inlet end with a flexible air hose 145 communicating with a suitable source of compressed air. For convenience the hose may be attached to the receptacle as by cleats 146.

The debris receptacle 137, rectangular in shape in the embodiment illustrated, may be made, for example of plastic, wood or metal having the front wall 136, of solid construction. Opposite side walls 151, a top 152, and a bottom 153 may likewise be of solid or rigid construction. A perforate or porous rear door 155 is most conveniently located at the rear wall of the receptacle. The door 155 may be hung upon hinges 156 at the upper rear corners, and provided with suitable latches 157 at lower rear corners. The hinges may be hung in any conventional manner. The latches preferably comprise flat plates 158 formed with a lug 159 extensible through suitably shaped slots 160 in a rearward edge 161 of the receptacle. Ears 162 provide a hand hold by which the latches may conveniently be pivoted about pivot pins 163 so as to retract the lugs 159 from their slots when the rear door 155 is to be opened for cleaning accumulated debris from within the receptacle.

The rear door 155 preferably comprises a frame 165 having an open central section and retains between its forward and rearward walls 166 and 167 respectively, an inner layer of porous material such as woven cloth 168 and an outer layer of more rigid material such as metal screen 169. The rim or margin of the frame is hollow and in cross section appears U-shaped with the open side of the U facing inwardly and adapted to receive the edges of porous material and the screen. A gasket or seal 170 of rubber or felt or other suitable substance may be provided around the inside of the door to prevent the escape of dust laden air. For the purpose of furnishing strength and adequate surface area for seating the seal the sides, top and bottom of the receptacle are formed with a flange 171.

Suitably cushioned wheels such as swivel castors 172 may be secured to the bottom of the receptacle in any desired manner to permit easy movement over a floor or other surface.

It will be understood that the nozzles may telescope to a desired extent and need not have the adjacent tips lying in substantially the same cross sectional plane. Likewise the fittings or couplings employed, instead of being the threaded type illustrated, may be of any satisfactory style, such as clamp-on, snap-on etc. On occasion fittings need not be provided but the nozzles may be permanently positioned relative to one another as by welding. It is desired, however, that for purposes of cleaning, replacement, adjustment, or repair the nozzles be made separable. Axial adjustment of the nozzles may be readily secured by removing one or more layers of the shims 46, 46', so as to adjust the vacuum to a maximum effective degree.

By way of example, though not of limitation, a suitable annular orifice is found to be secured by building the nozzles from a #9 gage sheet metal material, the tapered part of the nose tube being approximately 5" in length and the tapered part of the tail pipe being approximately 6" in length. The nose tube at its maximum diameter has been found satisfactory at 2½" internal diameter and the narrowest internal diameter one inch. A corresponding tail pipe may be approximately 1½" internal diameter at its narrowest portion and 2" internal diameter at its widest part. The shims may be any size, but a thickness of approximately .050 inch is suitable, and the total amount of axial adjustment should be of the order of at least ½".

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claim so as to embrace any and all equivalent structures and methods.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:
A suction apparatus comprising a source of air

pressure and a flexible air line therefrom, a suction piece having an outer inlet end, an inner frusto-conical converging end portion and an annular coupling element surrounding said end portion adjacent the inner end thereof, a tail pipe having an axis common with said converging end portion and comprising a diverging frusto-conical inlet portion in communication with a receptacle at the outlet of said tail pipe, the inlet end of the inlet portion having a diameter exceeding the diameter of the inner end of the converging end portion, said ends having adjacent positions concentric with said axis forming an annular space therebetween, a second coupling element adjacent the inlet end of the inlet portion complementary to the first coupling element and adjustably engageable therewith in position concentric with said axis, said coupling elements in coupled position having an expansion chamber therebetween communicating with said annular space, a longitudinally disposed handle on said tail pipe, an outlet end section of said pressure line extending along said handle, an air valve between the handle and the coupling elements having a manual release button adjacent the handle and a conduit operable jointly with said air valve and said second coupling element to connect the pressure line with said chamber.

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