

[54] PNEUMATIC ABRASIVE CUTTING APPARATUS

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[58] Field of Search 51/8, 12, 11; 137/597; 138/137

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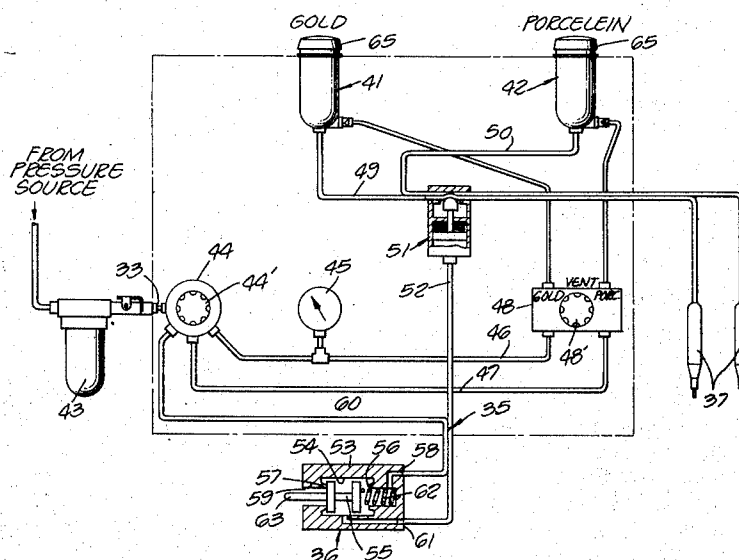
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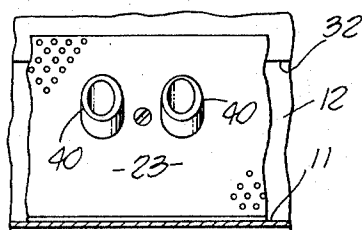
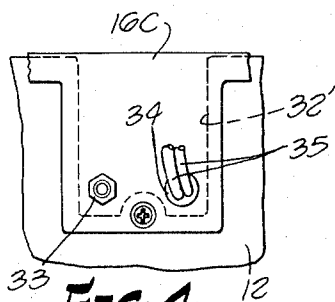
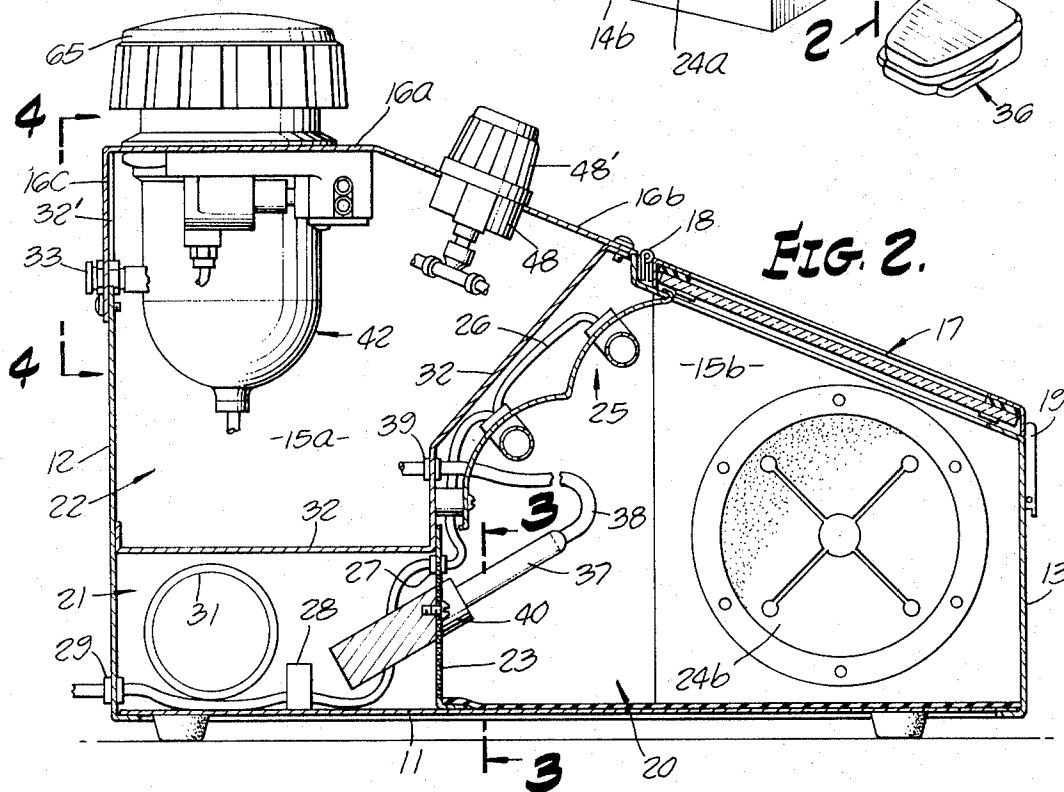
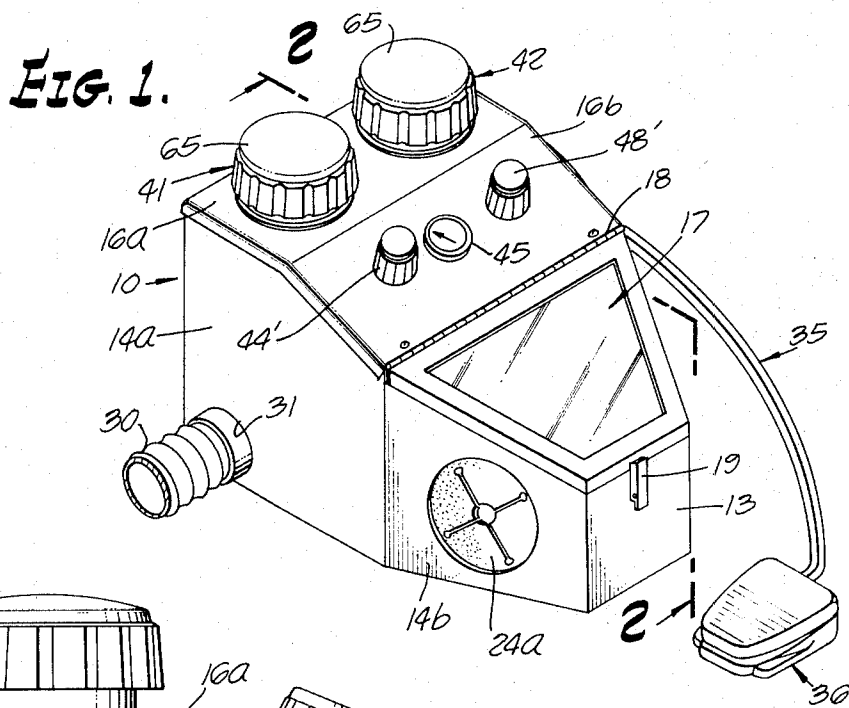
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ABSTRACT

Abrasive cutting apparatus in which a mixture of abrasive particles and a fluid, such as air, under pressure, are expelled at high speed from a nozzle, a compartmented housing being utilized to provide a working compartment connecting directly with a suction compartment, and an isolated control compartment for the abrasive reservoir or reservoirs and associated control components which are supported for removal as a unitary assembly. Means are provided for utilizing the pressurized fluid for fluffing up the abrasive powder in the reservoir to facilitate feeding to the nozzle, and to prevent clogging or packing in the reservoir. A pneumatically actuated pinch valve controls flow of air and the carried abrasive powder to the nozzle through a tubing of a material, such as latex, which prevents tunneling, and manually operable valve means provides for reservoir selection and venting.

7 Claims, 12 Drawing Figures





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FIG. 5.

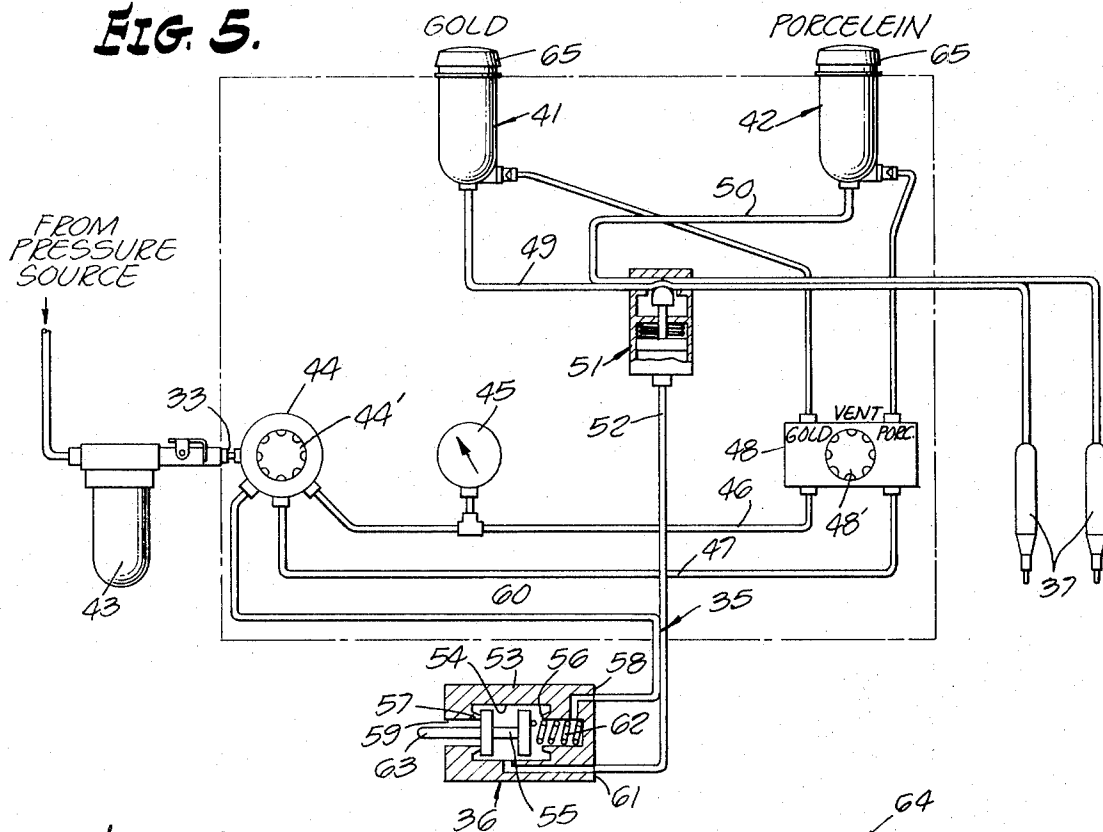
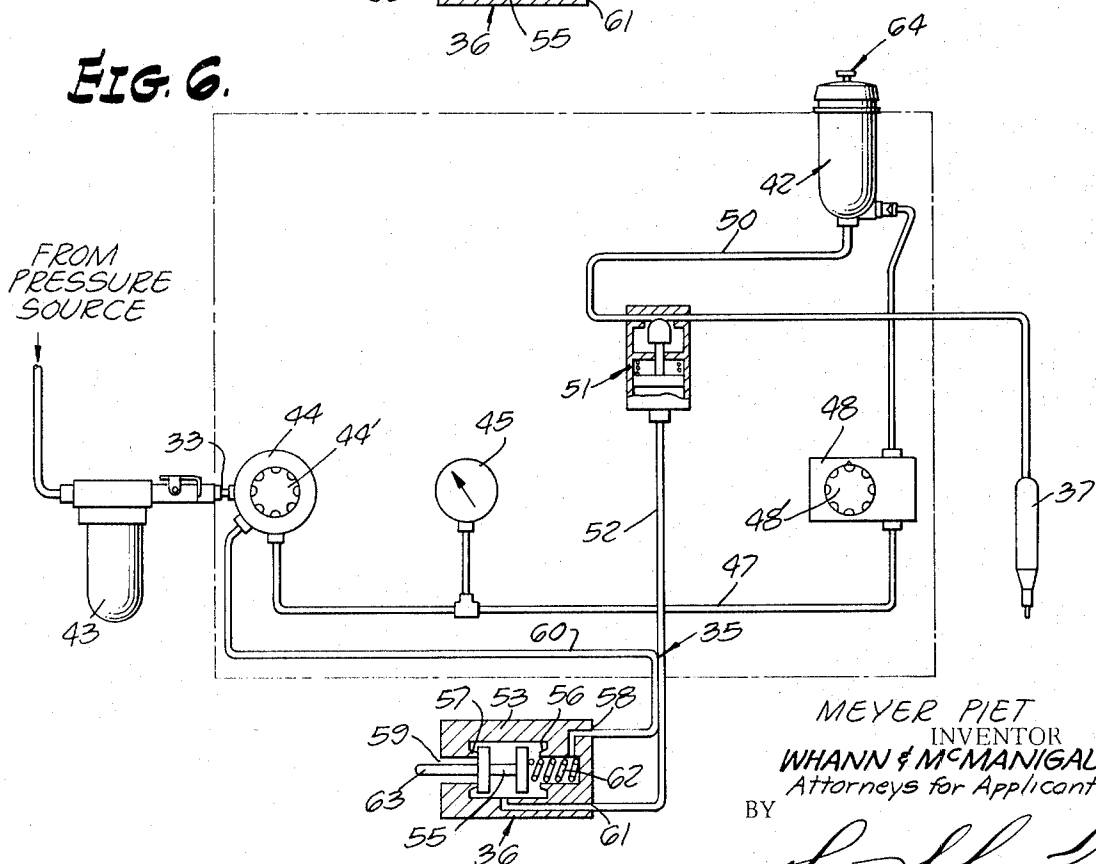


FIG. 6.



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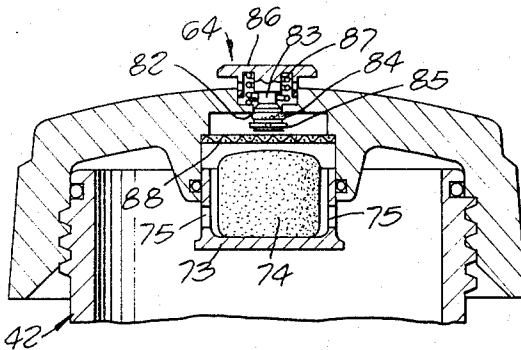
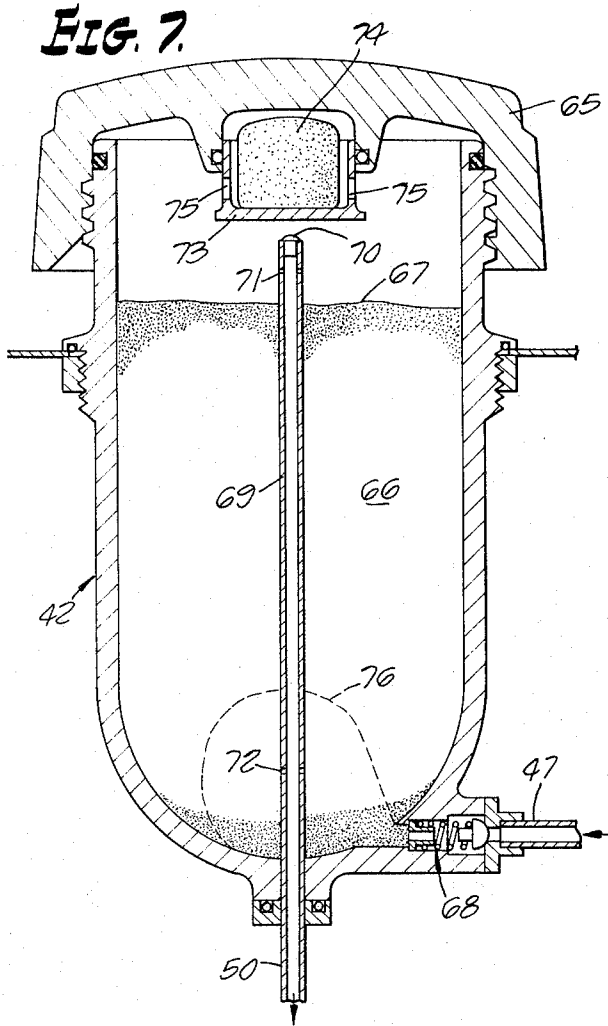
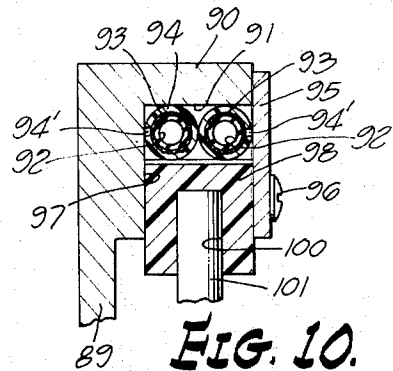
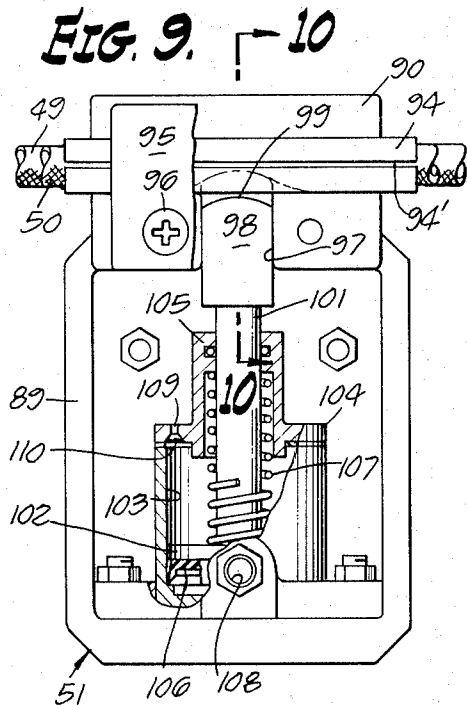


FIG. 8.



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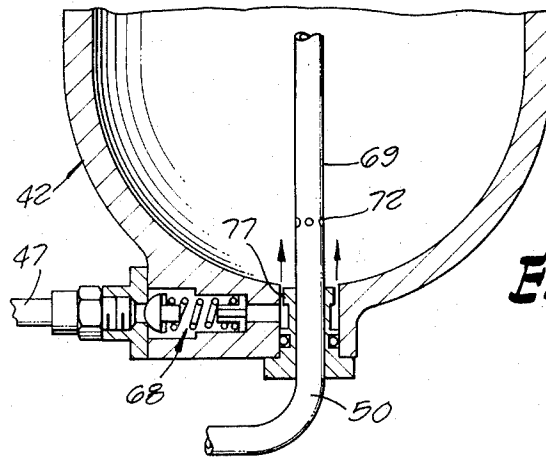


FIG. 11.

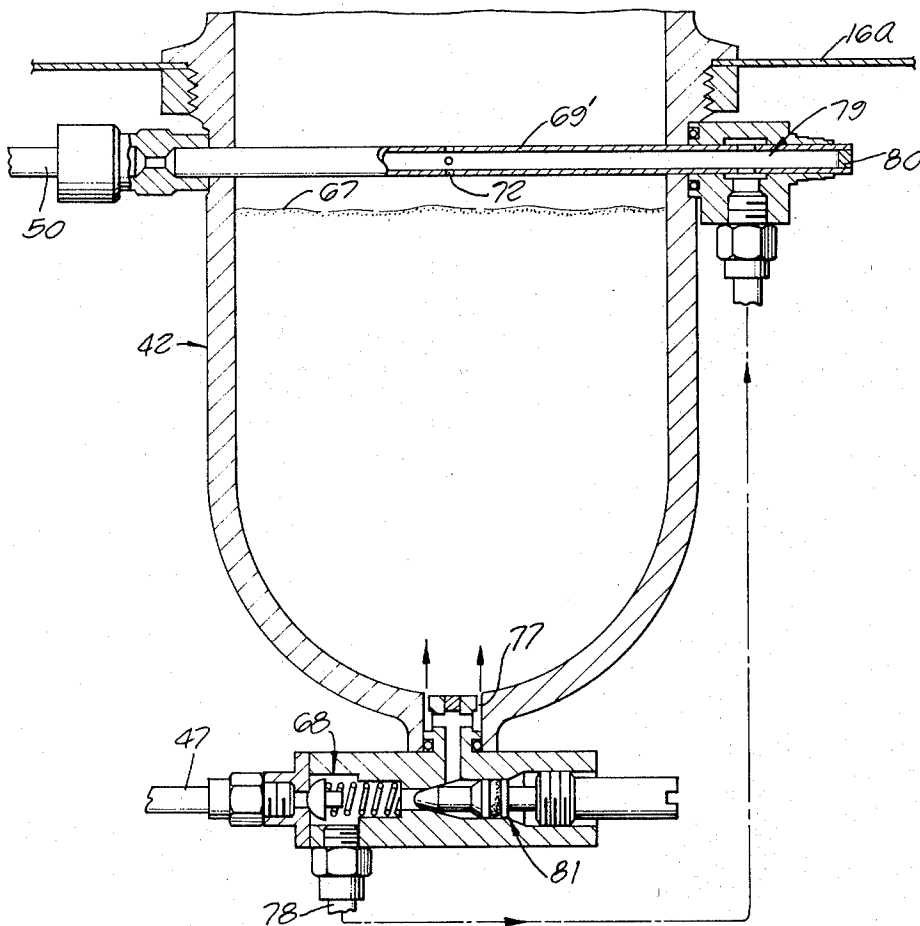


FIG. 12.

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PNEUMATIC ABRASIVE CUTTING APPARATUS**BACKGROUND OF THE INVENTION**

The present invention relates broadly to the field of abrasive cutting apparatus.

In the past, a variety of arrangements have been considered with a view to providing more effective and dependable mixing means in abrasive cutting apparatus. In such apparatus where abrasive materials having relatively large particles are utilized, such as sand and the like, gravity feed of the abrasive substance into the fluid stream has been comparatively satisfactory. However, in the case of certain types of abrasive cutting apparatus as used in industry and dental laboratory work, where the abrasive is composed of fine particles or is in the form of a powder, gravity feeds have not been practical for the reason that the abrasive substances have a tendency to become compacted and clog the passage openings to such an extent as to make the feed very erratic and unreliable. In these cases attempts have been made to improve the operation by providing vibratory or shaker means. However, such expedients have not been entirely satisfactory.

In the present invention, this problem has been greatly alleviated by a unique feeding arrangement, wherein the pressurized fluid is introduced into the abrasive reservoir in such a manner as to fluff up the abrasive substance adjacent the point where the abrasive is being introduced into the pressurized fluid stream for delivery to the nozzle.

Another source of trouble in the heretofore known apparatus resides in the eroding characteristic of the abrasive, and the wearing away of surfaces along the conducting path traversed by the fluid entrained abrasive. This problem has been a particularly serious one where conventional pinch valves have been used for starting and stopping the flow of the abrasive containing fluid between the feeding source and the applicator nozzle. One of the main sources of trouble in the currently available pinch valve structures was the tunneling effect of the abrasive on the lining of the flexible tube at the operating point of the pinch valve as the result of the opening and closing of the flow line there-through.

In the present invention, this problem has been overcome by the discovery that latex or natural rubber were substantially impervious to wear by the abrasive. By utilizing special tubing embodying a tubular core of this material, and providing a curved surface on the pinching member of the valve, effective and dependable control is obtainable.

In some of the currently available equipment, trouble has developed for the reason that the housings for the various control valves were not properly designed to protect the operating components from the effects of abrasive dust which could get into the parts and render them inoperative. This was particularly true in the case of solenoid actuated control valves which were difficult to seal. This problem has been substantially eliminated and the operation greatly improved by utilizing pneumatically operated valves, and by designing the housing in such a way that the valves and other control components will be isolated from the working areas which might contain abrasive dust.

The above refinements as well as the incorporation of other design features in the present invention has re-

sulted in the obtainment of a greatly improved abrasive cutting apparatus which is more efficient, longer lived, dependable and easier to use than the formerly known embodiments.

SUMMARY OF THE INVENTION

The present invention relates generally to abrasive cutting apparatus, and is more particularly concerned with a pneumatic abrasive cutter in which a mixture of relatively small abrasive particles or abrasive powder and air or other fluid under pressure is expelled at high speed from an applicator nozzle.

Having in mind the inherent disadvantages and problems of the heretofore known devices for this purpose, it is one object of the present invention to provide improved apparatus of this type which is simple of construction, easy to operate and maintain, efficient in operation, substantially free from malfunctions, and in which the component parts are readily and easily accessible for inspection, replacement or repair.

A further object of the herein described invention is to provide a unique compartmented housing for the control and other devices so as to isolate them from working areas and spaces where they might be subjected to abrasive dust which could produce a malfunction.

A further object is to provide abrasive cutting apparatus having pneumatic control devices which are more easily designed to protect moving parts from the effects of abrasive dust.

Another object resides in the provision of improved means for mixing the abrasive substances and pressurized air or other fluid within the supply reservoir of the abrasive, wherein the pressurized fluid is introduced into the reservoir in such a manner as to fluff up the abrasive powder in the area where it is to be introduced into the pressurized fluid stream for feeding to the applicator nozzle.

Still another object is to provide extremely compact abrasive cutting apparatus having improved means for controlling the flow of pressurized fluid and carried abrasive to an applicator nozzle, and in which the controlling means comprises a pneumatically controlled pinch valve of unique design, and in which abrasive tunneling will be substantially eliminated.

Also, still another object is to provide in apparatus of the herein described type, having provision for the use of several types of abrasive, improved selector valve means for the selection of the abrasive to be used, and for venting the supply reservoir of the nonselected abrasive.

Further objects and advantages of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing a preferred embodiment as well as several modifications of the invention without placing limitations thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a perspective view of pneumatic abrasive cutting apparatus embodying features of the present invention;

FIG. 2 is an enlarged section in elevation, taken substantially on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary section showing features of the internal wall structure of the housing, taken substantially on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary elevational view showing features of the housing structure, as seen from line 4—4 of FIG. 2;

FIG. 5 is a view schematically illustrating one embodiment of the invention which includes selective dual supplies of abrasive substances;

FIG. 6 is a similar view in which a single abrasive supply is provided;

FIG. 7 is an enlarged vertical section through an abrasive reservoir, and showing one arrangement for feeding the abrasive substance into a fluid stream;

FIG. 8 is a fragmentary view, in section, showing details of a reservoir closure cap containing a desiccant and vent valve;

FIG. 9 is a plan view, partly in section, of a pinch valve as embodied in the herein described invention;

FIG. 10 is a fragmentary section showing details of the cooperative relationship of certain parts of the pinch valve, taken substantially on line 10—10 of FIG. 9;

FIG. 11 is a fragmentary sectional view of a bottom portion of an abrasive reservoir showing a modified arrangement for abrasive feed; and

FIG. 12 is a similar view showing another modification of the abrasive feed.

DESCRIPTION OF A PREFERRED AND SEVERAL EMBODIMENTS

Referring more specifically to the drawings, there is illustrated in FIG. 1 an apparatus constructed and embodying the features of the present invention, wherein the operative components and devices are contained within a housing structure as generally indicated by the numeral 10. This structure is shown as a box-like container of fabricated sheet metal or other suitable material to provide a planar bottom wall 11 from which there extends a right angled rear wall 12 and front wall 13 which is of less width and less height than the rear wall. Forwardly extending on each side of the rear wall are right angled upstanding side wall portions 14a and 15a, which respectively connect with integrally formed side wall portions 14b and 15b which are in converging relation and connect with the respective sides of the front wall 13. As best shown in FIG. 2, the top wall of the housing comprises an integrally formed portion 16a which extends parallel to the bottom wall 11, and a portion 16b which is forwardly inclined downwardly towards the top of the front wall 13, and connects with a viewing window structure as generally indicated at 17. The window tapers towards the wall 13 and has a configuration conforming to that of the side walls. The window is connected by a hinge structure 18 to the wall portion 16b, and in its closed position is substantially coplanar with that of the wall portion 16b. At its forward edge, provision is made for releasably securing the window in a closed position by means of a suitable latch 19.

Interiorly, the housing as described above is compartmented to provide a forward work chamber as generally indicated by the numeral 20, a bottom rear suction chamber 21 and an associated upper control chamber 22.

As shown in FIGS. 1 and 2, the work chamber is in communication with the suction chamber 21 through

a perforated wall partition 23 so as to effect removal of waste abrasive materials as the result of a working operation performed in the work chamber. The work chamber wall portions 14b and 15b are shown as containing the usual hand ports 24a and 24b, respectively, while the window 17 permits the operator to view the work operation being carried on. Illumination is provided in the work chamber by means of a suitable fluorescent light source as generally indicated at 25, and having appropriate supply conductors 26 carried through an insulating grommet 27 in the wall 23, to a control switch 28 and thence through an insulating grommet 29 in the rear wall 12 to the housing exterior where it may be connected with a suitable electric supply source.

The suction chamber 21 is arranged to be selectively connected with a suitable vacuum source by means of a vacuum hose, as indicated at 30. To facilitate right or left hand connections of the hose to the suction chamber, openings 31—31 are provided in the opposite side walls of the chamber, a closure plug (not shown) being used to close the opening 31 that is not being used.

The control chamber 22 is separated from the work chamber 20 and the suction chamber 21 by means of an isolating solid partition wall 32 in order that the abrasive storage and control components will be shielded with respect to abrasive dust which might be prevalent in the work chamber and suction chamber. This is one of the important features of the invention, since it minimizes malfunction due to this abrasive dust getting into the operating parts of the control devices.

In order to provide ready access to the control devices for checking, replacement or repair, a further feature of the invention is to mount these various components on the top wall portions 16a and 16b which are arranged to provide a removable closure for the control chamber, whereby these components may be removed as a unit. As a part of this feature, it will be observed in FIG. 4, that the wall portion 16a is provided with a rear extension 16c which covers an opening 32' in the back wall 12 to accommodate a connection fitting 33 whereby the components may be connected with a suitable pressure source of fluid supply, as well as a protective entrance grommet 34 for bringing in the flexible pair of conduits 35 from a suitable foot valve control device as generally indicated at 36 by means of which the technician controls the supply of abrasive and fluid mixture to one of more handpiece nozzles as indicated at 37 (FIG. 2) this nozzle being supplied through an appropriate flexible conduit 38 which is carried through a protective grommet 39 in the wall 32 into the control chamber where it is connected with suitable control devices as will hereinafter be explained in detail. When the handpiece nozzle is not being used, it can be positioned in a tubular handpiece support 40 secured onto the wall partition 23.

Pneumatically controlled and operated apparatus of the present invention may take either of two forms as schematically illustrated in FIGS. 5 and 6 respectively. Basically the operation is the same in each case. In the arrangement shown in FIG. 5, provision is made for utilizing two different abrasives which are contained in separate supply reservoirs as indicated at 41 and 42 respectively. The reservoir 41 bears the legend "Gold" and contains an abrasive which is particularly adapted for working on the material gold, while the reservoir 42

is labeled "Porcelain" and contains an abrasive which is suitable for working on porcelain. The apparatus is not limited to the use of abrasives for these particular materials, and it is to be understood that they are mentioned merely for the reason that the disclosed apparatus is primarily used in connection with dental laboratory work. Pressurized fluid such as air or a neutral gas is supplied to the apparatus from a suitable external source which is introduced through a conventional filter 43 coupled to the connection fitting 33 from whence it is fed into a conventional pressure regulator 44 having a manually adjustable knob 44', as shown in FIG. 1, which is readily accessible on the top wall portion 16b which serves as a control panel. By means of this knob, the operating pressures are adjustable and readable on a pressure gauge 45 which is also on the control panel. Usually the operating pressures will be of the order of 120 P.S.I. Fluid pressure is distributed from the regulator 44 to the abrasive reservoirs 41 and 42 through individual supply conduits 46 and 47, these conduits being carried through a selector and venting valve 48 of conventional construction, and provided with a manually actuating knob 48' positioned on the control panel portion of the housing. This knob is operable to selectively connect the input conduits 46 and 47 with the desired reservoir, and also is positionable so as to vent the reservoirs to relieve pressure therein during times of nonuse.

The pressurized air or other fluid supplied to the abrasive reservoirs is mixed with the abrasive therein as will hereinafter be discussed in detail, and then delivered through separate outlet conduits 49 or 50 to the selected handpiece 37 depending upon which reservoir is being used.

In the arrangement shown in FIG. 5, which utilizes two abrasive reservoirs, the flow through the output conduits 49 and 50 to the handpiece nozzles is controlled by a pneumatically actuated pinch valve as generally indicated at 51 which will subsequently be described in detail, but basically comprises a structure which is normally urged to a non-pinching position with reference to associated portions of the conduits 49 and 50, but upon energization by pressure fluid supplied through a conduit 52 will be actuated into a pinching position in which flow will be terminated to the handpiece nozzles. Actuation of the pinch valve is controlled by means of the foot valve 36 as shown in FIG. 1, and which is diagrammatically illustrated in FIGS. 5 and 6 as comprising a casing 53 which is constructed to provide an internal cavity 54 within which there is reciprocally mounted a valve member 55 which is moveable between opposed valve seats 56 and 57, the first of these controlling flow between an inlet connection 58 and the cavity, and the second controlling flow between a vent passage 59 and the cavity. The inlet connection 58 is in communication by a conduit 60 with the regulator 44 from which pressurized fluid is obtained. The internal cavity 54 is in communication with an inlet-outlet connection 61 which is in communication with the conduit 52 connected to the pinch valve 51. A spring 62 normally maintains the valve member 55 in a position closing the vent passage 59, and at which time the valve member will be unseated with respect to the valve seat 56 so as to establish flow of pressurized fluid from the inlet connection 58 to the inlet-outlet connection 61 to energize the pinch valve and move it to pinching or closed position cutting off

flow to the connected handpiece nozzles. When it is desired to open the pinch valve 51 so as to provide flow to a selected nozzle 37, the valve 55 may be actuated by manually engaging a projecting stem portion 63 and moving it in a direction to overcome the action of the spring 62 and move the valve member into engagement with the seat 56. This cuts off the supply of pressurized fluid to the pinch valve and connects the cavity 54 with the vent passage so as to relieve the pressure in the pinch valve and enable it to move to its normal open position. The foot valve as shown in FIG. 6 is of the same construction and operates in the same manner as the one shown in FIG. 5. In the arrangement of FIG. 6, however, the valve 48 acts only as a selector or connecting valve for the reservoir 42 and does not perform a venting operation in this case. For this reason it is necessary to provide a normally closed vent valve 64, as will be subsequently described in detail, this valve being mounted in a removable closure cap 65 of the reservoir. This vent valve is not necessary for the caps of the reservoirs shown in FIG. 5, since the venting of these reservoirs is accomplished through the valve 48.

It will be noted that the reservoirs 41 and 42, as shown in FIG. 1, are mounted on the top wall portion 16a which provides the cover for the control chamber. For explaining the means utilized for the mixing of the abrasive in the reservoir arrangement shown in FIGS. 5 and 6, reference is made to the details of construction as shown in FIG. 7. As there shown, the reservoir 42 contains a quantity of the abrasive powder as indicated by the numeral 66 and which extends to an upper level as generally indicated at 67. The pressurized fluid inlet conduit 47 is shown as being connected at one side of the bottom of the reservoir by means of a fitting which includes a reverse flow check valve as generally indicated by the numeral 68. The outlet conduit 50 is connected with a central standpipe 69 which extends through the bottom of the reservoir and has an uppermost end which is shown as extending above the abrasive level 67. The upper end is closed by a plug 70 to prevent loading the standpipe tube with abrasive powder when the reservoir is being filled or replenished. Flow openings as indicated at 71 are provided below the plug, these openings being normally disposed in the space above the abrasive level 67. Adjacent the bottom end of the reservoir, the standpipe is provided with a plurality of pickup holes or openings as indicated at 72. It will be noted that the openings 72 are positioned above the inlet flow of air from the conduit 47 into the bottom of the reservoir. It is preferable that more than one opening 72 be provided since its orientation with respect to the air inlet is critical. For example, if a single pickup hole faces the air inlet, it will receive an abnormal blast of air-abrasive, which will throw the air-abrasive mixture out of balance, or undue erosion could result.

It is also important that means be provided to keep moisture out of the abrasive powder, and for this purpose there is provided on the inner surface of the cap 65 a removably mounted cup member 73 which is adapted to support a desiccant pill 74 in an operative position in the space at the top of the reservoir, communicating openings 75 being provided in the cup walls.

The operation of the arrangement described above will now be considered. With pressure fluid applied

through the conduit 47, the pressure will be substantially equalized within the reservoir, when the flow to the handpiece nozzle is cut off by the pinch valve. Upon opening the pinch valve by actuation of the foot valve control, flow will be established through the conduit 50 to the handpiece nozzle, and as a result the pressure at the upper end of the reservoir container will be decreased. The air now entering the reservoir from the conduit 47 will act to raise and fluff up the abrasive powder particularly at the lower end of the reservoir in the area of the pickup openings 72 as generally indicated in phantom lines by the numeral 76 so that as air flows downwardly through the standpipe 69 from the space at the upper end of the reservoir, abrasive will be asperated through the openings 72 into the air stream and thus carried to the handpiece nozzle. By placing the openings 72 above the entering air stream, compacting and clogging of the abrasive powder in the pickup area will be effectively prevented and more dependable and efficient operation obtained.

In the modified arrangement as shown in FIG. 11, the inlet fluid from the conduit 47 is carried to an annular discharge nozzle or opening 77 which surrounds the lower end of the standpipe and ejects a cylindrical air stream upwardly past the pickup openings 72. This arrangement has the advantage in that a uniform lifting and fluffing of the abrasive around the pickup openings is obtained and a condition produced in which the possibility of stagnant abrasive areas is reduced to a minimum.

The modified arrangement shown in FIG. 12, instead of utilizing a vertical standpipe, is arranged with a horizontal pipe 69' which is preferably supported above the abrasive level 67 with pickup holes 72 therein at the center of the reservoir. In this arrangement, instead of first conducting the gas through the abrasive material prior to entering the tube having the pickup holes therein, the air is conducted through a branch line 78 directly from the inlet of conduit 47 to an inlet end 79 of the tube 69', the normally open end of this tube being shut off by suitable closure means 80. In addition, the flow of fluid from the conduit 47 to the nozzle outlet 77, which is the same as previously described for FIG. 11, may be varied by means of an adjustable needle valve structure as generally indicated at 81. This arrangement has the advantage of being more versatile and permitting a regulatory control of the fluid stream from the nozzle 77 for causing fluffing of the abrasive substance. This is of particular advantage when using abrasives of different size characteristics.

Referring to FIG. 8, the details of the structure of the vent valve 64 are shown. The upper cap wall is provided with a vent opening 82 through which a valve stem 83 extends. The innermost end of this valve stem carries a sealing ring 84 having valving association with the opening 82, the sealing ring being retained on the stem by a snap ring 85. The outer end of the stem 83 is formed to provide a digitally engageable button 86. A compression spring 87 having one end in engagement with the underside of the button and its other end in engagement with a flange in the cap wall, operates to normally urge the sealing ring 84 into a valve closed position. With a valve as just described, it is a simple matter to vent the abrasive reservoir; which may be done by manually depressing the button 86. In order to prevent the dissemination of abrasive powder from the reservoir during a venting operation, a fine screen of the

order of 400 mesh, as indicated by the numeral 88, is appropriately mounted in the venting path.

The details of construction of the pinch valve 51 will now be considered, reference being had to FIGS. 5 and 10. As there disclosed, this valve comprises a frame structure 89 that is fabricated with a head portion 90 provided with an elongate open-sided groove or passage 91 which is adapted to receive in side-by-side relation the conduit structures 49 and 50 leading to the handpiece nozzles 37—37. These conduits are of special design and comprise in each case a tubing core 92 of latex or natural rubber which have been found to be substantially impervious to wear by the abrasive. This core is encased within a braided nylon sheath as indicated at 93, and where the conduits are carried through the passage 91, the conduits are surrounded by a protective plastic tube 94 in each case which is longitudinally split as indicated at 94'. The conduit assemblies are retained within the passage by means of a front retaining plate 95 which is secured by means of appropriate screws 96. In communication with the passage 91, there is provided a lateral opening 97 within which there is reciprocally movably positioned a pinch block member 98. This block as shown in FIG. 9 is provided with a transversely curved surface 99 for engaging with the conduit assemblies which include the conduits 49 and 50. The opposite side of the block 98 is provided with a recess 100 which is adapted to loosely receive the outer end of an actuating stem 101 having connection with a piston 102 operatively reciprocal within an associated cylinder 103 that is closed at one end by a cap member 104 which carries a guide bushing 105 for the stem 101. The piston is provided with a cup seal 106 which serves to seal the piston when fluid pressure is applied through an inlet 108 to the opposite end of the cylinder to move the block 98 into pinching position with respect to the conduit assemblies in the passage 91. A compression spring 107, which extends between the piston and an abutment shoulder formed in the guide bushing 105, normally urges the block 98 to a non-pinching position. The upper end of the cylinder, as shown in FIG. 9, is connected with atmosphere through a vent opening 109 containing a fine mesh screen 110 which prevents the entrance of any abrasive dust which might be within the control chamber.

The pinch valve structure having the design as described above, has been found to be very effective and trouble free, and especially free of tunneling of the materials constituting the cores of the conduits 49 and 50. Moreover, the utilization of pneumatic actuating means for this valve is also trouble free as compared to electrically actuated valves which have been heretofore utilized.

From the foregoing description and drawings, it will be clearly evident that the delineated objects and features of the invention will be accomplished.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of the disclosed invention, and, hence, it is not wished to be restricted to the specific form shown or uses mentioned except to the extent indicated in the appended claims.

I claim:

1. Abrasive cutting apparatus, comprising:
 - a. a source of pressurized fluid;
 - b. an assembly comprising a reservoir containing an abrasive substance, said reservoir having an inlet

- connectible with said source and being positioned to discharge fluid into said abrasive substance in a bottom portion of said reservoir, and outlet means including a fluid flow passage in a tubular member, a portion of which is positioned in a top space of said reservoir, and an inlet opening in said tubular member for admission of the abrasive substance into said fluid flow passage;
- c. discharge nozzle means connected with said outlet means;
- d. pneumatic actuated valve means for controlling flow to said discharge nozzle; and
- e. a foot valve for controlling the actuation of said valve means including:
- a casing having an internal cavity communicating with a vent opening;
 - a pressurized fluid inlet connected with an inlet-outlet connection operatively connected with said valve means;
 - a valve structure in said cavity normally urged to one position closing said vent opening and establishing flow between said inlet and said inlet-outlet connection, and upon manual actuation to another position interrupting flow between said inlet and said inlet-outlet connection and connecting said inlet-outlet connection with said vent opening.
2. Abrasive cutting apparatus, comprising:
- a. a source of pressurized fluid;
 - b. an assembly comprising a reservoir containing an abrasive substance, said reservoir having an inlet connectible with said source and being positioned to discharge fluid into said abrasive substance in a bottom portion of said reservoir, and outlet means including a fluid flow passage in a tubular member, a portion of which is positioned in a top space of said reservoir, and an inlet opening in said tubular member for admission of the abrasive substance into said fluid flow passage;
 - c. discharge nozzle means connected with said outlet means by a flexible tubing structure;
 - d. valve means for controlling flow to said discharge nozzle including a block member reciprocally movable into pinching and non-pinching relation with respect to said flexible tubing structure; and
 - e. a pneumatic actuator comprising:
 - a cylinder and a piston reciprocable in said cylinder, said piston having a stem with an outer end positioned within a receiving socket of said block member;
 - spring means for moving said piston in a direction enabling movement of said block member into said non-pinching relation;
 - and a connection with said cylinder for supplying pressurized fluid to move said piston in a direction to carry said block member into said pinching relation.
3. Abrasive cutting apparatus, comprising:
- a. a source of pressurized fluid;

- b. an assembly comprising a reservoir containing an abrasive substance, said reservoir having an inlet connectible with said source and being positioned in a bottom portion of said reservoir, and outlet means including a fluid flow passage in a horizontally extending tubular member positioned in a top space at the upper end of said reservoir above the abrasive and with an input end connecting the fluid flow passage with said source of pressurized fluid, and an inlet opening in said tubular member for admission of the abrasive substance into said fluid flow passage, said reservoir inlet having a fluid discharge axis directed generally into the abrasive substance below the inlet opening in said tubular member;
 - c. a reverse flow check-valve between said source, the reservoir inlet, and said input end of said fluid flow passage;
 - d. discharge nozzle means connected with said outlet means; and
 - e. valve means for controlling the flow to said discharge nozzle.
4. Abrasive cutting apparatus according to claim 3, including a flow adjusting needle valve between said check valve and said reservoir inlet.
5. Abrasive cutting apparatus, comprising:
- a. a source of pressurized fluid;
 - b. an assembly comprising a reservoir containing an abrasive substance, a removable cap closure member, a reservoir inlet connectible with said source and being positioned in a bottom portion of said reservoir, and outlet means including a fluid flow passage in a tubular member, a portion of which is positioned in a top space of said reservoir, and an inlet opening in said tubular member for admission of the abrasive substance into said fluid flow passage, said reservoir inlet having a fluid discharge axis directed generally into the abrasive substance surrounding the inlet opening in said tubular member;
 - c. desiccant means within said reservoir carried by and being removable with said cap member;
 - d. discharge nozzle means connected with said outlet means; and
 - e. valve means for controlling flow to said discharge nozzle.
6. Abrasive cutting apparatus according to claim 5, wherein the cap closure has a vent opening normally closed by valve means having an exteriorly manually operable actuator for moving the valve means to open position with respect to said vent opening.
7. Abrasive cutting apparatus according to claim 5, wherein the tubular member of the outlet means extends vertically of the reservoir and has an opening at its upper end for receiving fluid discharged from said reservoir inlet after it has passed through the abrasive substance, and the inlet in said tubular member is positioned at the bottom portion of said reservoir.
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