

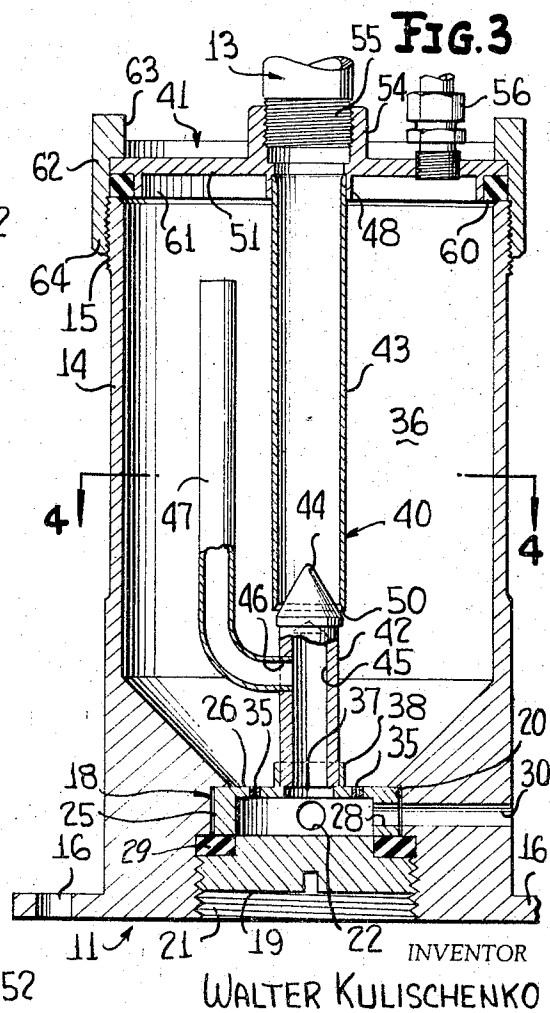
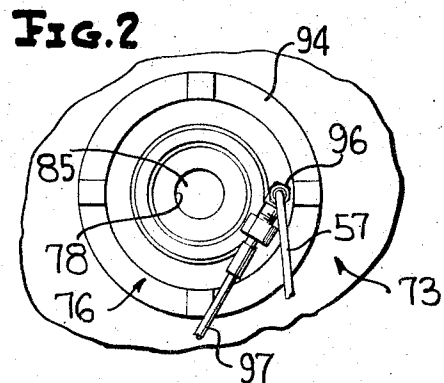
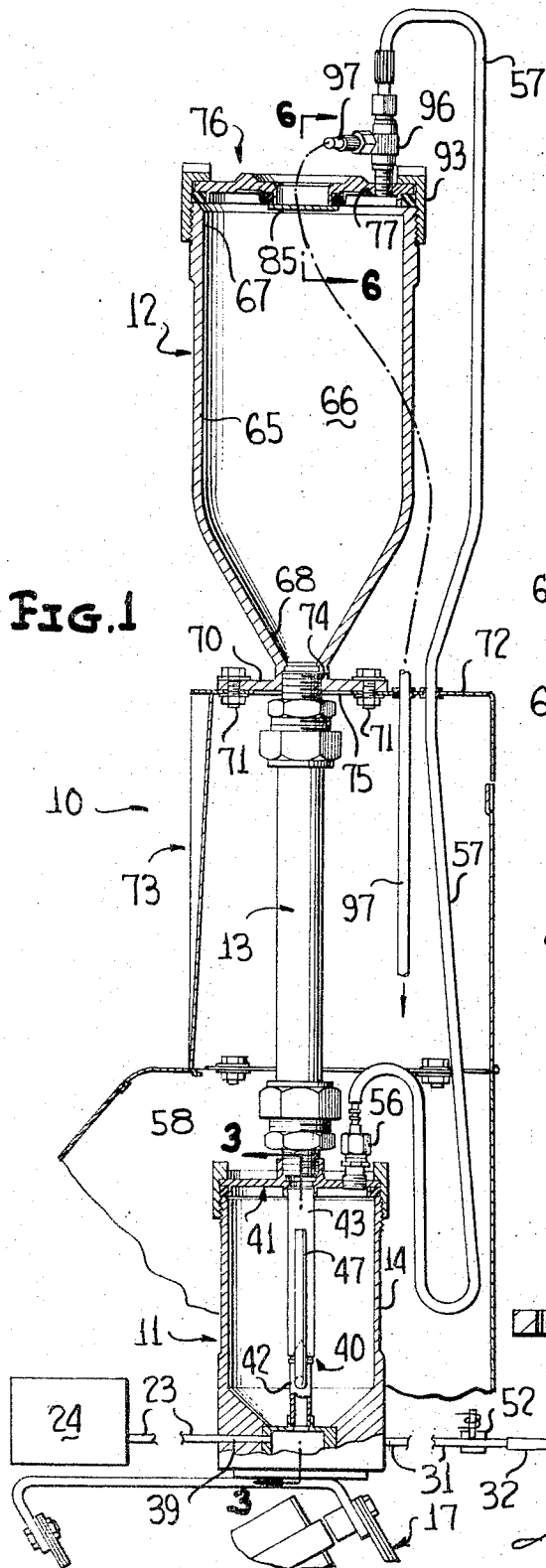
Oct. 3, 1967

W. KULISCHENKO
APPARATUS FOR STORING AND DELIVERING
ABRASIVE AND NON-ABRASIVE POWDERS

3,344,524

Filed May 5, 1964

2 Sheets-Sheet 1



INVENTOR
WALTER KULISCHENKO
BY *Maxm. Porter, Willm. Stewart*
ATTORNEYS

Oct. 3, 1967

W. KULISCHENKO
APPARATUS FOR STORING AND DELIVERING
ABRASIVE AND NON-ABRASIVE POWDERS

3,344,524

Filed May 5, 1964

2 Sheets-Sheet 2

FIG. 4

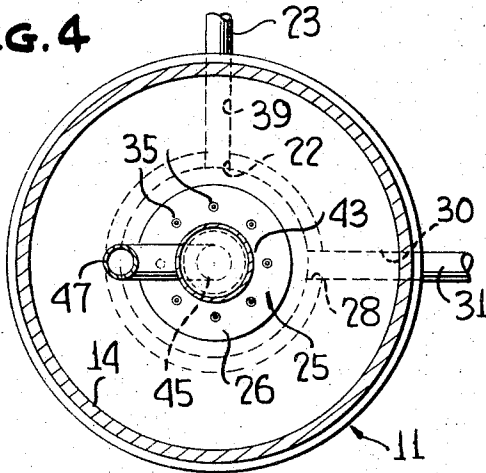


FIG. 5

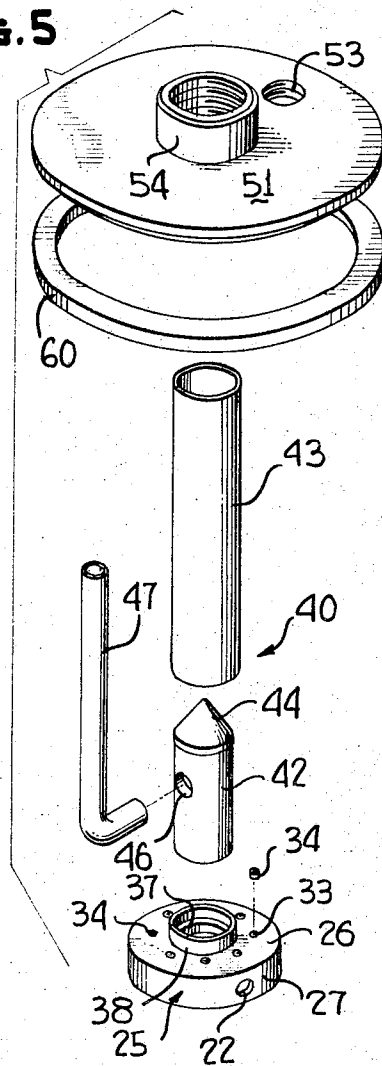


FIG. 6

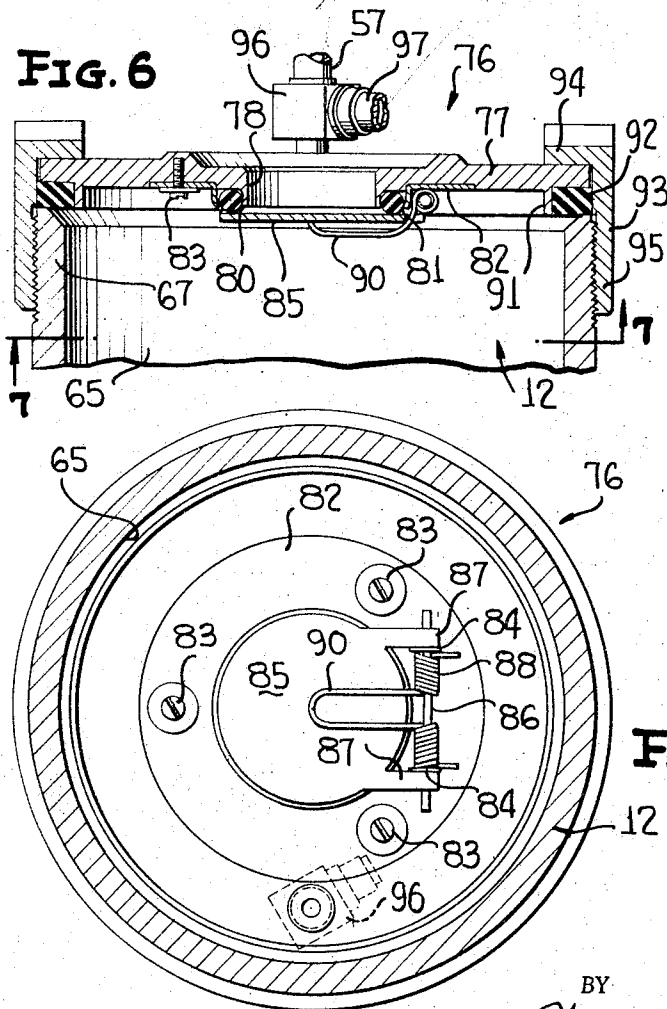


FIG. 7

INVENTOR
WALTER KULISCHENKO

BY
Mason, Porter, Miller & Stewart
ATTORNEYS

1

3,344,524

**APPARATUS FOR STORING AND DELIVERING
ABRASIVE AND NON-ABRASIVE POWDERS**

Walter Kulischenko, Richmond County, N.Y., assignor,
by mesne assignments, to S. S. White Company, Phila-
delphia, Pa., a corporation of Pennsylvania (1966)

Filed May 5, 1964, Ser. No. 365,123

11 Claims. (Cl. 32—58)

This invention relates to a novel apparatus for storing abrasive and non-abrasive powder in both a primary and an auxiliary chamber, admixing the powder with pressurized gas and delivering the admixture in a stream for a variety of purposes.

This invention is directed to a novel apparatus of the type disclosed in the U.S. patent to Robert B. Black, 2,696,049 of Dec. 7, 1954. This patent is directed to a method and apparatus for cutting tooth structure by directing a jet of abrasive-laden gas against the tooth structure whereby the abrasive nature of the material and the velocity thereof results in the desired cutting action. The abrasive material is first placed in a low volume storage chamber and is delivered to a mixing chamber into which is directed pressurized gas. If desired, the chamber is vibrated to facilitate the delivery of the abrasive material from the storage chamber to the mixing chamber and the pressure in these two chambers is equalized to stabilize the rate of feed of the abrasive material into the mixing chamber.

The primary purpose of this apparatus is in the field of dentistry to prepare dental cavities. Since the primary purpose of the abrasive material is to excavate cavities, the individual particles of abrasive material are extremely small and vary from about ten to forty microns.

Since the particles of abrasive material are extremely small and the cutting action effected thereby is relatively rapid, the storage chambers of such conventional apparatuses are of relatively low volume and continuous operation without refilling or supplementing the supply of abrasive material in the storage chamber is assured.

For industrial applications, such conventional apparatus has been found to be deficient for several reasons. A major obstacle to the successful application of such apparatus for industrial purposes has been the relatively rapid depletion or exhausting of the abrasive material from the storage chamber during a conventional industrial cutting operation. In addition, the sizes of the particles of the abrasive material used for industrial cutting purposes, as opposed to dental purposes, is relatively larger. The conventional storage chambers therefore lack a sufficient capacity for industrial cutting purposes and lack structure whereby a wide range of abrasive material sizes can be employed for industrial cutting purposes.

In accordance with the above, it is an object of this invention to provide a novel storage device for abrasive material which is of a relatively high capacity and which includes means for controllably regulating the delivery of a wide range of sizes of abrasive material during a cutting operation whereby the storage device is particularly adapted for industrial cutting purposes.

A further object of this invention is to provide a novel apparatus particularly adapted for the storage of abrasive material including a primary and an auxiliary storage chamber, means placing the primary chamber in communication with the auxiliary chamber whereby abrasive material can be delivered from the auxiliary chamber to the primary chamber, the primary chamber including means for admixing the abrasive material with gas under pressure and emitting the admixture from the primary chamber in a pressurized stream, and valve means for controllably regulating the delivery of the ab-

2

rasive material to the primary chamber from the auxiliary chamber.

A further object of this invention is to provide a novel apparatus of the type immediately above-described in which is provided means for vibrating at least one of the storage chambers whereby the abrasive material will be delivered to the primary chamber in a relatively controlled regulated stream of material flow.

A further object of this invention is to provide a novel apparatus of the type immediately described in which means are also provided for introducing gas under pressure into at least one of the storage chambers, and providing means for balancing the pressure of the gas in at least one of the primary and the auxiliary chambers.

Another object of this invention is to provide a novel storage device for controllably receiving abrasive material from an auxiliary chamber, admixing the abrasive material with pressurized gas and emitting the admixed abrasive material and gas in a stream comprising a housing, a storage chamber in the housing for receiving abrasive material, a mixing chamber, means placing said chambers in communication whereby abrasive material will be delivered from the storage chamber to the mixing chamber, means for admixing the abrasive material with gas under pressure in the mixing chamber and emitting the admixture therefrom, means for delivering the abrasive material into the storage chamber, the delivery means including a conduit having an open end portion received in the storage chamber, and an element restricting the open end portion of the conduit to limit the delivery of the abrasive material from the conduit into the storage chamber.

A further object of this invention is to provide a novel storage device of the type immediately above-described in which the conduit and the element cooperate to define a delivery port opening into the storage chamber, and means for adjusting the size of the delivery port to regulate the flow of the abrasive material from the conduit into the storage chamber.

With the above and other objects in view that will hereinafter appear the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

In the drawings:

FIGURE 1 is a fragmentary elevational view partially in section of the novel apparatus of this invention, and illustrates an auxiliary chamber supported above a primary storage chamber and a conduit between the chambers.

FIGURE 2 is a fragmentary top plan view of the auxiliary chamber and illustrates an end cap assembly closing an upper end of the auxiliary chamber.

FIGURE 3 is an enlarged sectional view taken along line 3—3 of FIGURE 1, and illustrates a control mechanism of the primary storage chamber and means for delivering compressed gas from a mixing chamber into the primary chamber.

FIGURE 4 is a transverse sectional view taken along line 4—4 of FIGURE 3, and illustrates a plurality of apertures in a plate separating the primary storage chamber from the mixing chamber.

FIGURE 5 is an exploded perspective view of several of the components of the primary storage chamber, and further shows a cap and seal assembly of the primary storage chamber.

FIGURE 6 is a fragmentary sectional view taken along line 6—6 of FIGURE 1, and more clearly illustrates the end cap assembly of the auxiliary chamber and a trap door normally closing an opening in a plate of the cap assembly.

FIGURE 7 is a sectional view taken along line 7—7 of FIGURE 6 and more clearly illustrates a spring normally biasing the trap door in a closed position.

A novel apparatus constructed in accordance with this invention for storing abrasive material is best illustrated in FIGURE 1 of the drawings, and is generally designated by the reference numeral 10. The apparatus or storage device 10 comprises a primary storage chamber 11, an auxiliary storage chamber 12 and flexible conduit means 13 between the chambers 11, 12.

The primary storage chamber 11 (FIGURES 1, 3 and 5) comprises a generally cylindrical housing 14 having an exteriorly threaded upper end portion 15 and a plurality of identical apertured securing flanges 16. The securing flanges 16 receive fasteners for securing the primary storage chamber 11 to a conventional vibrator 17 (FIGURE 1) in a well known manner.

A mixing chamber 18 is formed in the lower end portion (unnumbered) of the housing 14 of the primary storage chamber 11 by an axial bored portion 20 and a counterbored and threaded portion 21.

An orifice plate 25 is conventionally secured by a threaded retainer 19 in the bored portion 20 of the mixing chamber 18. An annular seal or gasket 29 is interposed between a lower edge of the plate 25 and the retainer 19. The orifice plate 25 includes an end wall 26 (FIGURES 3 and 5) and a depending peripheral wall 27 having a radial aperture or port 28 in axial alignment with a port 30 (FIGURE 3) opening outwardly of the housing 14. The port 30 is connected by a flexible hose or conduit 31 (FIGURE 1) including a pinch valve 52 to a conventional nozzle 32. A similar port or opening 22 in the wall 27 is in axial alignment with a port 39 (FIGURE 4) opening outwardly of the housing 14. The port 39 is connected by a flexible hose or conduit 23 to a conventional source of high pressure gas 24, such as air under pressure for a purpose to be described hereafter. A plurality of openings 33 (FIGURE 5) are formed in the end wall 26 of the orifice plate 25. There are eight such openings illustrated in the end wall 26 of the orifice plate 25, but more or less of such openings can be formed therein in accordance with this invention.

An identical carbide insert 34 (FIGURES 3 through 5) is received in each of the openings 33 and secured therein in a conventional manner as by soldering. Each of the inserts 34 is provided with an axial opening 35 (FIGURES 3 and 4) which place an interior 36 of the chamber housing 14 in communication with the mixing chamber 18 in a manner clearly illustrated in FIGURE 3 of the drawings. The orifice plate 25 further includes an axial opening 37 and an upwardly directed axial collar 38.

Control means or valve means 40 for regulating the rate of delivery of abrasive material from the auxiliary chamber 12 through the conduit means 13 into the primary chamber 11 is positioned in the interior 36 of the housing 14 between the orifice plate 25 and an end cap assembly 41 of the primary chamber 11. The valve means 40 comprises a restrictor or torpedo element 42 and a feed tube 43.

The restrictor 42 is substantially cylindrical in transverse section and includes a closed substantially conical upper end portion 44 and an axial bore 45. The restrictor 42 is received in the axial collar 38 in the orifice plate 25 and secured therein in a conventional manner, such as by soldering. An axial opening 46 (FIGURE 5) is formed in the restrictor 42 and a substantially L-shaped tube 47 is conventionally secured in the opening 46. The tube 47 is directed upwardly, as viewed in FIGURE 3 of the drawings toward the end cap assembly 41 and terminates adjacent thereto at a point above the normal level of abrasive material (not shown) in the interior 36 of the primary chamber 11.

An upper end portion (unnumbered) of the feed tube 43 is received in and conventionally secured to a depending axial collar 48 of the end cap assembly 41. In the assembled position of the restrictor 42 and the feed tube 43 (FIGURE 3) the conical end portion 44 of the restrictor 42 is partially received in a lower open end portion (unnumbered) of the feed tube 43 to define therewith a generally annular dispensing port or opening 50.

The end cap assembly 41 of the primary storage chamber 11 includes a generally circular end wall 51 (FIGURES 3 and 5) which is provided with a threaded bore or aperture 53, and an axially upwardly directed internally threaded collar 54. A lower threaded end portion 55 of the flexible conduit means 13 is threadably secured to the threaded collar 54, as is clearly illustrated in FIGURE 3 of the drawings. A coupling 56 (FIGURE 1) is threaded in the threaded bore 53 of the end wall 51. The coupling 56 is connected to a pressure equalizing tube 57 (FIGURE 1) which equalizes or balances the pressure in the chambers 11 and 12 in a manner to be described more fully hereafter.

An annular sealing gasket 60 (FIGURES 3 and 5) surrounds a depending generally circular rib 61 (FIGURE 3). The gasket 60 sealingly seats against the edge (unnumbered) of the threaded upper end portion 15 of the housing 14. A locking and adjusting collar 62 having a radially inwardly directed flange portion 63 and a lower threaded end portion 64 (FIGURE 3) is threadably secured upon the housing 14 of the primary storage chamber 11 in a manner clearly illustrated in FIGURE 3 of the drawings. The collar 62 is shown completely seated upon the threaded end portion 15 of the housing 14 in FIGURE 3. In this position of the collar 62 the size of the dispensing opening 50 between the end portion 44 of the restrictor 42 and the feed tube 43 is of a minimum size. However, by unthreading the collar 62 the size of the dispensing opening 50 increases. For minor adjustment of the dispensing opening 50, the natural resiliency of the gasket 60 to rebound from its deformed condition upon a slight unthreading of the collar 62 will maintain the interior 36 of the housing 14 relatively gas-proof. However, upon a major increase in the size of the opening 50, the gasket 60 can be replaced by a similar gasket of an axially longer length.

The auxiliary storage chamber 12 includes a housing 65 defining a chamber interior 66. The housing 65 includes an upper exteriorly threaded end portion 67 and a downwardly tapering lower end portion 68 (FIGURE 1) terminating in a radially outwardly directed securing flange 70. The flange 70 is secured by a plurality of identical nuts and bolts 71 to an upper plate 72 of a conventional cabinet structure 73. An upper externally threaded end portion 74 of the flexible conduit means 13 passes through an opening 75 (FIGURE 1) of the upper plate 72 and is threadably secured to an internally threaded end portion (unnumbered) of the lower end portion 68 of the housing 65. In this manner abrasive material or powder in the auxiliary chamber is free to flow by gravity and the vibration of the conventional vibrator 17 from the interior 66 of the auxiliary chamber 12 through the conduit means 13, the feed tube 43, (FIGURE 3) and the annular dispensing orifice 50 into the interior 36 of the primary storage chamber 11.

The upper end portion of the auxiliary storage chamber 12 is closed by an end cap assembly 76 which is best illustrated in FIGURES 6 and 7 of the drawings. The end cap assembly 76 of the auxiliary storage chamber 12 comprises a generally circular end plate or wall 77 having an axial opening 78 which is partially defined by a flange portion 80. A gasket 81 (FIGURE 6) surrounds the flange portion 80 and is secured thereto by a clamping collar 82 secured to the underside of the plate 77 by a plurality of identical screws 83, as is clearly illustrated in FIGURES 6 and 7 of the drawings. Two identically apertured bail ears 84 (FIGURE 7) are struck from the collar 82 and project

5

downwardly into the interior of the auxiliary housing 65. A trap door or closure 85 is pivotally journaled to the ears 84 by a pin 86 passing through the openings (not shown) in the bail ears 84 and through openings in a pair of identical legs 87 of the trap door 85 as is best illustrated in FIGURE 7 of the drawings. A spring 88 is wound about the pin 86 and an end portion 90 thereof bears against the trap door 85 to normally bias the same to a closed position in sealing contact with the gasket 81 (FIGURE 6).

A generally circular gasket 92, substantially identical to the gasket 60 of FIGURE 3, is secured in surrounding relationship to a depending rib 91 of the end wall 77 of the end cap assembly 76. The gasket 92 normally seats on an uppermost edge (unnumbered) of the threaded end portion 67 of the auxiliary storage chamber 12. A locking or clamping collar 93 having a radially inwardly directed upper flange portion 94 and a lower internally threaded securing portion 95 clamps the gasket 92 in sealing contact with the uppermost edge of the auxiliary storage chamber housing 65 in a manner clearly illustrated in FIGURE 6 of the drawings.

A T-coupling 96 (FIGURES 1 and 6) is threadably received in a threaded bore (unnumbered) of the end wall 77 of the cap assembly 76. The pressure equalizing or balancing tube 57 (FIGURE 1) is connected to the coupling 96 while a similar tube or conduit 97 (FIGURE 1) is connected between the coupling 96 and a bleed valve (not shown).

A typical operation of the apparatus 10 will be described immediately hereafter, and attention is particularly directed to FIGURE 1 of the drawings. It is assumed for purposes of this description that the auxiliary storage chamber 12, the flexible conduit 13, the feed tube 43, and the primary storage chamber 11 have been filled with abrasive material by introducing the same through the trap door 85 of the auxiliary storage chamber 12. The height of the abrasive material in the primary storage chamber 11 is in line with the dispensing opening 50. An unfilled area is provided in the auxiliary storage chamber 12 adjacent the end plate 77 for the purpose of opening and closing the trap door 85. At this time pressurized gas is introduced from the conventional source 24 through the conduit 23, the port 39 and the port 22 into the mixing chamber 18 and upwardly through the bore 45 of the restrictor 42 and the tube 47 into the interior of the primary storage chamber 11. The gas is communicated from the interior 36 of the primary storage chamber 11 to the interior of the auxiliary storage chamber 12 by means of the coupling 56, the pressure equalizing tube 57 and the T-coupling 96 equalizing or balancing the pressure in each of the storage chambers 11 and 12. The gas pressure in the auxiliary storage chamber 12 augments the seating of the trap door 85 against the gasket 81 (FIGURE 6) and prevents the leakage of the gas through the bore 78 in the end cap assembly 76. This same pressure in the chambers 11 and 12 is transmitted by the conduit 97 to a special bleed-off valve (not shown) which depressurizes the system for the purpose of adding abrasive powder when needed.

Gas under pressure leaves the conventional source 24 and is communicated into the mixing chamber 18 through the conduit 23, the port 39 and the port 22 (FIGURE 3). At the same time the gas enters the mixing chamber 18, the abrasive particles fall through the openings 35 in the inserts 34 of the orifice plate 25 due to the vibration of the primary storage chamber 11 by the vibrator 17 in a conventional manner. The abrasive particles are entrained in or admixed with the gas in the mixing chamber 18, and this admixture is emitted or discharged from the mixing chamber 18 through the port 28 in the orifice plate 25 (FIGURE 3), the port 30 in the housing 14, the conduit 31, the pinch valve 52 and the nozzle 32. The nozzle 32 is manually or automatically guided in a conventional manner to cut a desired structure.

6

During such a cutting operation which may be of a relatively long duration, the abrasive material being removed from the primary storage chamber 11 through the mixing chamber 18 is being replaced by an exactly identical amount of abrasive powder which is introduced into the interior 36 of the primary storage chamber 11 through the annular dispensing orifice 50 (FIGURE 3). As has been heretofore noted, the size of the dispensing orifice 50 determines the rate of feed of the abrasive material from the auxiliary storage chamber 12 into the primary storage chamber 11, and thus is a direct regulation at the rate of which the abrasive material flows into the mixing chamber 18 and outwardly through the nozzle 32. The rate of feed of the abrasive material is controlled or regulated, as has heretofore been noted by the distance of the feed tube 33 from the conical portion 44 of the restrictor 45 and determined by the seating of the collar 62 upon the upper threaded end portion 15 of the housing 14. The size of the annular dispensing orifice 50 (not less than 0.0005 inch) and the vibrations of the vibrator 17 insures controlled uniform constant flow of the abrasive material from the auxiliary storage chamber 12 to the mixing chamber 18 until the cutting operation is completed and/or the abrasive material in the apparatus 10 is depleted.

While a preferred form of the invention has been disclosed herein, it is to be understood that variations in the example disclosure may be made within the scope of this invention. For example, the control means 40 (FIGURE 3) for metering the abrasive material into the interior 36 of the primary chamber 11 need not necessarily be a conical restrictor 42 received in a feed tube 43, but can be similar structure for accomplishing the function of controlled feed. For example, the end of the tube 43 adjacent the lower end of the primary storage chamber 11 can be bent and directed against the inside wall (unnumbered) of the interior 36 of the housing 14, and in this bent position the lowermost portion of the tube 43 and the wall of the housing 14 will form a dispensing opening similar to the dispensing opening 50. As an alternative construction, the lowermost end portion of the feed tube 43 can be flattened to form a generally narrow elongated dispensing opening, or the feed tube 43 can be similarly flattened at a midportion thereof and again will act as a metering or control device for the flow of abrasive material from the auxiliary storage chamber 12 to the primary storage chamber 13.

The invention has been described to emphasize the use of the apparatus for carrying out cutting operations by the rapid flow of abrasive material. However, non-abrasive material, such as non-abrasive polishing powders can also be used with the structure disclosed herein.

From the foregoing, it will be seen that novel and advantageous provisions have been made by carrying out the desired end. However, attention is again directed to the fact that additional variations may be made in this invention without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for storing a flowable abrasive material and mixing the material with a pressurized gas for delivery therewith as a stream, comprising:

- (a) a primary storage chamber having upper and lower ends, with said primary chamber having an outlet in a lower end portion thereof, said primary chamber being adapted to store a flowable abrasive material therein at a predetermined level intermediate said upper and lower ends,
- (b) an auxiliary storage chamber for the abrasive material,
- (c) means for conducting abrasive material from said auxiliary chamber to said primary chamber,
- (d) means operatively associated with said conducting means for automatically maintaining the level of abrasive material in the primary chamber at said predetermined level, said level maintaining means co-

acting with said conducting means to replenish said primary storage chamber with abrasive material from said auxiliary chamber as abrasive material flows through said outlet to said mixing chamber,
 (e) means for supplying pressurized gas,
 (f) means for delivering a mixture of pressurized gas and abrasive material,
 (g) a mixing chamber in communication with the outlet of said primary storage chamber and said gas supplying means, adapted to mix pressurized gas and abrasive material therein and to discharge the mixture to said delivering means, and
 (h) a vibrator operatively associated with said primary storage chamber for transmitting vibrations thereto, the construction and arrangement being such that the vibrator of said primary storage chamber and the maintenance of a predetermined level of abrasive material in said primary chamber ensures the delivery of abrasive material to said mixing chamber at a uniform rate.

2. Apparatus according to claim 1 wherein said conducting means includes a flexible conduit connected between said auxiliary chamber and said primary chamber.

3. Apparatus according to claim 1 wherein said conducting means has an end portion terminating within said primary storage chamber at said predetermined level.

4. Apparatus according to claim 3 wherein said level maintaining means is a valve operatively associated with the end portion of said conducting means to define a restricted port for the discharge of said abrasive material into said primary chamber.

5. Apparatus according to claim 1 further including conduit means connected between said mixing chamber, an upper position of said auxiliary chamber, and an upper portion of said primary chamber above said predetermined level for equalizing the pressure in said chambers.

6. Apparatus according to claim 1 wherein the outlet of said primary chamber includes a plurality of orifices.

7. Apparatus for storing a flowable abrasive material and mixing the material with a pressurized gas for delivery therewith as a stream, comprising:

- (a) a primary storage chamber having upper and lower ends, with said primary chamber having an outlet comprising a plurality of orifices in a lower end portion thereof, said primary chamber being adapted to store a flowable abrasive material therein at a predetermined level intermediate said upper and lower ends,
- (b) an auxiliary storage chamber for the abrasive material above said primary chamber,
- (c) means including a conduit for conducting the abrasive material from said auxiliary chamber to said primary chamber, with said conduit having an end portion terminating within said primary storage chamber at said predetermined level,
- (d) means including a restrictor operatively associated with said conducting means defining a restricted discharge port for maintaining the level of abrasive material in the primary chamber at said predetermined level,
- (e) means for supplying pressurized gas,
- (f) means for delivering a mixture of pressurized gas and abrasive material,
- (g) a mixing chamber below said primary chamber in communication with the outlet of said primary storage chamber and said gas supplying means adapted to mix pressurized gas and abrasive material therein and to discharge the mixture to said delivering means, and
- (h) a vibrator operatively associated with said primary storage chamber for transmitting vibrations thereto, the construction and arrangement being such that the vibration of said primary storage chamber and the main-

tenance of a predetermined level of abrasive material in said primary chamber ensures the delivery of abrasive material to said mixing chamber at a uniform rate.

8. A storage device for controllably receiving abrasive material from an auxiliary chamber, admixing the abrasive material with pressurized gas and emitting the admixed abrasive material and gas in a stream comprising a housing, a storage chamber in said housing for receiving abrasive material, a mixing chamber, means placing said chambers in communication whereby abrasive material will be delivered from said storage chamber to said mixing chamber, means for admixing the abrasive material with gas under pressure in the mixing chamber and emitting the admixture therefrom, means for delivering abrasive material into said storage chamber, said delivering means including a conduit having an open end portion in said storage chamber, a restrictor partially received in said open end portion, and said restrictor having a bore communicating with said mixing chamber and said storage chamber whereby pressure equalization between said chambers is effected.

9. A storage device for controllably receiving abrasive material from an auxiliary chamber, admixing the abrasive material with pressurized gas and emitting the admixed abrasive material and gas in a stream comprising a housing, a storage chamber in said housing for receiving abrasive material, a mixing chamber, means placing said chambers in communication whereby abrasive material will be delivered from said storage chamber to said mixing chamber, means for admixing the abrasive material with gas under pressure in the mixing chamber and emitting the admixture therefrom, means for delivering abrasive material into said storage chamber, said delivering means including a conduit having an open end portion in said storage chamber, a restrictor partially received in said open end portion to define a delivering port, and means for adjusting the size of said port to regulate the flow of abrasive material from said conduit into said storage chamber.

10. A storage device for controllably receiving abrasive material from an auxiliary chamber, admixing the abrasive material with pressurized gas emitting the admixed abrasive material and gas in a stream comprising a housing, a storage chamber in said housing for receiving abrasive material, a mixing chamber, means placing said chambers in communication whereby abrasive material will be delivered from said storage chamber to said mixing chamber, means for admixing the abrasive material with gas under pressure in the mixing chamber and emitting the admixture therefrom, means for delivering abrasive material into said storage chamber, said delivering means including a conduit having an open end portion in said storage chamber, a restrictor partially received in said end portion to define a generally annular delivery port, and means for axially adjusting the conduit relative to the restrictor for adjusting the size of said port.

11. The storage device as defined in claim 10 wherein said adjusting means includes a plate threadably secured to said housing carrying said conduit.

References Cited

UNITED STATES PATENTS

864,471	8/1907	Kelly	51—12
2,696,049	12/1954	Black	32—58
3,073,070	1/1963	Mead	51—8

FOREIGN PATENTS

532,271 10/1956 Canada.

RICHARD A. GAUDET, *Primary Examiner*.

J. W. HINEY, *Assistant Examiner*.