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(54) **Pressurized abrasive cleaning device.**

(57) An improved device (1) for pressurized abrasive cleaning surfaces and simultaneously recovering all the spent abrasive particles and debris removed from the surface. A venturi nozzle (13) adapted to be connected to supply of pressurized air containing abrasive particles is mounted within a cylindrical blast tube (15). The blast tube extends beyond the nozzle and generally throughout the length of a vacuum chamber (30) formed within a vacuum cone (20) that is mounted on and extends concentrically about the blast tube. A cast urethane work ring (47) is movably mounted on the outer end of the vacuum cone by a gimbal ring (41) and flexible sealing duct (48). An exhaust tube (31) adapted to be connected to a source of suction is connected to the vacuum cone to provide a vacuum within the cone. The blast tube protects the blast pattern of abrasive particles and pressurized air after leaving the nozzle and passing through the vacuum chamber and directs it in a confined effectively large and efficient pattern against the surface being cleaned. The work ring traps the spent abrasive particles and debris which is removed from the work ring and vacuum chamber through the exhaust tube. The work ring has an outer edge (74) shaped to match the contour of the surface being cleaned and is moved along the surface by rollers (53) mounted on the work ring holder (35).

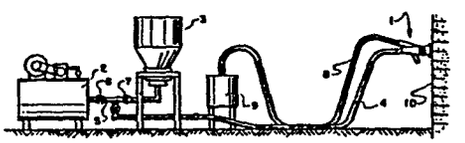

FIG. 1

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PRESSURIZED ABRASIVE CLEANING DEVICE

TECHNICAL FIELD

The invention relates to devices for cleaning surfaces and in particular to devices which use abrasives entrained in a stream of high pressure air on the cleaning substance. More particularly, the invention relates to such cleaning devices in which the spent abrasive particles and debris are captured within the device and removed by a vacuum source and collected in a recovery unit to prevent escape of the particles and debris into the surrounding atmosphere.

BACKGROUND ART

Abrasive blasting devices commonly referred to as sandblasters, have been used for a considerable number of years in the cleaning industry for cleaning various surfaces. A supply of abrasive particles, usually sand, is entrained in a stream of high pressure air and fed into a nozzle from which it is ejected and impinged against the surface to be cleaned. The high pressure abrasive particles remove dirt and debris from the surface and provide an extremely satisfactory cleaning means. However, considerable problems are involved with such abrasive cleaning operations. Many of the cleaning operations are performed in enclosed places such as the interior of tank cars and ship hulls or in factories and other locations where the spent abrasive particles and debris enter the air and become deposited on the surrounding equipment. Also when the cleaning is done in a confined place the dust that is created is so intense that the blasting can be performed only for short periods

of time after which the operator must wait until the dust settles and visibility increases before continuing. This results in wasted time and increases considerably the cost of the cleaning operation.

The generated dust also is a serious problem even when the cleaning operation is being performed in outside environments due to the pollution created thereby. For example, red lead base primers have been applied to bridges over waterways throughout much of the country. Environment laws now require that these primers be removed due to their health hazards and that when removed it does not enter the waterways which would poison the fish or water tables. Thus, the usual heretofore abrasive blasting operation cannot be used for such cleaning operations.

Likewise, a considerable number of railroad cars, tankers, ship hulls and the like have storage compartments that require pressurized abrasive blasting both interior and exterior in which the particles present a health hazard to the workman or pollution to the surrounding atmosphere and waterways. Accordingly, such existing problems and equipment provide an expensive abrasive blasting cleaning operation and in many applications prevent the use of such abrasive cleaning due to pollution restrictions and laws.

Others devices have attempted to overcome this problem by removing the spent abrasives and debris from within the cleaning nozzle by placing a vacuum thereon. In such prior constructions, the skirt of the nozzle or nozzle housing was formed of brush bristles which was in contact with the surface being cleaned to prevent the escape of such particles into the surrounding atmosphere, yet which enabled sufficient air to pass through the bristles as makeup air for the vacuum produced within the nozzle housing. These devices although performing

satisfactory for certain applications provide an excessive amount of drag on the device as it is being moved across the surface being cleaned. Also the internal blast pattern of particles leaving the nozzle is disrupted by the internal vacuum. In order to prevent this disruption the nozzle had to terminate beyond the vacuum chamber and closely adjacent to the surface being cleaned. This formed a relatively small blast pattern against the surface resulting in increased time and correspondingly cost in performing a cleaning operation.

Another problem with prior abrasive cleaning devices is that the amount of abrasives used determined to a great extent the final cost of the cleaning operation. This becomes very important where expensive abrasives are used such as steel grid, star blast, garnet, copper slag, aluminum oxide, and walnut shell. The non recoverable abrasives thus increased the cost of a cleaning operation considerably, in addition to the pollution and health hazards created thereby.

Thus the need has existed for an improved pressurized abrasive cleaning device which enables the spent abrasives to be recovered along with the debris eliminating polluting of the surrounding atmostphere and enabling the spent abrasives to be reused, and which provides an efficiently large blast pattern.

DISCLOSURE OF THE INVENTION

Objectives of the invention include providing an improved pressurized abrasive cleaning device for abrasive blasting a surface and simultaneously recovering nearly all of the abrasives and debris, and in which the device has various work ring configurations which are interchangable to conform to the surface being cleaned to prevent escape of the abrasive and debris into

the surrounding atmosphere. Another objective is to provide such a device which has an outer housing forming an internal vacuum chamber which is connected to a suction exhaust line for recovering nearly all of the spent abrasives and debris for reclaiming the abrasive particles in a filtering unit, and in which a venturi nozzle is located within a blast tube which extends concentrically through the housing and vacuum chamber to a position closely adjacent to the work surface thereby maintaining the integrity of the blast pattern by preventing its disruption as it passes through the vacuum chamber resulting in a relatively large and efficient blast pattern against the work surface.

A further objective of the invention is to prove such an abrasive cleaning device in which the work rings are removably mounted on a ring holder located at the end of the housing, in which the holder is moveably mounted by a gimbal on the housing enabling the outer ring edges to maintain close contact as it is being moved over the work surface without excessive manipulation and movement of the housing, and in which the work ring holder is connected to the housing by a flexible vacuum duct with the gimbal being located within the duct.

A further objective is to provide a cleaning device in which a pair of roller assemblies are pivotally mounted on the work holder ring for rolling engagement with the work surface to maintain the work ring in close contact with the surface, and which enables the device to be moved easily along the work surface reducing fatigue on the operator, and in which the surface contact rollers are adjustable to provide a makeup air gap between the work ring and work surface by maintaining the desired space for the makeup air without materially effecting the strength of the internal vacuum.

Still another objective of the invention is to provide such a cleaning device in which the work rings are formed of cast urethane which retards the wearing away action thereon by the pressurized abrasives, which can be formed easily with outer edges which match the contour of the surface being cleaned, and which are readily mounted on and removed from the work holder ring without the use of external clamping or attachment means.

A further objective is to provide such a device in which the vacuum housing interior blast tube and work ring holder are formed of stainless steel to provide a sturdy construction which is able to resist or retard materially the abrasive action created thereon by the pressurized abrasives, in which the rollers are provided with relief slots extending along the roller bores to prevent and reduce binding of the rollers on their mounting axles due to the collection of abrasives and debris therebetween, and in which the rollers also are formed of urethane to provide sufficient strength and durability while reducing the abrasive action and wear thereon by the abrasive particles and continuous contact with the work surfaces.

Another objective is to provide such an abrasive cleaning device which eliminates difficulties heretofore encountered, achieves the objectives simply, efficiently and economically, and solves the problems and satisfies needs existing in the art.

These objectives and advantages are obtained by the improved pressurized abrasive cleaning device the general nature of which may be stated as including a housing having a vacuum chamber formed therein; a blast tube having inlet and outlet ends located within and extending through the vacuum chamber; a nozzle having inlet and outlet ends mounted within the housing

with said outlet end extending a predetermined distance concentrically within the blast tube toward the outlet end of said tube, and with the inlet end of the nozzle being adapted to be connected to a source of pressurized air containing abrasive particles; work ring means mounted on the outer end of the housing for movement along a surface to be abrasively cleaned; gimbal means for movably mounting the work ring means on the outer end of the housing; and exhaust tube means communicating with the vacuum chamber and adapted to be connected to a suction source for removing spent abrasive particles and debris trapped within the work ring means and vacuum chamber preventing their escape into the atmosphere.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention, illustrative of the best mode in which applicants have contemplated applying the principles, is set forth in the following description and is shown in the drawings, and is particularly and distinctly pointed out and set forth in the appended claims.

FIG. 1 is a diagrammatic perspective view showing the improved pressurized abrasive cleaning device in combination with usual pressurized air and abrasive supply equipment being used in cleaning a vertical wall;

FIG. 2 is an enlarged plan view with portions broken away and in section, showing the improved abrasive cleaning device;

FIG. 3 is a longitudinal sectional view taken on line 3-3, FIG. 2;

FIG. 4 is an enlarged sectional view taken on line 4-4, FIG. 3;

FIG. 5 is an enlarged sectional view taken on line 5-5, FIG. 3;

FIG. 6 is an enlarged sectional view taken on line 6-6, FIG. 3;

FIG. 7 is an enlarged sectional view taken on line 7-7, FIG. 3;

FIG. 8 is an enlarged fragmentary sectional view taken on line 8-8, FIG. 3;

FIG. 9 is a perspective view showing one of the rollers of the cleaning device;

FIG. 10 is a perspective view showing one form of work ring used for cleaning relatively flat surfaces;

FIG. 11 is a perspective view showing another form of work ring used for cleaning outer right angle corners;

FIG. 12 is a perspective view similar to FIGS. 10 and 11 showing another work ring used for cleaning inner right angle corners;

FIG. 13 is a fragmentary perspective view showing the work ring of FIG. 11 cleaning an outer corner;

FIG. 14 is a fragmentary perspective view showing the work ring of FIG. 12 being used to clean an inner right angle corner;

FIG. 15 is a fragmentary perspective view showing the gimbal moutning of the work ring holder on the end of the housing ; and

FIG. 16 is a fragmentary plan view of one of the roller assemblies mounted on the work ring holder.

Similar numerals refer to similar parts throughout the drawings.

BEST MODE FOR CARRYING OUT THE INVENTION

The improved pressurized abrasive cleaning device is indicated generally at 1, and is shown in FIG. 1 connected to auxilary abrasive cleaning equipment which may include a pressurized air supply system 2 and

a hopper 3 containing abrasive particles which are fed through a supply hose 4 to nozzle 1. Supply hose 4 is connected to a conduit 5 which extends between supply system 2 and hopper 3. Control valves 6 and 7 are located in conduit 5 for regulating the air pressure from unit 2 and for controlling the rate of flow of abrasive particles from hopper 3 into line 4. An exhaust line 8 is connected at one end to device 1 and at its opposite end to a spent abrasive particle collection tank and filter unit 9.

The details of construction of cleaning device 1 is shown particularly in FIGS. 2 and 3. Device 1 includes a main housing indicated generally at 14, with supply hose 4 being connected thereto by a cylindrical nozzle holder 11 and a plurality of attachment screws 12. A usual venturi nozzle 13 is threadably engaged and mounted on nozzle holder 11 and extends forwardly therefrom with a cylindrical portion 19 of housing 14. A cylindrical shaped blast tube 15 is telescopically concentrically mounted with respect to nozzle 13 within housing 14 by screws 18 to a cylindrical end portion 21 of a vacuum cone, indicated generally at 20. A collar 16 is mounted on nozzle holder 11 and is attached by welds 17 to the inner end of housing portion 19. Cylindrical portion 21 of cone 20 preferably is attached by welds 22 to the outer end of housing section 19. Vacuum cone 20 includes an outwardy forwardly extending conical wall 23 connected integrally with cylindrical portion 21 and terminating in an axially extending cylindrical wall 24. Wall 24 terminates in an inwardly extending annular flange 25 which forms a central circular opening 26.

A handle 28 is attached by welds 29 to housing 14 and exhaust line 8 communicates with the interior of vacuum chamber 30 formed within housing 14 through a

hollow exhaust tube 31. Exhaust tube 31 communicates with vacuum chamber 30 through an elliptical-shaped opening 32.

Referring particularly to FIGS. 2, 3 and 15, a cylindrical work ring holder indicated generally at 35 is movably mounted on the outer end of vacuum cone 20 by a gimbal, indicated generally at 36. Work ring holder 35 is formed by a cylindrical sidewall 37 which terminates in an inner inwardly extending annular flange 38 which forms a central circular shaped opening 39. Gimbal 36 includes a gimbal ring 41 mounted by a pair of gimbal mounts 42 and pivot bolts 43 to annular flange 25 at the outer end of vacuum cone 20. Ring holder 35 is mounted by another pair of gimbal mounts 44 and pivot bolts 45 located diametrically opposite of each other and spaced 90° with respect to gimbal mounts 42 of vacuum cone 20. This gimbal arrangement provides for precise movement of work holder ring 35 and associated work ring along the work surface by enabling pivotal movement of the work ring in two directions with respect to vacuum cone 20.

A flexible vacuum duct 48 is mounted on the outer end of vacuum cone 20 by a clamp 49 and is attached to the outer surface of cylindrical wall 37 of work ring holder 35 by a similar clamp 50. Duct 48 enables movement to occur between work ring holder 35 and vacuum cone 20 assisting the outer work engaging edges of the work ring to follow the contour of the surface being cleaned while forming a dust tight passage into the vacuum chamber.

In accordance with another feature of the invention, a pair of diametrically spaced roller assemblies indicated generally at 53, are mounted on work ring holder 35. Each roller assembly is similar to each other and therefore only one is described in detail. Roller assembly 53 includes a pair of spaced stud brackets 54

(FIG. 8) which are welded to the outer surface of work ring holder wall 37 for pivotally mounting a plurality of individual rollers each of which is indicated generally at 55. Roller 55 are rotatably mounted on a shaft 56 which is rotatably supported and extends between a pair of spaced legs 59 of a U-shaped bracket 58. Preferablly three rollers 55 are rotatably mounted on shaft 56 with bracket legs 59 being located between the central roller and the two outer end rollers. Bracket 58 is pivotally mounted on a pivot shaft 65 which extends between stud brackets 54.

An adjustment bolt 60 is threadably mounted in a threaded hole 61 formed in a plate 62 which extends between the bracket legs 59. A torsional coil spring 64 is telescopically mounted on shaft 65 with one end engaging plate 62 and an other end engaging a stud bracket 54 biasing roller assembly 53 in a retracted position indicated by arrow A in FIG. 8. The head of bolt 60 engages flexible duct mounting band 50 and when adjusted in plate 62 will effect the size of spacing 52 between outer work engaging edge of a work ring 47 with respect to a work surface 10 as shown in exaggerated condition in FIG. 8. Rollers 55 are formed of rugged cast urethane and have a central bore 66 formed therein (FIG. 9) through which shaft 56 extends for rotatably mounting rollers 55 thereon.

In accordance with another feature of the invention, a plurality of radially extended slots 67 generally circular in cross section communicate with bore 66 and extend radially outwardly therefrom. Slots 67 extend longitudinally throughout the length of bore 66 and provide a channel through which abrasive particles and debris can be collected and discharged from the rollers. The edges of slots 67 act as scrapers to remove the particles from shaft 56 and bring them into

and along the slots. Relief slots 67 enable spent abrasive particles and debris from being trapped within and between bore 66 and shaft 56 resulting in binding up of the rollers on the shaft. The outer circular roller ends 68 are formed with recesses 69 in which a mounting shaft nut 70 and washer 71 (FIG. 2) is located for securing rollers 55 on shaft 56. Work ring 47 which is shown mounted in work ring holder 35 in FIGS. 2, 3 and 8 is shown in detail in FIG. 10. Ring 47 is of the type adapted to be used on a generally flat surface 10 as shown in FIGS. 1 and 2. Work ring 47 preferably is formed of cast urethane and has a main cylindrical body 72 terminating in a radially outwardly extending annular flange 73 providing a flat annular work engaging edge surface 74. Cylindrical body 72 has an axial length equal to the axial length of work ring holer 35 whereby rear annular surface 75 thereof abuts against work ring flagne 38 with annular flange 73 abutting against the outer circular edge 40 of work ring holder 37 as shown particularly in FIG. 3. Cylindrical body 72 of work ring 47 has a sliding slip-fit engagement with the interior of work ring holder wall 37 and does not require any additional components to secure or lock the work ring in the work ring holder.

Additional work ring configruations, indicated generally at 77 and 78 are shown in FIGS. 11 and 12, respectively, are used for cleaning exterior generally right angle corners 83 as shown in FIG. 13 and interior right angle corners 88 as shown in FIG. 14. Work ring 77 includes a cylindrical body 70 complementary in diameter and axial length to the inside surface of cylindrical wall 37 of work ring holder 35 so as to provide a slip-fit engagement therebetween. Rear annular surface 80 of ring 77 abuts against annular flange 38 of

ring holder 35, and an annular shoulder 81 formed at the forward end of cylindrical body 79 abuts against outer edge 40 of ring holder wall 37. An outer increased diameter cylindrical portion 90 of work ring 77 is formed with an inwardly extending V-shaped notch 82 which forms an included right angle therebetween. This configuration enables the work ring to conform to exterior right angle corner 83 as shown in FIG. 13 for effectively cleaning the same without losing its sealing engagement with the wall surfaces.

Work ring 78 is generally similar to that of ring 77 having a cylindrical wall body 84 which is complementary with the interior surface of work ring holder wall 37. The outer cylindrical portion 85 of ring 78 is formed with a outwardly extending V-shaped configuration 86. Edges 87 of body portion 85 form an included right angle enabling the edges to abut against the perpendicular mating surfaces of an inner right angle corner 88 as shown in FIG. 14.

Other work ring configurations can be provided for specific types of surface to be abrasively cleaned. For example, a semicircular configuration of a predetermined size diameter would be used for cleaning cylindrical members such as poles enabling the contour to match that of work surface. The particular work rings shown in the drawings and indicated by the numerals 47, 77, and 78 are only three examples of such work ring configurations.

Improved abrasive cleaning device 1 has a number of features and advantages not believed present in existing devices. In accordance with one of the main features of the invention, device 1 recovers nearly all of the spent abrasive particles which are ejected through nozzle 13 and impinged against a surface being cleaned together with the debris removed from the cleaned surface.

These particles are retained within the work ring and vacuum cone 20 and are removed therefrom through exhaust tube 31 preventing them from escaping into the surrounding atmosphere as with prior pressurized abrasive cleaning devices. The spent abrasive particles and debris cleaned from the surface enter line 8 and are collected in exhaust tank and filter unit 9. The recaptured abrasive particles then may be filtered and cleaned and returned to supply hopper 3 for reuse which reduces considerably the cost for the abrasive. This is especially important for certain types of abrasives which are relatively expensive. More importantly, than the cost savings achieved by the reuse of the abrasive particles, is the elimination of the particles entering into the surrounding atmosphere and being deposited on nearby equipment or landscape and with the resulting pollution produced thereby.

Another important feature is the retaining of an extremely efficient, effective and relatively large blast pattern by blast tube 15 as the particles are ejected from nozzle 13 and carried along blast tube 15 and impinged against a surface the pressurized air. The size of the blast pattern is adjustable by the distance that the outlet end of the nozzle is spaced rewardly from the outer end of blast tube 15. This spacing is adjusted so that the blast pattern reaches its most efficient size just beyond the end of blast tube 15. This eliminates excessive abrasive action and wear on the end of tube 15 while providing the largest most efficient blast pattern size for striking surface 10. Blast tube 15 maintains the blast pattern after it leaves nozzle 13 by preventing its destruction or disturbance as it passes through the vacuum chamber within vacuum cone 20.

Another advantage is the mounting of the work ring on the housing of the cleaning device by gimbal 36. Gimbal 36 together with flexible exhaust duct 48 enables the work ring to follow the contour of the surface extremely accurately without excess manipulation or work on the operators part. The operator merely rolls or moves the cleaning device 1 along the work surface and the gimbal mounting of the work ring automatically enables the work ring to follow the contour of the surface. This cleaning movement also is assited by roller assemblies 53 which reduce considerably the fatigue exerted on the operator since much of the weight is supported by or exerted on roller assemblies 53.

Roller assemblies 53 also maintain the desired contact or spacing of the outer work engaging surface of the work ring with respect to the surface being cleaned. Although annular or V-shaped edges of the work rings are referred to as the contact work engaging surfaces they are maintained at a very slight distance from the surface being cleaned. Preferably a spacing of approximately 1/32 inch is maintained between the outer edges of the work ring and the surface. This small space enables a sufficient airflow to enter vacuum cone 20 from around the work ring edges and into the vacuum chamber without destroying the vacuum produced therein and providing the makeup air. For example, an airflow of 200 cfm may be emitted through nozzle 13 and 400 cfm removed through exhaust line 8. This inrush of air around the work ring prevents the particles from being blown outwardly beyond the edges and into the surrouding atmosphere.

The adjustable feature of roller assemblies 53 enables this spacing to be maintained at the desired distance as the surface being cleaned is worn down by

the abrasives.

Still another feature of the invention is the providing of relief slots in the individual rollers along the shaft receiving bores thereof preventing the rollers from binding on their mounting shafts even though abrasive particles may be trapped therebetween. Also the forming of the blast tube and vacuum cone of stainless steel provides a rugged construction able to withstand the abrasive action exerted on the interior surfaces thereof by the abrasive particles being moved along by the air pressure entering through line 4.

Accordingly, the improved pressurized abrasive cleaning device is simplified, provides an effective, safe, inexpensive, and efficient device which achieves all the enumerated objectives, provides for eliminating difficulties encountered with prior devices, and solves problems and obtains new results in the art.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

Having now described the features, discoveries and principles of the invention, the manner in which the improved pressurized abrasive cleaning device is constructed and used, the characteristics of the construction, and the advantageous, new and useful results obtained; the new and useful structures, devices, elements, arrangements, parts, and combinations, are set forth in the appended claims.

CLAIMS

1. An improved pressurized abrasive cleaning device (1) including:

a) a housing (14) having a vacuum chamber (30) formed therein;

b) a blast tube (15) having inlet and outlet ends located within and extending through the vacuum chamber;

c) a nozzle (13) having inlet and outlet ends mounted within the housing with said outlet end extending a predetermined distance concentrically within the blast tube toward the outlet end of said tube, and with the inlet end of the nozzle being adapted to be connected to a source of pressurized air containing abrasive particles;

d) work ring means (35,47) mounted on the outer end of the housing for movement along a surface (10) to be abrasively cleaned; and

e) exhaust tube means (31) communicating with the vacuum chamber and adapted to be connected to a suction source for removing spent abrasive particles and debris trapped within the work ring means and vacuum chamber preventing their escape into the atmosphere.

2. The abrasive cleaning device defined in Claim 1, in which gimbal means (36) movably mounts the work ring means on the outer end of the housing.

3. The abrasive cleaning device defined in Claim 2, in which the work ring means includes a work ring holder (35) and a work ring (47) mounted on said holder; in which the gimbal means includes a gimbal ring (41), a first pair of mounts (42) pivotally mounting the gimbal ring on the outer end of the housing, and a second pair of mounts (44) pivotally mounting the work ring holder on the gimbal ring.

4. The abrasive cleaning device defined in Claim 3, in which the work ring holder includes a cylindrical wall (37) with an annular flange (38) extending radially inwardly from an inner end thereof; in which the work ring is formed of cast urethane and has a cylindrical shaped body portion (72) which is telescopically mounted in the cylindrical wall of the ring holder; in which an inner edge (75) of the work ring abuts against the annular flange of the ring holder wall to position the work ring within the work ring holder; and in which the work ring is formed with an outer edge (74) shaped to match the general contour of a surface being cleaned.

5. The abrasive cleaning device defined in Claim 3, in which the work ring is formed with an outer edge shaped to match the general contour of a surface being cleaned; and in which the outer edge of the work ring is a flat annular surface (74).

6. The abrasive cleaning device defined in Claim 3, in which the work ring is formed with an outer edge shaped to match the general contour of a surface being cleaned; and in which the outer edge of the work ring has an inwardly extending V-shaped configuration (82) for use in cleaning outer generally right angled corners.

7. The abrasive cleaning device defined in Claim 3, in which the work ring is formed with an outer edge shaped to match the general contour of a surface being cleaned; and in which the outer edge of the work ring has an outwardly extending V-shaped configuration (86) for use in cleaning inner generally right angled corners.

8. The abrasive cleaning device defined in Claim 3, in which a flexible vacuum duct (48) is mounted on and extends between the work ring holder (35) and a vacuum cone (80) to provide a generally dust tight seal and to permit movement of the work ring with respect to the housing by the gimbal means.

9. The abrasive cleaning device defined in Claim 1, in which roller means is mounted on the work ring means for positioning said work ring means closely adjacent to a surface being cleaned and for moving the device along said surface; in which the roller means includes a pair of roller assemblies (53) mounted diametrically opposite of each other on the work ring means; and in which the roller assemblies are adjustably mounted on the work ring means for adjusting the spacing between said work ring means and the surface being cleaned.

10. The abrasive cleaning device defined in Claim 9, in which each of the roller assemblies includes a plurality of rollers (55) rotatably mounted on a shaft (56); in which the roller shaft is pivotally mounted with respect to the work ring means; in which

spring means (64) bias the rollers toward a retracted position; in which the rollers are formed with a central bore (66) through which the shaft extends for rotatably mounting the rollers thereon; and in which a plurality of radially extending slots (67) are formed in the rollers and communicate with the bore and extend longitudinally along said bore for collecting and discharging abrasive particles trapped in the roller bore.

11. The abrasive cleaning device defined in Claim 10, in which each of the roller shafts is mounted on a bracket (58); in which said bracket is pivotally mounted on the work ring means by a pivot shaft (65); and in which the spring means is a torsional coil spring telescopically mounted on the pivot shaft and engageable with the bracket for biasing the bracket and mounted rollers toward the retracted position.

12. The abrasive cleaning device defined in Claim 1, in which the nozzle is a venturi style nozzle; and in which the outlet end of the nozzle terminates a predetermined distance rearwardly from the outlet end of the blast tube.

13. The abrasive cleaning device defined in Claim 1, in which the blast tube is a cylindrical shaped tube which extends beyond the outlet end of the nozzle and terminates concentrically within the work ring means at a predetermined distance inwardly from an outer work edge of the work ring means.

14. The abrasive cleaning device defined in Claim 13 in which the outlet end of the blast tube terminates approximately 10 1/2 inches beyond the outlet end of the nozzle and terminates approximately 1 1/2 inches rearwardly of an outer work edge of the work ring means.

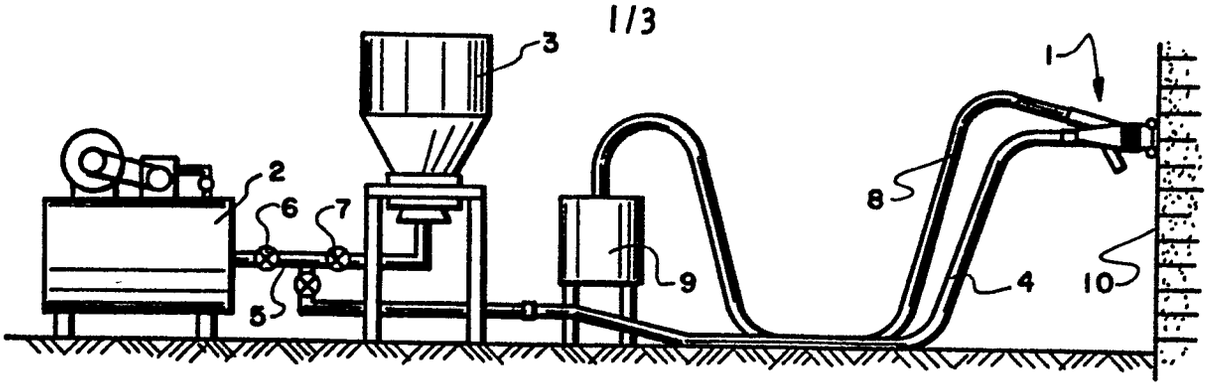


FIG. 1

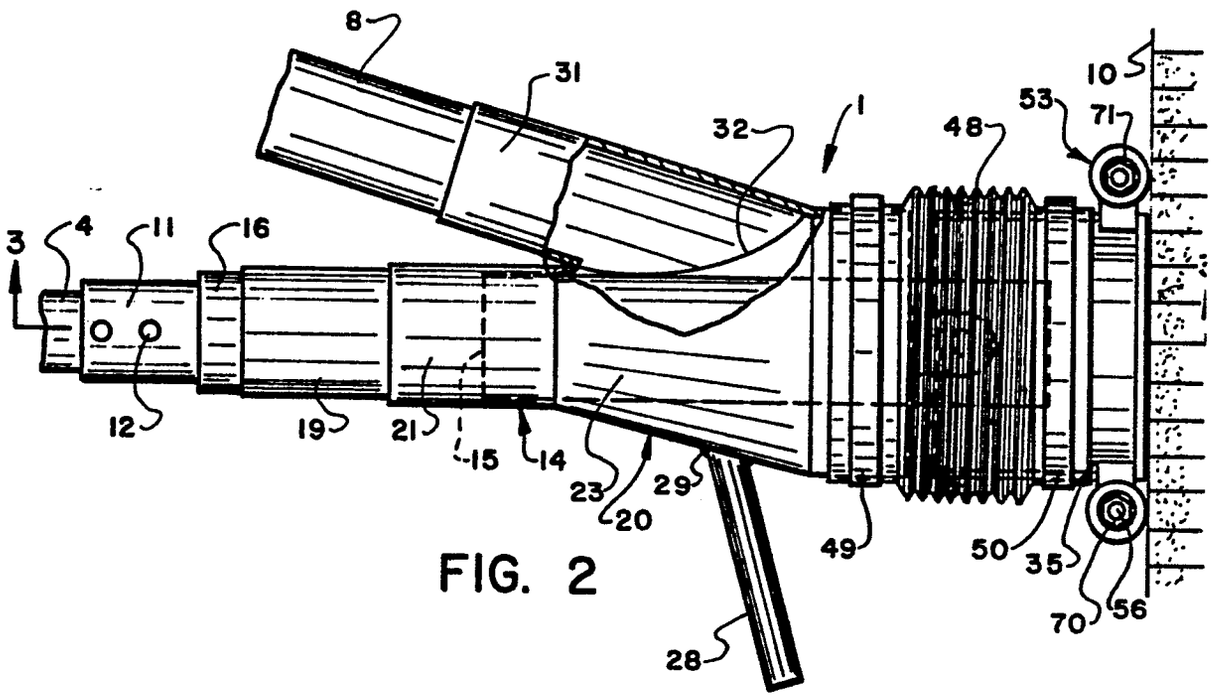


FIG. 2

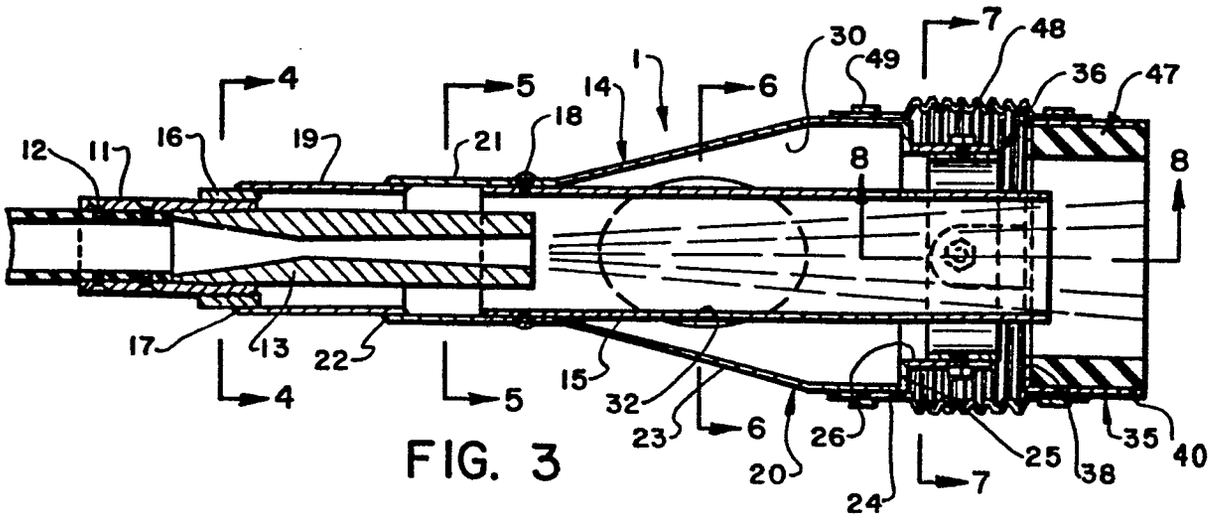
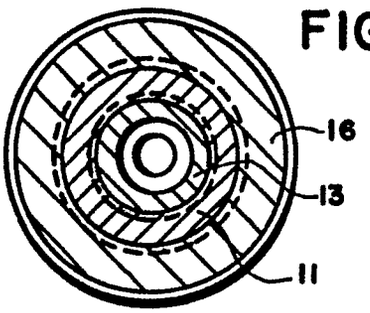


FIG. 3

FIG. 4



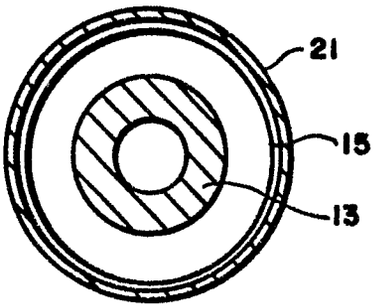


FIG. 5

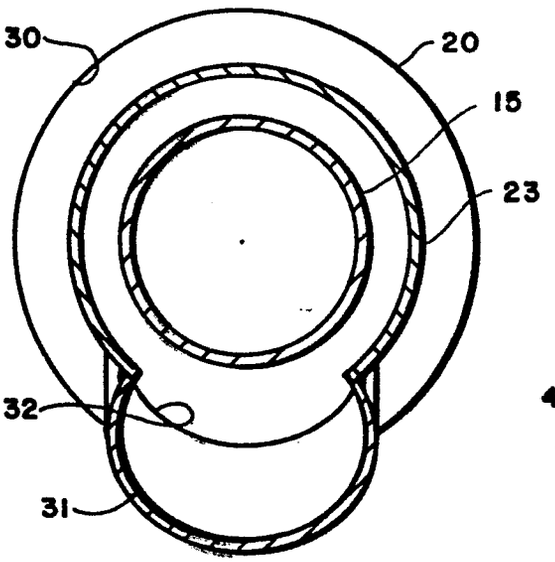


FIG. 6

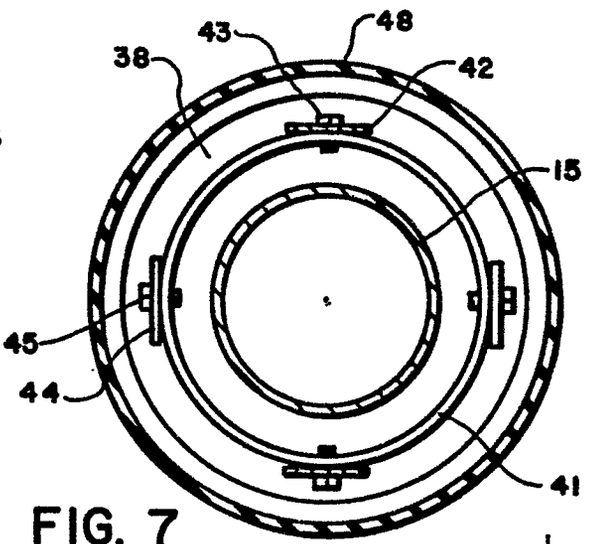


FIG. 7

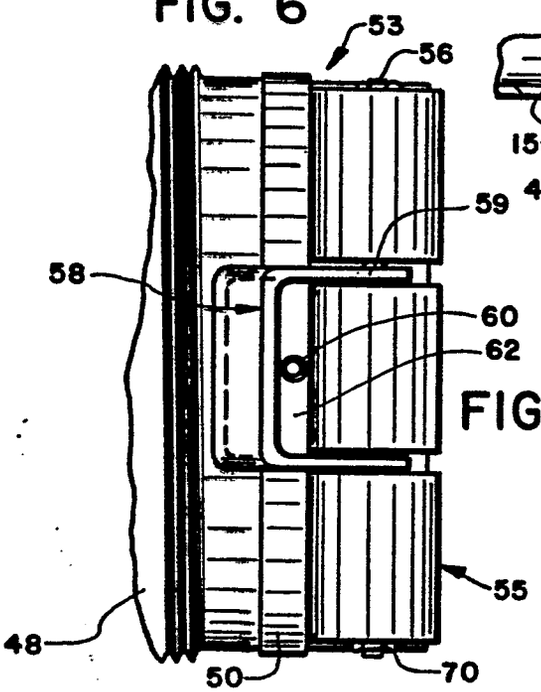


FIG. 16

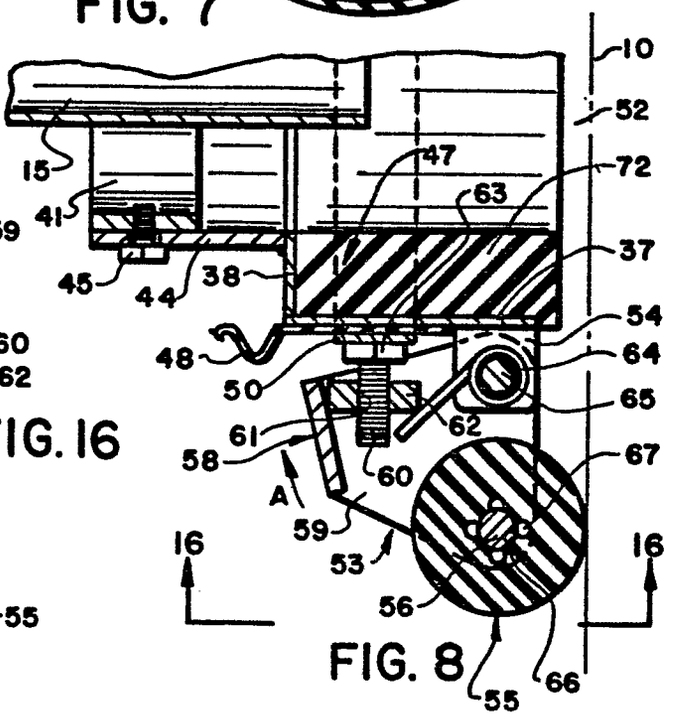


FIG. 8

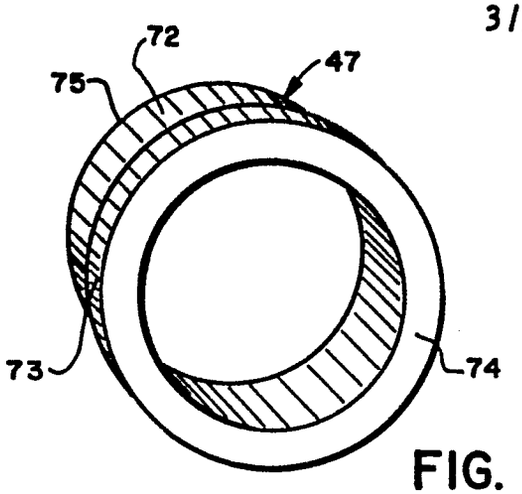


FIG. 10

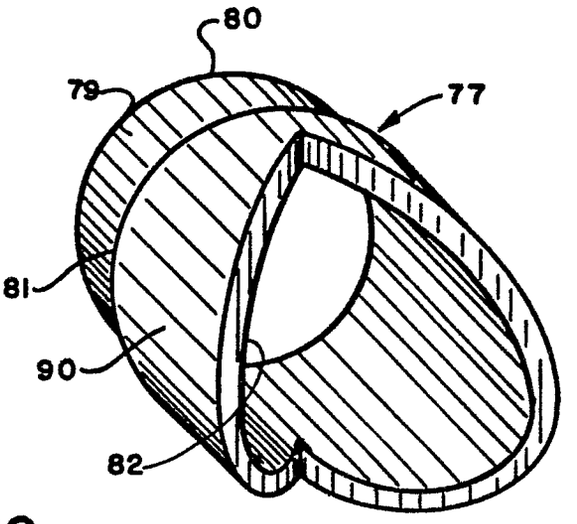


FIG. 11

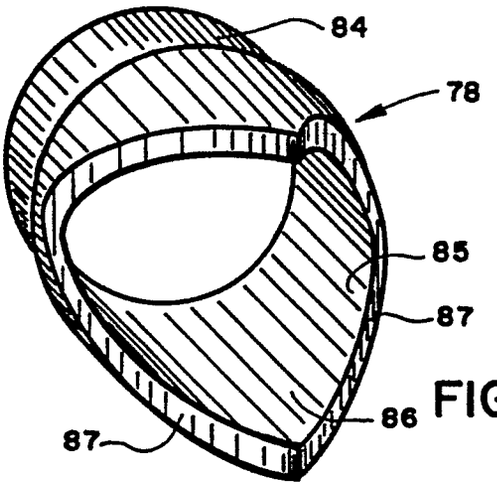


FIG. 12

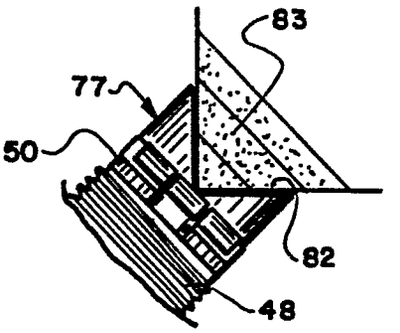


FIG. 13

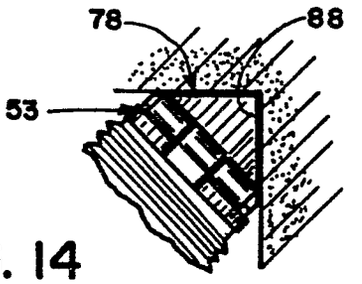
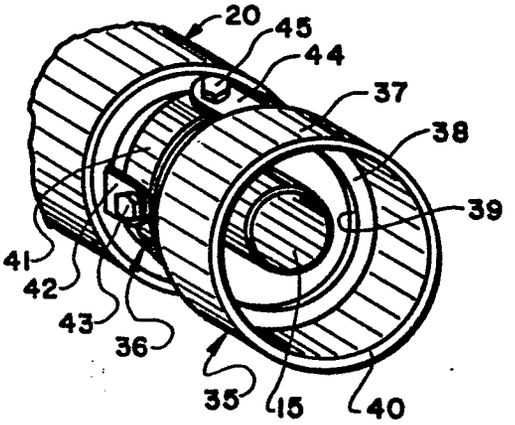


FIG. 14

FIG. 15



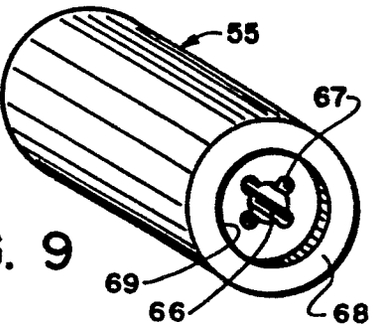


FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

0160353
Application number

EP 85 30 0417

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl 4)
P,X	WO-A-8 402 673 (JAKOBSSON) * Abstract; figures * ---	1,5,8, 12,13	B 24 C 5/02 B 24 C 3/06
X	US-A-4 333 277 (TASEDAN) * Figure 2 * ---	1,5,13	
A	US-A-2 846 822 (STEFFEN) * Figures * ---	1-5,8, 13	
A	US-A-4 395 850 (BROWN) * Figures * ---	1-7	
A	DE-A-2 450 509 (WOMA) * Claim 7; figures * ---	9-11	
A	US-A-3 750 961 (FRANZ) * Figure 8 * ---	12	
A	FR-A-2 350 766 (LUCHAIRE) * Figures * ---	12	
A	US-A-3 753 318 (ESKIJIAN) * Figures * ---	9-11	
A	US-A-2 723 498 (HASTRUP) -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 24 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	01-07-1985	ESCHBACH D.P.M.

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