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(71) Applicant: **Petty, Robert Hugh**
Washington NE38 9DZ (GB)

(72) Inventor: **Petty, Robert Hugh**
Washington NE38 9DZ (GB)

(74) Representative: **Elsworth, Dominic Stephen**
Hargreaves Elsworth
Rotterdam House
116 Quayside
Newcastle-upon-Tyne NE1 3DY (GB)

(54) Cleaning apparatus

(57) Cleaning apparatus (1) comprises a structure mounting a cleaning tank (3), the tank (3) including at least one fluid outlet connectable to at least one fluid supply. The tank (3) is removably mounted on the structure.

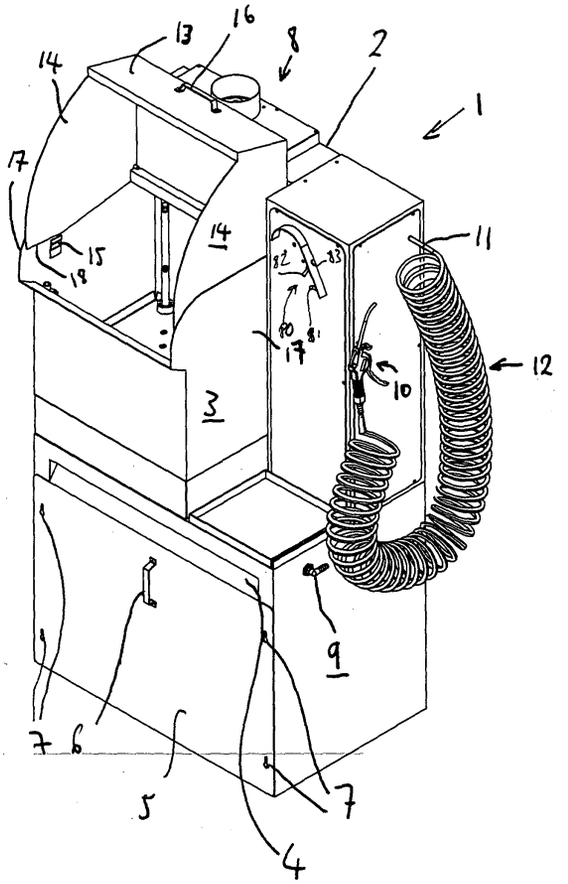

FIGURE 1A

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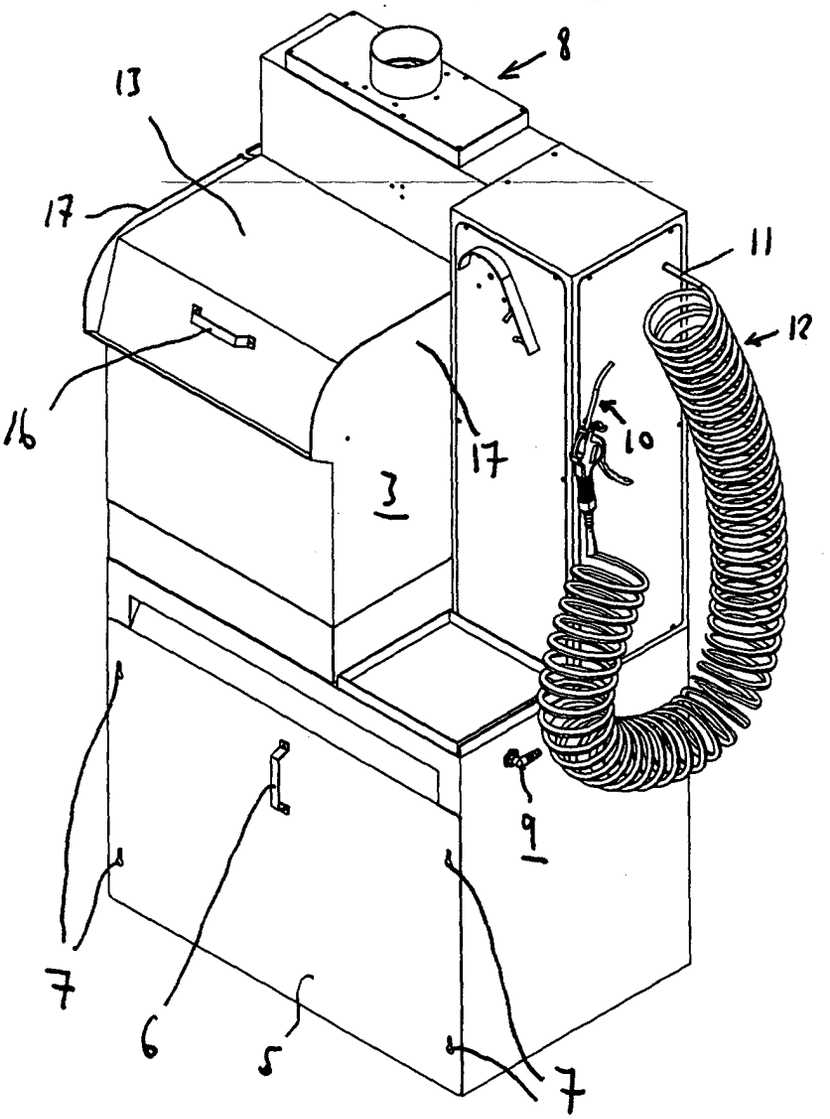
FIGURE 1B



Description

Field of the Invention

[0001] This invention relates to cleaning tools, and in particular to an apparatus for cleaning spray guns.

Background of the Invention

[0002] Paint spray guns are widely used in automotive repair shops and other industries where spray painting is carried out. These spray guns must be cleaned regularly if they are to have a reasonable service life. Furthermore, spray guns must be thoroughly cleaned within a limited time frame following use, otherwise the paint tends to solidify, making the spray gun exceedingly difficult to clean.

[0003] There are many examples of spray gun cleaning apparatus. The most commonly used apparatus comprise a cabinet which includes a drain, a fluid supply, a fluid dispersion means and fluid collector. The fluid supply and fluid collector are consumables, brought to and removed from the machine.

[0004] The spray gun cleaning apparatus must itself be cleaned periodically. This gives rise to a number of problems. First, whilst the apparatus is being cleaned, it is not possible to use the same apparatus for cleaning spray guns, and hence spray gun operators may be forced to stand idle whilst waiting to clean their spray guns. Second, spray guns and ancillary equipment must be cleaned within 10 minutes of ceasing spraying. If an operator has to wait longer than this threshold time, the paint in his gun may "go off", making the gun particularly difficult to clean. Third, because the spray gun cleaning apparatus must be dismantled for cleaning, only a properly trained service engineer can carry out the cleaning operation. Fourth, because known spray gun cleaning apparatus require on site cleaning, the number of apparatus that a service engineer can attend to in any one day is limited by the amount of time he must spend cleaning apparatus. Fifth, the cleaning agents used to clean the apparatus must be acceptable for use in a spray shop.

[0005] A number of patents and patent applications relate to spray gun cleaning apparatus. WO97/3567 describes equipment for cleaning spray guns in which an electric pump is used to convey cleaning liquid to an through spray nozzles.

[0006] Another known spray gun cleaning apparatus is described in US 6,647,997. The apparatus described in this patent is characterised in not requiring hand operation of taps and the like.

[0007] Another known spray gun cleaning apparatus is described in US 4,827,955. In this patent, a suction system is used to expose the spray gun to a vacuum for cleaning. This apparatus avoids solvent being sprayed into the atmosphere.

[0008] A spray gun cleaning apparatus is also known from US 2004/0103933. In this patent the apparatus is characterised by the washer apparatus providing clean solution throughout each wash cycle.

[0009] Another spray gun cleaning apparatus is described in EP 1327485. In this patent the apparatus is characterised by the presence of a partially submerged rotatable brush.

[0010] None of the spray gun cleaning apparatus described in the above-mentioned patent information addresses the problems previously set out.

[0011] It would therefore be desirable to provide an improved cleaning apparatus, which is suitable for the cleaning of spray guns.

Summary of the Invention

[0012] According to one aspect of the invention there is provided a cleaning apparatus as specified in Claim 1.

[0013] According to a second aspect of the invention there is provided a method of cleaning spray painting equipment as specified in Claim 22.

Brief Description of the Drawings

[0014] In the drawings, which illustrate preferred embodiments of the invention, and are by way of example

Figure 1a is a schematic representation of a cleaning apparatus according to the invention with the lid open;

Figure 1b is a schematic representation of the cleaning apparatus illustrated in Figure 1a with the lid closed;

Figure 2a is a schematic representation of a cleaning apparatus according to the invention in assembled configuration;

Figure 2b is a schematic representation of the cleaning apparatus illustrated in Figure 2c with the lid removed;

Figure 2c is a schematic representation of the cleaning apparatus illustrated in Figures 2a and 2b with the cleaning tank partially removed;

Figure 2d is a schematic representation of the cleaning apparatus illustrated in Figures 2a to 2c with the cleaning tank fully removed;

Figure 3a is an exploded view of a stack of three cleaning tanks forming part of the cleaning apparatus according to the invention;

Figure 3b is an exploded view of a part of a connecting arrangement according to the invention;

Figure 3c illustrates the three cleaning tanks of Figure 3a in stacked configuration;

Figure 3d is an exploded view of the connecting arrangement partially illustrated in Figure 3b;

Figure 4a is a schematic illustration of the cleaning tank forming part of the cleaning apparatus according to the invention;

Figure 4b is a schematic representation of the cleaning tank illustrated in Figure 4a and showing additional elements of the tank;

Figure 4c is an exploded view of a base portion of the tank illustrated in Figures 4a and 4b;

Figure 5a is a schematic representation of cleaning apparatus according to the invention;

Figure 5b is a schematic representation of the cleaning apparatus illustrated in Figure 5a with a cover removed;

Figure 5c is a cut-away view of the cleaning apparatus illustrated in Figures 5a and 5b;

Figure 5d is detail view of a first valve forming part of the cleaning apparatus illustrated in Figure 5c;

Figure 5e is a detail view of a second valve forming part of the cleaning apparatus illustrated in Figure 5c;

Figure 6a is a schematic representation of cleaning apparatus according to the invention;

Figure 6b is a detailed view of pressurised air connector;

Figure 6c is a detailed view of a pressurised air gun;

Figure 7a is a schematic representation of an extractor unit of the cleaning apparatus according to the invention;

Figure 7b is an exploded view of the extractor unit illustrated in Figure 7a;

Figure 7c is a cross-sectional elevation of the extractor unit illustrated in Figure 7a;

Figure 8 is a schematic representation of the cleaning fluid hydraulics of the cleaning apparatus according to the invention; and

Figure 9 is a schematic representation of the pressurised air hydraulics of the cleaning apparatus according to the invention.

Detailed Description of the Preferred Embodiments

[0015] Referring now to Figures 1a and 1b, a cleaning apparatus 1 comprises a cabinet structure 2 upon which a cleaning tank 3 is removably mounted. The cabinet structure 2 further includes a thinners store 4 covered by a removable plate 5. The removable plate 5 includes a handle 6 and four spaced apart key hole slots 7, which co-operate with pins mounted on the cabinet structure 2 to hold the removable plate in place. Mounted on one side of the cabinet structure are compressed air services in the form of a hose connection 9 for connection to a supply of compressed air (not shown) and a compressed air gun 10 connected to a compressed air outlet 11 by means of a flexible hose 12. The cleaning apparatus 1 further includes an extractor unit 8, which is described in greater detail with reference to Figures 7a to 7c. In Figure 1a the lid 13 of tank 3 is open, whereas in Figure 1b the said lid 13 is closed.

[0016] The lid 13 is held in the lifted position illustrated in Figure 1a by means of engagement between sides 14 of said lid 13 and a clip 15. The sides 14 are fabricated from a material having at least some resilience. The lid 13 is fabricated such that the in the closed position illustrated in Figure 1b the sides 14 press against sides 17 of the tank 3. As the lid is opened, the sides 14 ride over the bracket 15. When the edge 18 of the side 14 has passed over the bracket 15, the said edge 18 is aligned with an opening provided by the bracket. The lid 13 is then pulled slightly as if to close said lid 13, bringing the edge 18 into engagement with the bracket 15.

[0017] Also shown in Figure 1a is the switch bank 80, which includes a hand wash switch 81, a clean rinse switch 82, a timer switch 84 (see Figure 2d), and cover plate 83 to protect the switches from unintentional switching.

[0018] Figures 2a to 2d illustrate the steps for removing the tank 3 from the cleaning apparatus 1.

[0019] In Figure 2a the tank is situated in the cleaning apparatus with the lid 13 closed.

[0020] In Figure 2b the lid 13 is shown removed from the cleaning apparatus 1. In the sides 17 of the tank 3 are provided with slots 19 in which pins 20 of the lid 13 locate.

[0021] In Figure 2c the tank 3 is in the process of being removed from the cabinet structure 2. Removal of the tank 3 is achieved by pulling the lower front part of the tank 3 forwards and upwards so that the tank rotates about a point X where the tank 3 engages with the extractor unit 8. As the tank rotates a corner 21 of the tank slides on a track 24 of the cabinet structure 2.

[0022] In Figure 2d the tank 3 is fully removed from the cabinet structure 2. The tracks 24 on which the base 26 of the tank 3 slides and rests are formed from angle sections, with the leading edge of each track 24 being provided with a chamfer 25 to facilitate easy alignment

of the tank 3 to the cabinet structure 2 when re-fitting the tank 3 to the cabinet structure 2. A ledge 23 is provided in the upper rear part of the tank 3. This ledge 23 engages with the underside of the extractor 8 to provide an effective seal between the tank 3 and the extractor 8 when the cleaning apparatus 1 is in the configurations illustrated in Figures 2a and 2b.

[0023] Referring now to Figures 3a to 3d, there is shown a stack of three tanks 3. In Figure 3a the tanks 3 are shown spaced apart. Looking at the middle tank 3 in Figure 3a, it can be seen that the wall 17 extends beyond the upper surface of lid 13 by a small distance. In the configuration shown in Figure 3c, the upper tank 3 sits on the middle tank 3, which in turn sits on the lower tank 3, the base 26 of a tank 3 sitting on the lid 13 of the tank 3 below. A tank 3 stacked on top of another tank 3 is constrained from lateral movement by the extension of walls 17 beyond the upper surface of lid 13. Each tank 3 that is stacked on top of another tank 3 is constrained from longitudinal movement by pins 22 which engage with the slots 19 previously described with reference to Figure 2b. The slots 19 therefore fulfil dual functions. First, they form part of the lid hinge, and second they provide for the safe stacking of the tanks 3.

[0024] The tank 3 is illustrated in greater detail in Figures 4a to 4c. Referring now to Figure 4b, the tank 3 comprises a chassis 27 strengthened by substantially U shaped members 28 disposed adjacent walls 17 of the tank 3. The width of these U shaped members corresponds substantially to the width of tracks 24, and it is the lower parts of the U shaped members that rest on the said tracks. The chassis 27 mounts a base plate 33 in which a drain 32 is located. Located in each corner of the tank 3 is a pipe 34 having outlet nozzles 35 (numbered on one pipe only for the sake of clarity). Each tube 34 is fluidly connected to a tube mount 36. A perforated plate 29 rests on the tube mounts 36 such that a void exists between the perforated plate 29 and the base plate 33. The perforated plate 29 is provided with edge formations 30, 31 which essentially consist of folded metal, and serve to strengthen the said plate. In use a piece of filter material is place on beneath the perforated plate 29, and another perforated plate is placed beneath the filter material. Fluid exiting through the nozzles 35 and 37 passes through the first perforated plate 29, through the filter material, and the second perforated plate to gather on base plate 33 to exit through drain 32.

[0025] Referring now to Figures 5a to 5e, drums 40, 41 are located in the fluid store 4. In this embodiment drum 40 contains unused clean thinners fluid, whereas drum 41 contains used dirty thinners fluid. In operation, the used thinners fluid contained in drum 41 is recycled and re-used for the first part of a cleaning cycle, and the clean thinners fluid from drum 40 is used for the final rinse cycle. When the cleaning apparatus is serviced, the old drums 40 and 41 are removed, with the old drum 40 that has been removed becoming the new drum 41, and a new drum 40 is installed. The new drum 40 and old drum 40 (new drum 41) are each approximately half full. A pipe 42 extends from the drum 40 to a shut-off valve 43, which is in fluid connection with a pipe 44 that is connected to a clean rinse nozzle (see Figure 8) the pipes 34. A pipe 45 extends from the drum 41 to a shut-off valve 46, which is in fluid connection with a pipe 47 that is connected to the pipes 34. Another pipe (not shown) extends from drain 32 to the drum 40.

[0026] Referring now to Figures 6a to 6c, the cleaning apparatus 1 includes a hose connection 9 for connection to a supply of compressed air (not shown) to the apparatus. Compressed air is the power source for the apparatus as will be described in greater detail with reference to Figure 9. The apparatus also includes an air gun 10 connected to a compressed air outlet 11 by means of a flexible hose 12. The air gun is provided as many spray gun operators like to use compressed air to assist in cleaning their spray guns. As is best shown in Figure 6c, the air gun 10 includes a hook 48, which hooks onto a corresponding hook 49 protruding from the cabinet structure 2. The air gun is conveniently positioned for use by an individual using the cleaning apparatus 1.

[0027] Figure 7a to 7c illustrate the extractor unit 8 which comprises a housing 50 on top of which is mounted a chamber 51 having an outlet 52. In the assembled cleaning apparatus 1, the housing 50 lies above the rear part of the cleaning tank 3. The housing 50 includes a pair of spaced apart apertures 57 which receive tubular elements extending downwardly from the housing 50. Seals 61 ensure that air extracted from the tank 3 does not leak into the housing 50.

[0028] Extraction of air from the tank 3 is achieved by means of an air jet 60. The air jet 60 is connected to the supply of compressed air by means of pipe 54. The air jet 60 functions as a venturi, creating a region of high velocity and low pressure air at the top of the chamber 51. This has the effect of drawing air in the tank through the chamber 51 and out of the outlet 52.

[0029] The housing 50 includes an element 58 which mounts a cut-off switch 59. The cut-off switch 59 is on when the lid 13 is up, because any contamination can escape to atmosphere, and off when the lid 13 is down. The switch 59 is turned on and off by engagement/disengagement of a part of the lid 13 with the switch 59.

[0030] Referring now to Figure 8, the cleaning fluid circuit comprises a drum 40 containing clean thinners fluid and a drum 41 containing recycled thinners fluid. Inlets of two pumps 71 and 73 are connected by pipes 72 and 74 respectively to the drum 41, each pipe 72, 74 having a filter 70 at the drum end. Each pump 71, 73 has an outlet connected to a nozzle located in the tank 3. The pump 71 is connected by a pipe 75 to connectors 76 which attach to pipes 34 to deliver fluid to nozzles 35 and 37. The outlet of pump 73 is connected to a hand wash nozzle 77, which, in use, is located in the tank 3 towards the rear thereof.

[0031] The drum 40 containing clean thinners fluid is connected by a pipe 42 to a clean rinse nozzle 78, which,

in use, is located in the tank 3 towards the rear thereof. Clean thinners fluid is drawn from the drum 40 to the nozzle 78 due to a partial vacuum created in a chamber in the clean rinse block by the admission of air through a jet in the same clean rinse block when the tank lid is open and the clean rinse switch 82 is operated.

[0032] Outlet 32 of the tank 3 is fluidly connected to the drum 41 by means of a shut off valve 79. For most cleaning operations the shut off valve 79 is open so that spent cleaning fluid that has passed through the filter elements in the base of the tank 3 return to the thinners fluid drum 41. However, one cleaning operation involves soaking items placed in the tank 3. In order to run this cycle the valve 79 must be closed.

[0033] Referring now to Figure 9, the pressurised air system includes: a compressed air supply connection 9, the pumps 71 and 73, both of which are powered by compressed air, an on/off valve 85, an air filter 86, an air gun 10, a timer valve 84, a hand wash switch 81, a clean rinse switch 82, an pressure regulator valves 87 and 88.

[0034] In use, with the a compressed air supply attached to the connection 9, the on/off valve 85 is opened and air flows through the filter 86 to supply the air gun 10 and the switch 59. When the lid is open, the switch 59 is open and compressed air flows to the nozzle 60 and to the hand wash switch 81. If the hand wash switch 81 is opened, air flows via pressure regulator 87 to the pump 73, thereby pumping thinners fluid from the drum 41 to the hand wash outlet nozzle 77. Similarly, with the lid open and the switch 59 open compressed air is delivered to the clean rinse switch 82. When the clean rinse switch 82 is opened, air is allowed to pass to the clean rinse outlet 78 and within this outlet through a jet and into a chamber. A partial vacuum is created in the chamber drawing thinners fluid from the clean thinners drum 40 into the chamber, where it is atomised and forced out of the clean rinse outlet 78.

[0035] With the switch 59 closed, compressed is prevented from flowing to the nozzle 60 and handwash switch 81. In this condition the extraction system is switched off, and pump 73 does not operate. Compressed air is delivered to the timer valve 84, through a pressure regulator 88 and then to pump 71. In use, an operator sets the timer valve to give a particular period of wash, e.g. 45 seconds. The timer valve allows compressed air to pass therethrough for the selected wash period resulting in the pump 71 pumping thinners fluid from the drum 41 to the nozzles 35, 37 for the selected period. At the end of the selected period the timer valve 84 prevents further passage of compressed air and the pump ceases operation.

Operation of the cleaning apparatus is as follows:

[0036] An operator opens the lid 13, opening switch 59 thereby activating the extraction system, the manual wash and clean rinse functions. To use the manual wash the operator switches switch 81 to the "on" position. When the manual wash is finished the operator switches switch 81 to the "off" position.

[0037] To use the clean rinse function the operator switches switch 82 to the "on" position. When the clean rinse is finished the operator switches switch 82 to the "off" position. The extraction system continues extraction until the lid 13 is closed.

[0038] Where an operator wishes to use the automatic mode, he closes the lid 13 and sets the timer 84, which causes thinners fluid to be delivered to the outlet nozzles 35, 37.

[0039] To operate in "soak" mode, the operator closes shut-off valve 79. Any of the "automatic", "manual wash", and "clean rinse modes" can be used in "soak" mode.

[0040] The cleaning apparatus of the invention is particularly advantageous as it allows the apparatus to be cleaned away from the place where the apparatus is located. This is achieved by having a tank 3 which is detachable from the rest of the machine. This provides a number of advantages: First, the apparatus downtime is reduced from around 30 to 45 minutes to 5 to 10 minutes, resulting in less down time for spray gun operators. Second, because the time taken to service the cleaning apparatus is only 5 to 10 minutes compared to around 30 to 45 minutes for known apparatus, a service engineer can service many more machines in a day. Third, the actual operation of cleaning a tank does not require a person having the same skill level as a service engineer. As such the cost of cleaning can be reduced by using labour having a skill level appropriate for the task in hand.

[0041] Furthermore, in one embodiment of the invention a simple stacking system is provided. This is beneficial for both safe transportation and storage of the tanks.

[0042] Additionally, another embodiment of the invention provides a convenient means for holding the tank lid in its open position.

Claims

1. Cleaning apparatus comprising a structure mounting a cleaning tank, wherein the tank includes at least one fluid outlet connectable to at least one fluid supply, and wherein the said tank is removably mounted on the structure.

2. Cleaning apparatus as claimed in Claim 1, wherein the tank includes a lid moveable between an open position and a closed position.

3. Cleaning apparatus as claimed in Claim 2, wherein mounting means removably mount the lid on the tank.

4. Cleaning apparatus as claimed in Claim 3, wherein the lid is removably mounted on the tank by mounting means, said mounting means providing a hinge between the tank and the lid.

5. Cleaning apparatus as claimed in Claim 3 or 4, wherein the mounting means comprise at least one elongate slot and at least one pin.

6. Cleaning apparatus as claimed in Claim 5, wherein the tank comprises two elongate slots, one in each side thereof, and the lid is provided with two pins, each of the two pins engaging with a respective one of the slots.

7. Cleaning apparatus as claimed in any preceding claim, wherein the said structure includes at least one track upon which the tank slides.

8. Cleaning apparatus as claimed in any preceding claim, wherein the tank includes an angled portion engagable with the or each track.

9. Cleaning apparatus according to any preceding claim, wherein the apparatus includes an extractor system.

10. Cleaning apparatus according to Claim 9, wherein with the lid in its closed position the extractor system is switched on, and with the lid in its open position the extractor system is switched off.

11. A cleaning apparatus according to any preceding claim, wherein one of the removable tanks is stackable on top of another removable tank.

12. A cleaning tank as claimed in Claim 11, wherein the lower portion of each tank is provided with one part of a securing means, and the upper portion of each tank is provided with a second part of a securing means, and when one tank is stacked on top of another, the two parts of the securing means engage and respective movement in at least one plane between two stacked tanks is substantially prevented.

13. A cleaning tank as claimed in Claim 12, wherein one part of the securing means is a one part of a male/female coupling and the other part is the other part of a male female coupling.

14. A cleaning tank as claimed in Claim 13, wherein the male part is a pin and the female part is a slot.

15. A cleaning apparatus as claimed in any preceding claim, wherein the cleaning fluid is thinners.

16. A cleaning apparatus as claimed in any preceding claim, and comprising two removable cleaning fluid stores.

17. A cleaning apparatus as claimed in Claim 16, wherein fluid used in the apparatus is recycled to one of the stores.

18. A cleaning apparatus as claimed in any preceding claim, further comprising at least one pump.

19. A cleaning apparatus as claimed in Claim 18, wherein the pump is powered by compressed air.

20. A cleaning apparatus according to any of Claims 2 to 19, further comprising means to hold the lid in the said open position comprising at least one slot and at least one edge portion of said lid, wherein the or each edge portion are resilient, and during movement from the closed position to the open position the edge portion rides over the slot, to be aligned therewith.

21. A cleaning apparatus substantially as shown in, or as described with reference to, the drawings.

22. A method of cleaning an object comprising the steps of:

a. Placing the object in the tank of an apparatus as claimed in any of Claims 1to 20;
b. Selecting a wash cycle;
c. Removing the object.

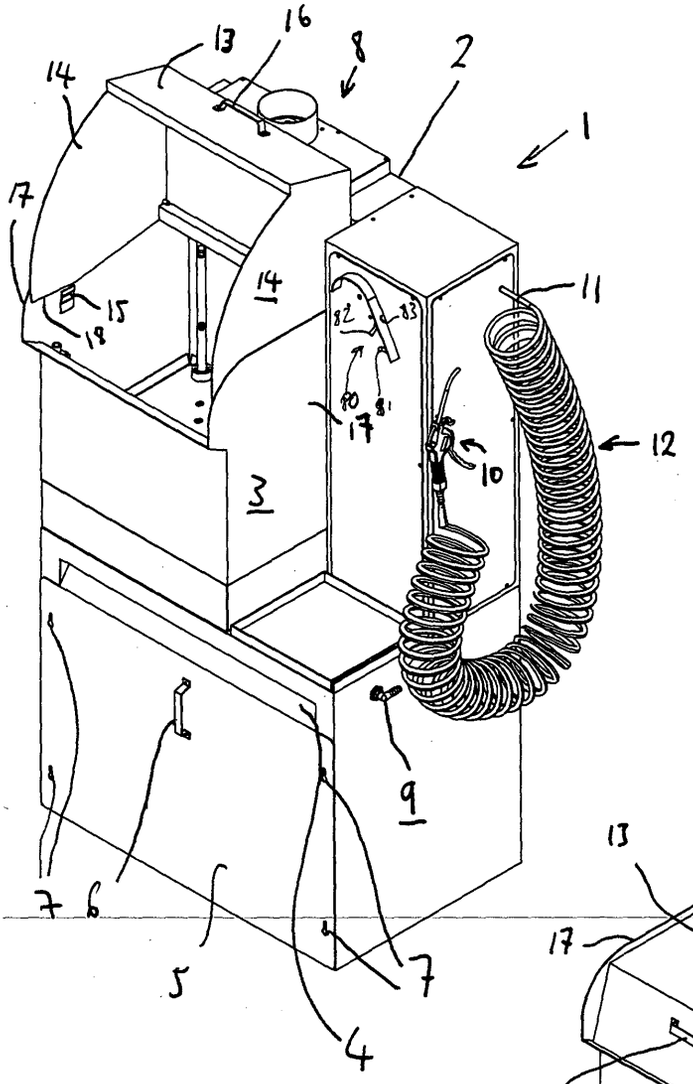


FIGURE 1A

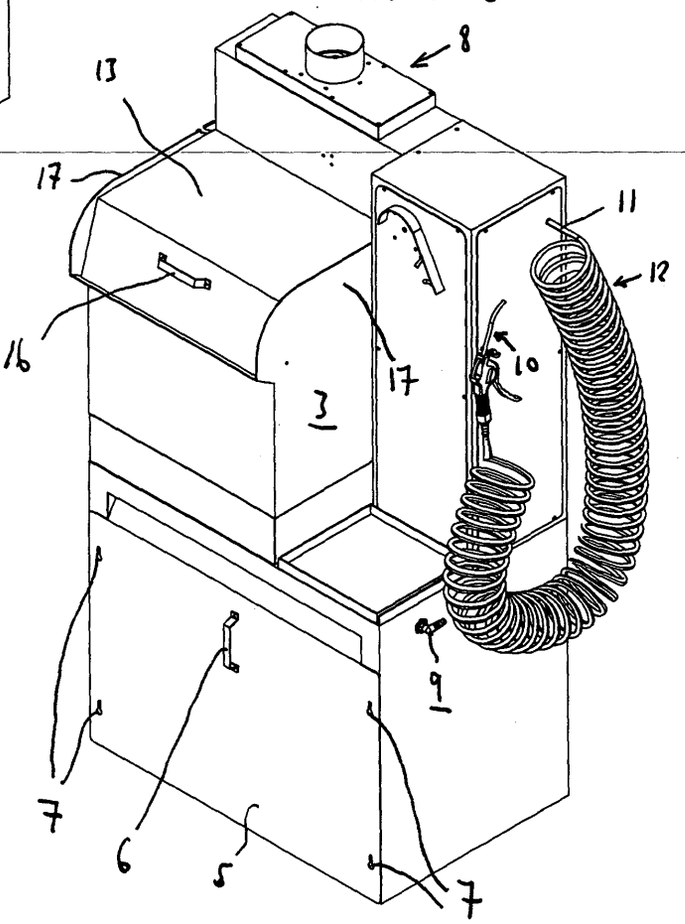


FIGURE 1B

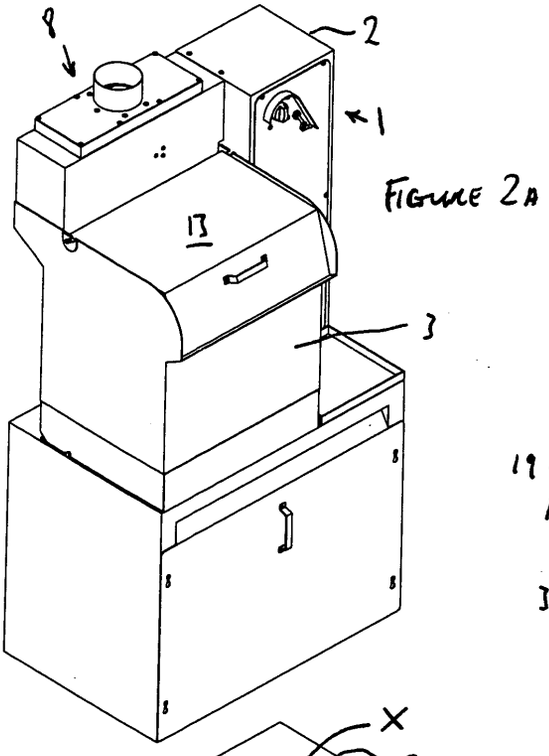


FIGURE 2A

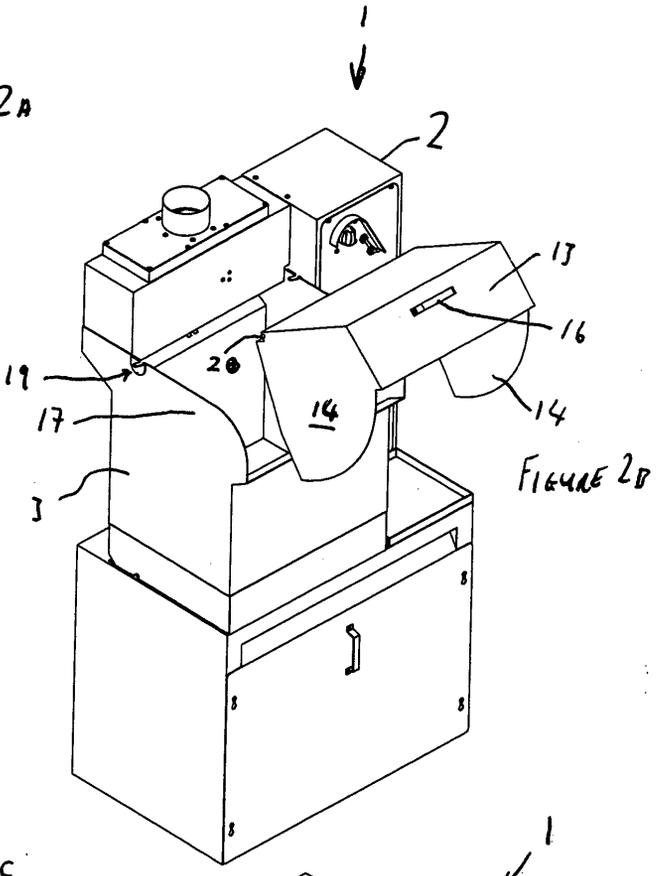


FIGURE 2B

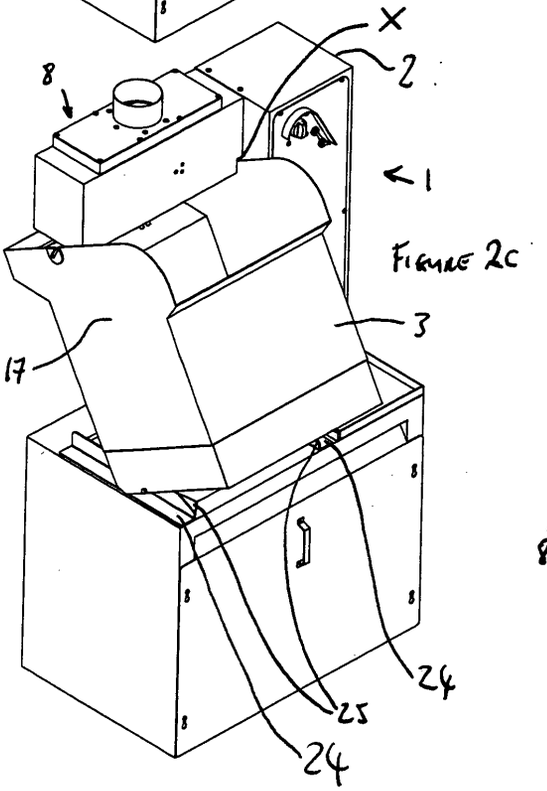


FIGURE 2C

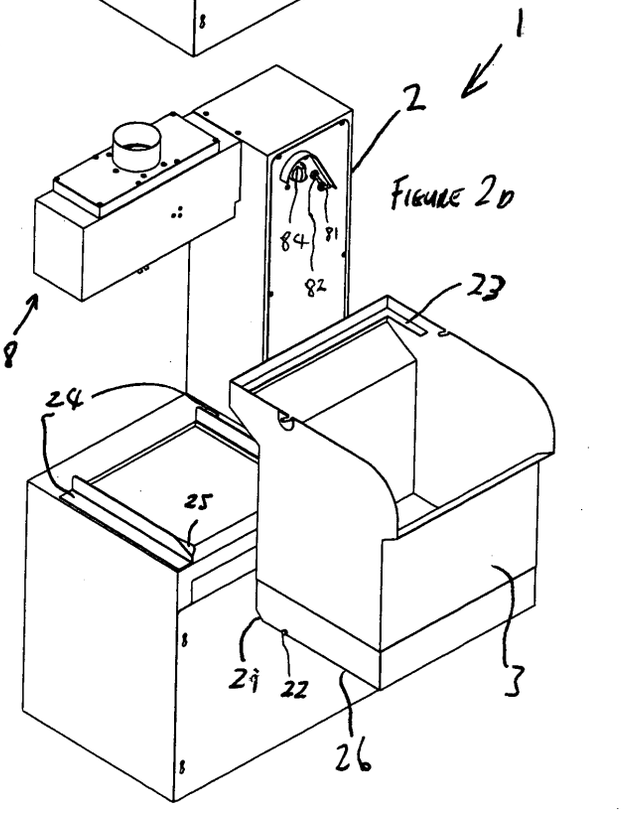


FIGURE 2D

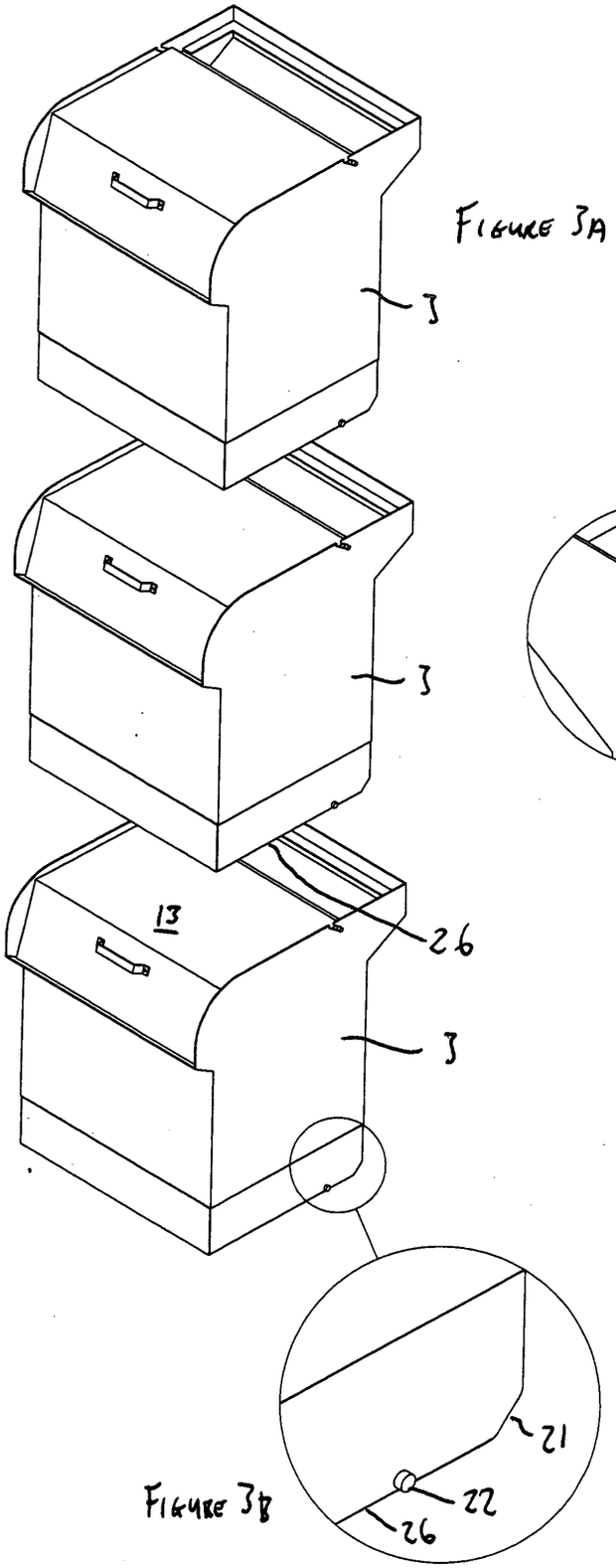


FIGURE 3A

FIGURE 3B

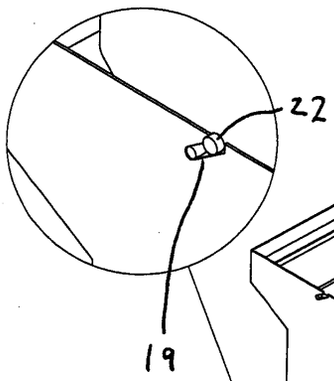


FIGURE 3D

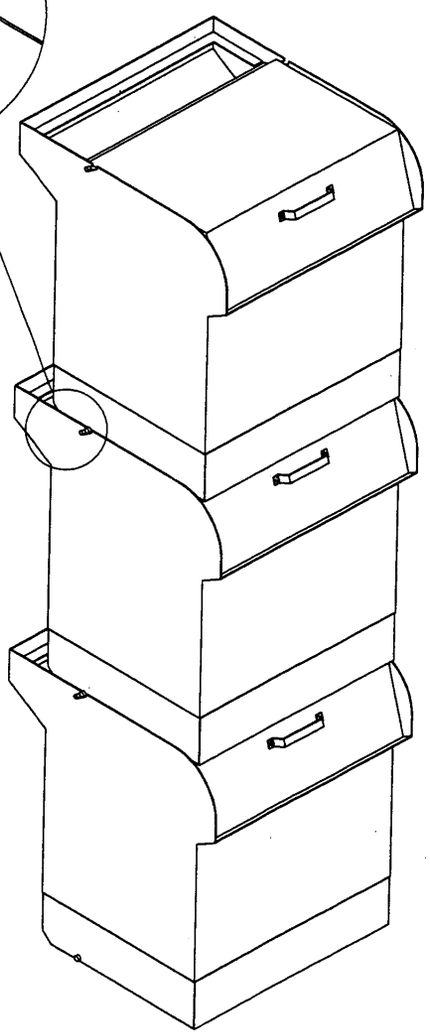


FIGURE 3C

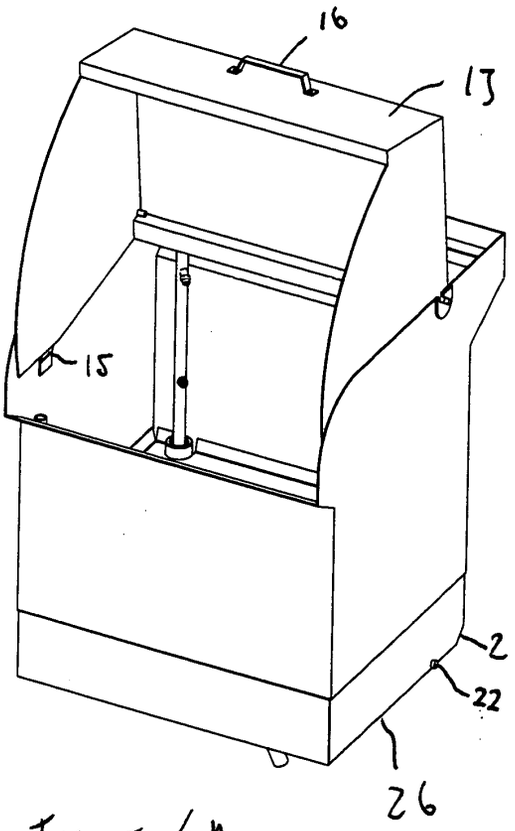


FIGURE 4A

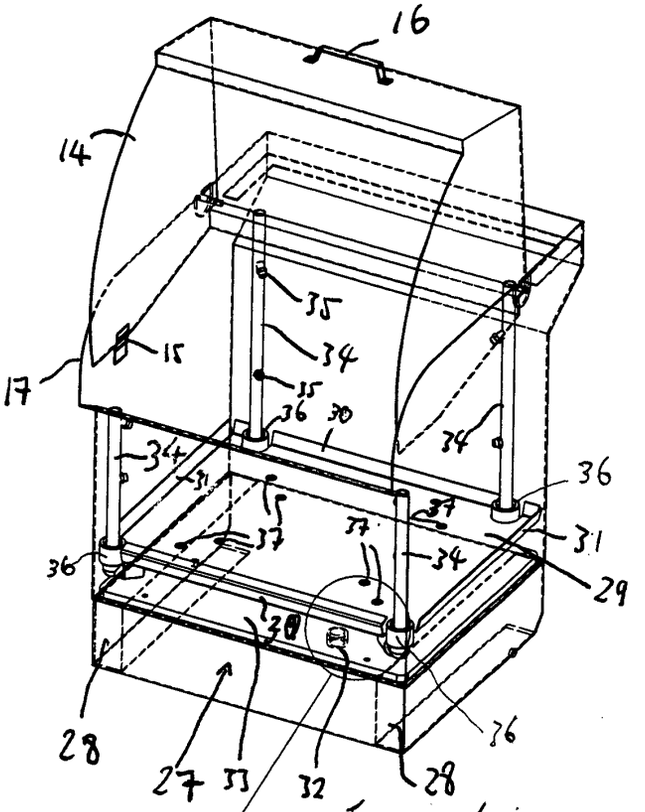


FIGURE 4B

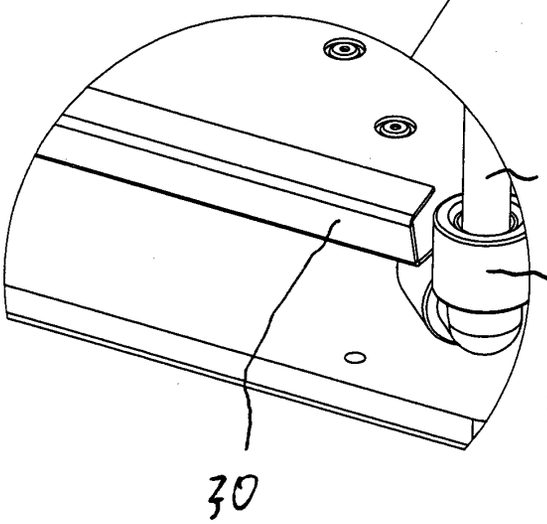


FIGURE 4C

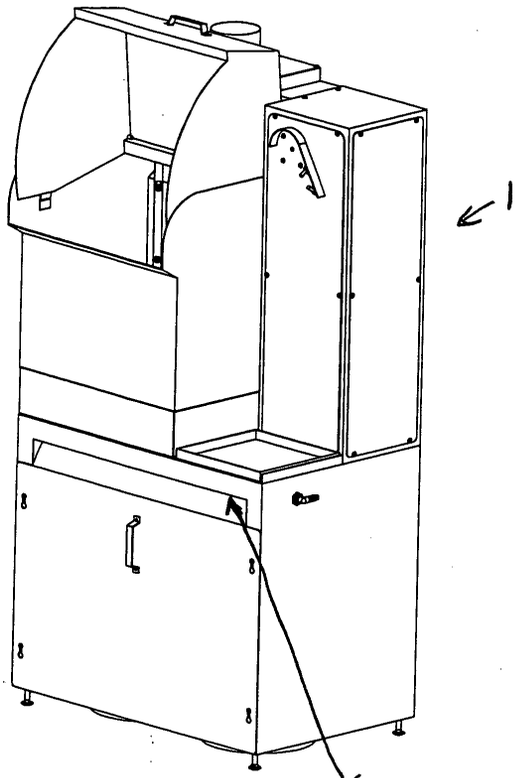


FIGURE 5A

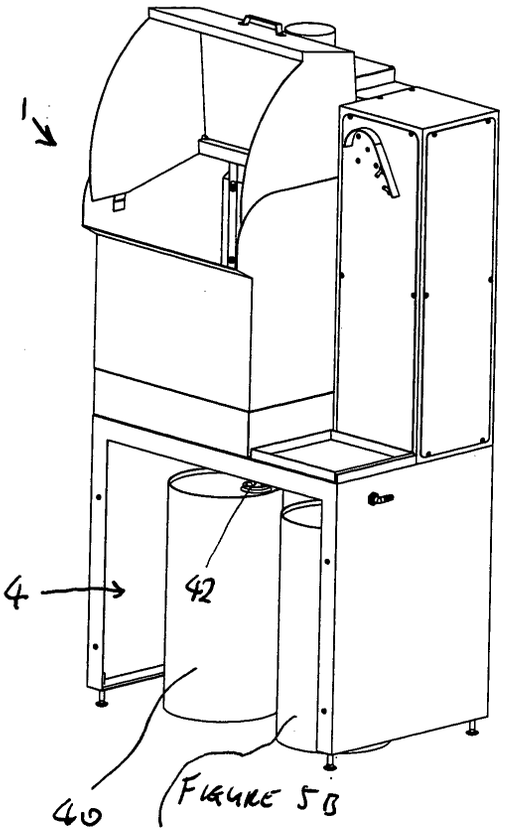


FIGURE 5B

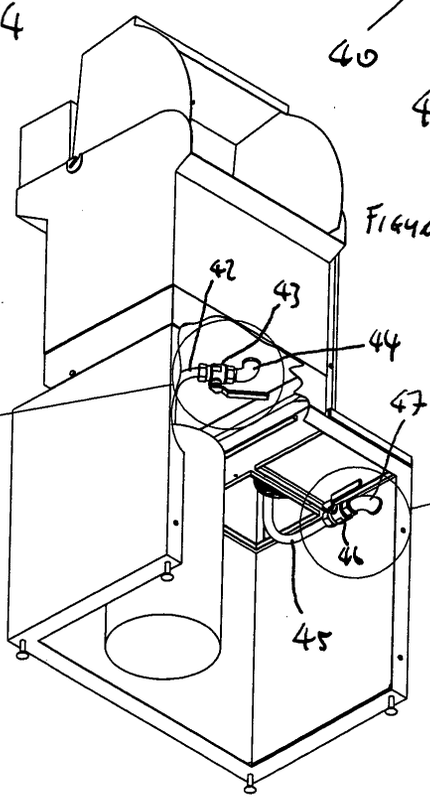


FIGURE 5C

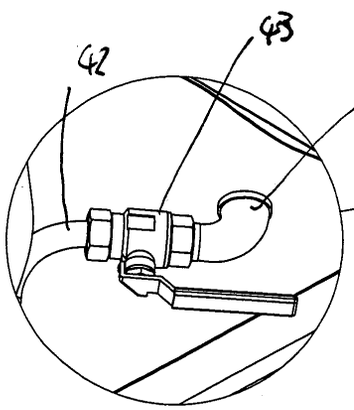


FIGURE 5D

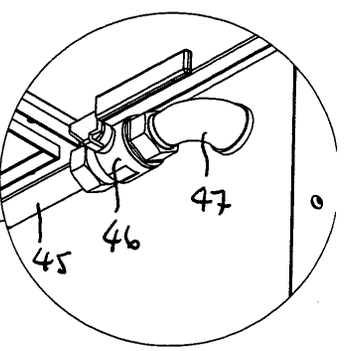


FIGURE 5E

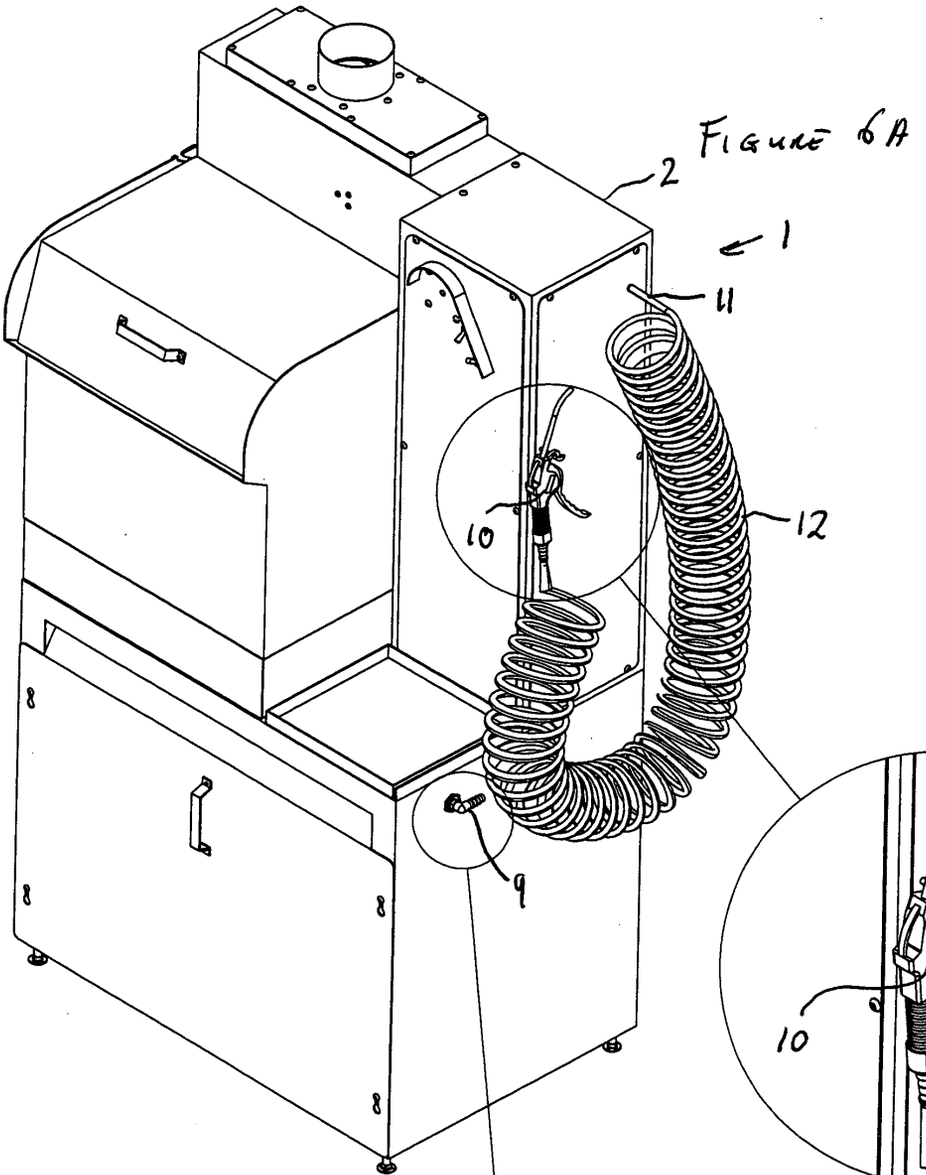


FIGURE 6A

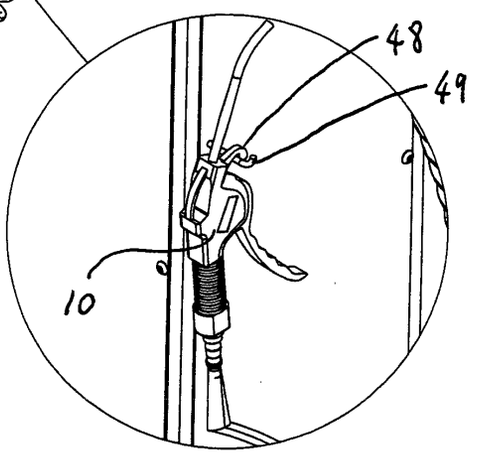


FIGURE 6C

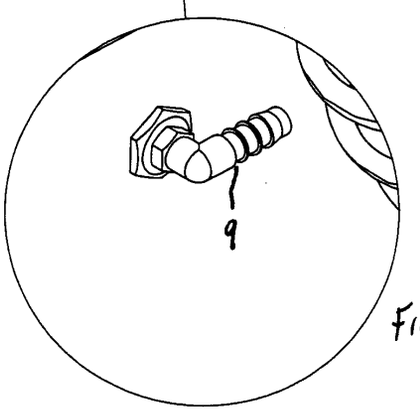


FIGURE 6B

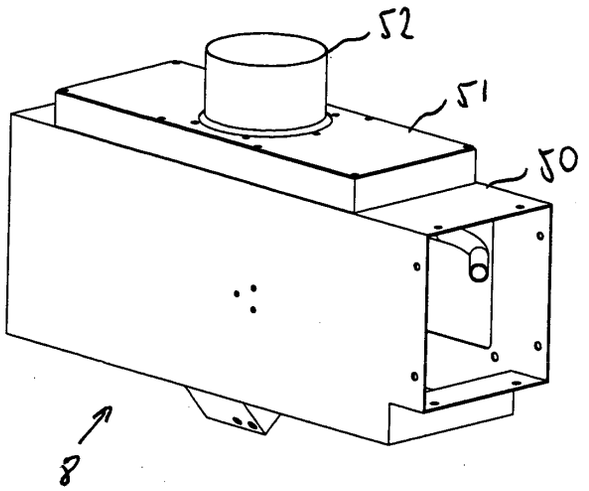


FIGURE 7A

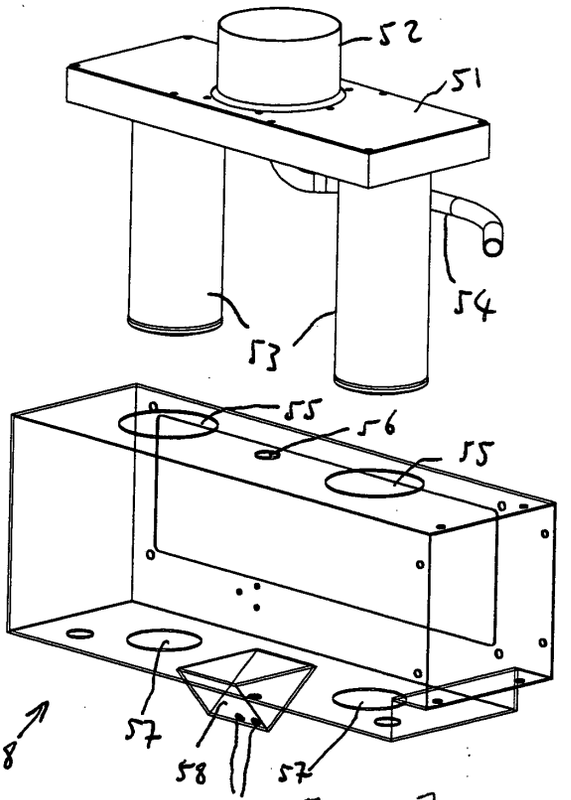


FIGURE 7B

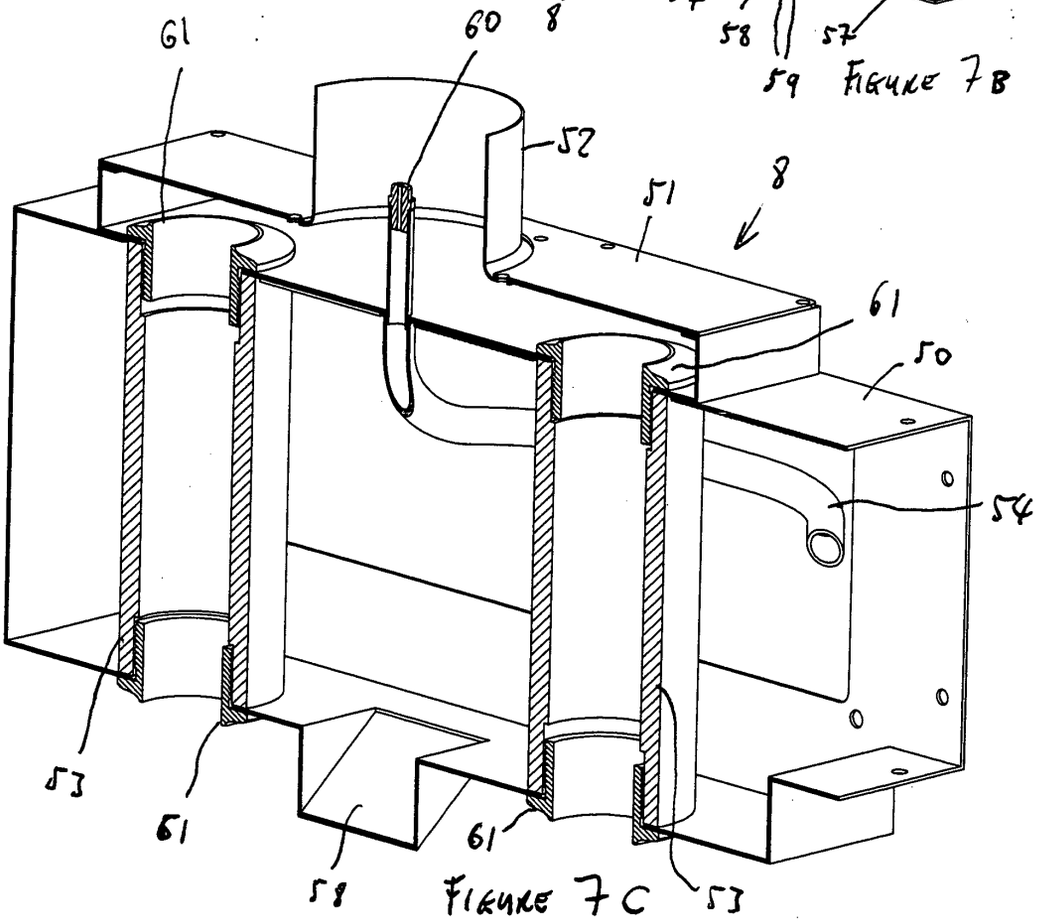


FIGURE 7C

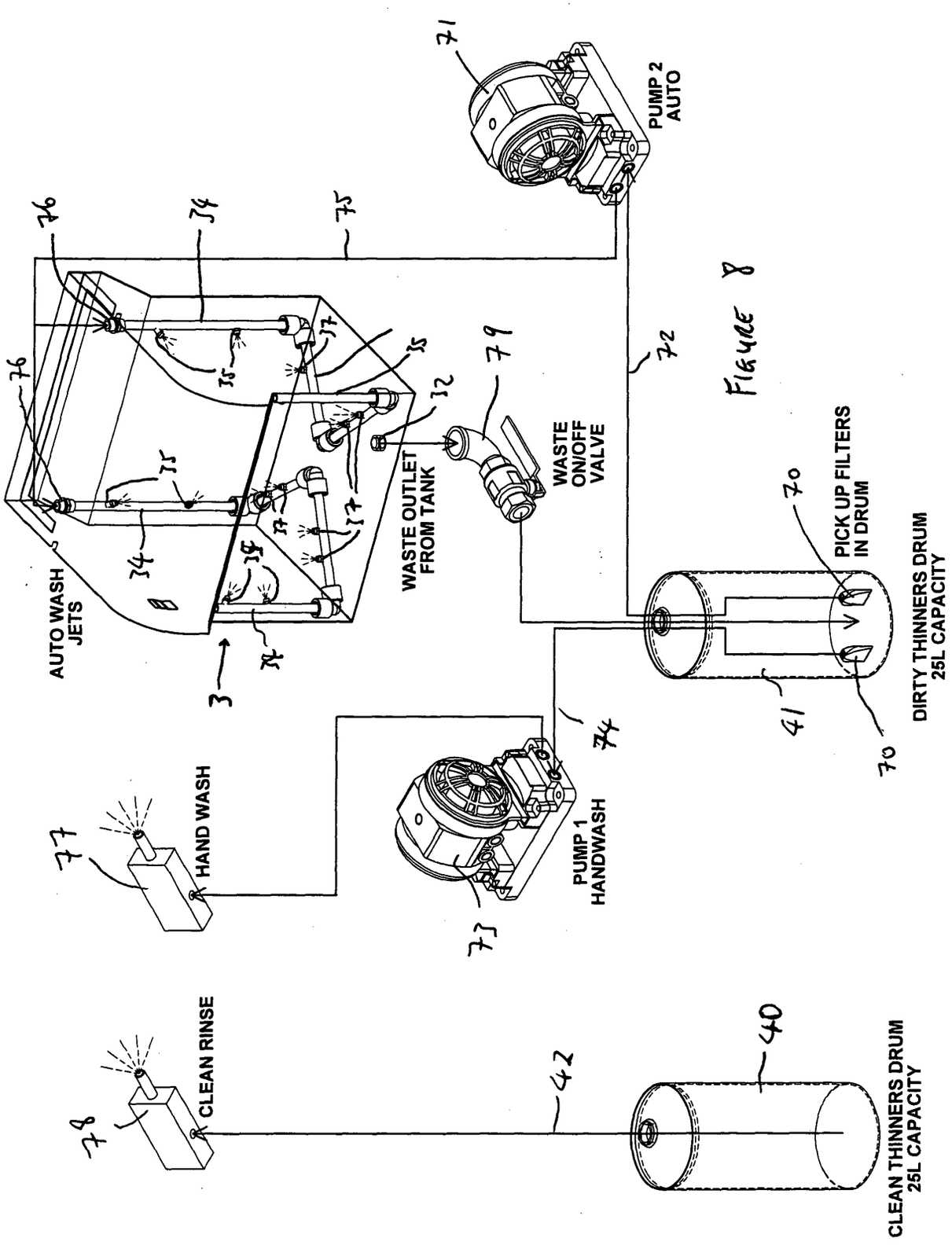

AUTO WASH JETS
WASTE OUTLET FROM TANK
WASTE ON/OFF VALVE
PUMP 2 AUTO
PICK UP FILTERS IN DRUM
DIRTY THINNERS DRUM 25L CAPACITY
HAND WASH
PUMP 1 HANDWASH
CLEAN RINSE
CLEAN THINNERS DRUM 25L CAPACITY

Figure 8

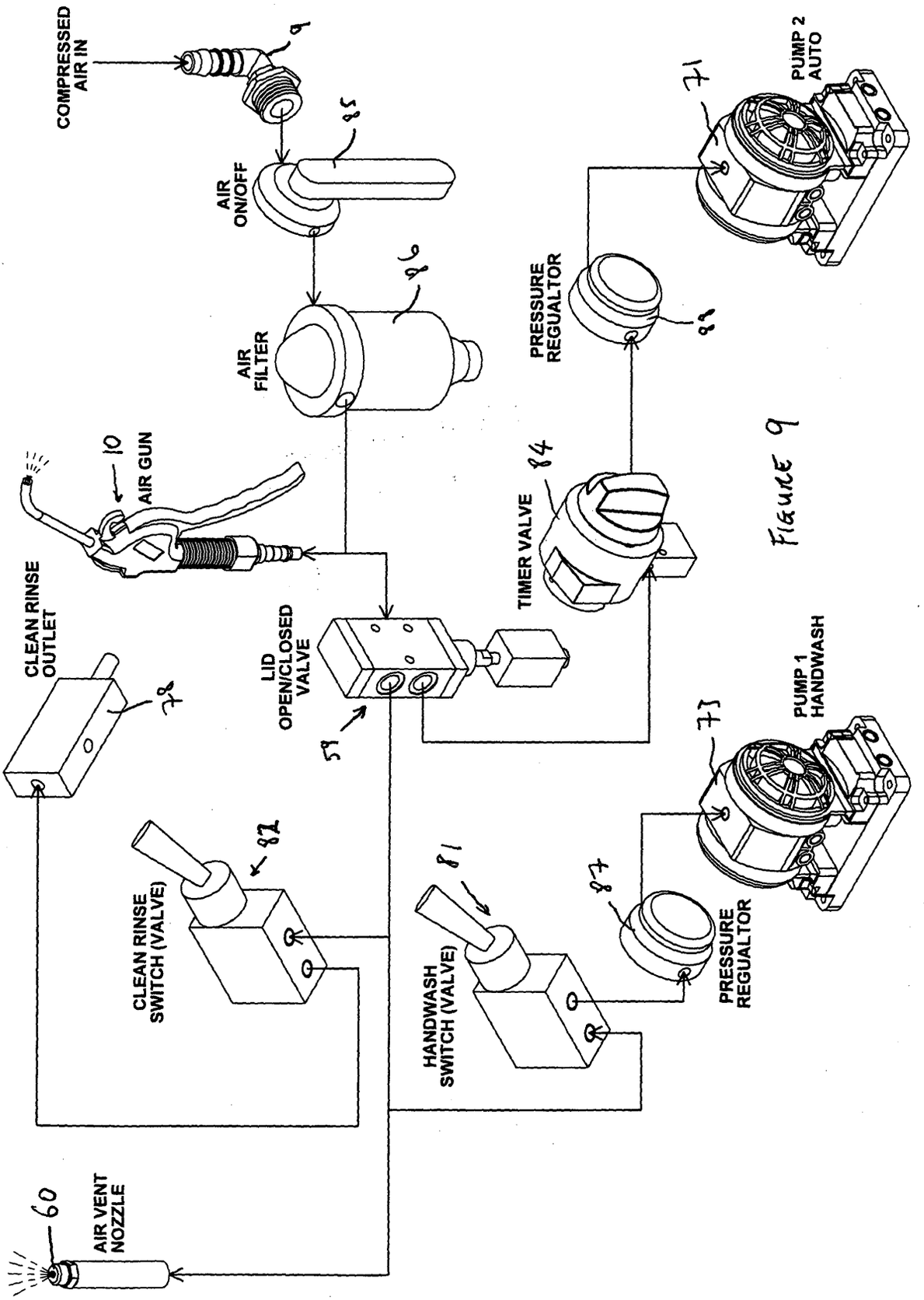

COMPRESSED AIR IN
9
95
AIR ON/OFF
96
AIR FILTER
10
AIR GUN
CLEAN RINSE OUTLET
78
LID OPEN/CLOSED VALVE
59
TIMER VALVE
84
PRESSURE REGUALTOR
99
PUMP 2 AUTO
71
PUMP 1 HANDWASH
73
PRESSURE REGUALTOR
87
CLEAN RINSE SWITCH (VALVE)
82
HANDWASH SWITCH (VALVE)
81
AIR VENT NOZZLE
60

Figure 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
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B05B
B44D
B08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 June 2005	Eberwein, M

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