



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.10.2000 Bulletin 2000/41

(51) Int. Cl.⁷: **B24B 9/14**, B24B 55/02,
B24B 55/06

(21) Application number: **00250110.4**

(22) Date of filing: **04.04.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **05.04.1999 JP 9807699**

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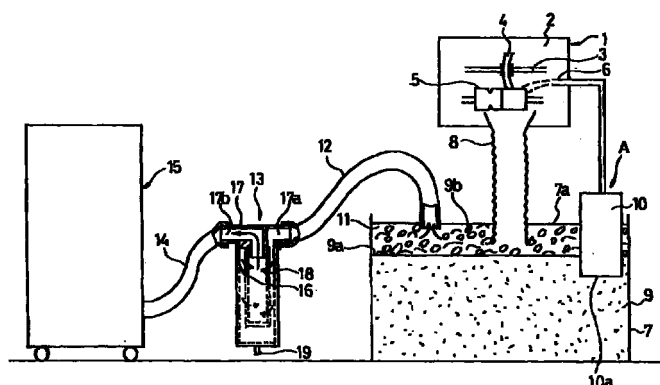
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(54) **Deodorization system for lens-grinding machine**

(57) A deodorization system for a lens-grinding machine (1) for grinding a lens (4) has a suction hose (12, 14) and a deodorization device (36). Bad-smelling air is sucked from the grinding chamber (2) and a waste water tank (7) for storing waste water used in the chamber (2) through the tank (7). The bad-smelling air sucked through the suction hose (12, 14) is filtered by a dehydration filter (13), a centrifugal separator (23) and a fine filter (37) to separate and remove the waste water, bubbles and cut chips from the bad-smelling air, and is

deodorized by the deodorization device (36). A water storage tank (24) arranged in the separator (23) stores the waste water, the bubbles and the cut chips removed from the bad-smelling air. A volume detection sensor (35) provides a signal upon the increase of the volume of the waste water stored in the tank (24) to a value substantially equal to the capacity of the tank (24) to prevent the overflow of the waste water from the tank (24).

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a deodorization system for a lens-grinding machine for deodorizing bad-smelling air produced when a lens (a lens to be ground) is subjected to a grinding process on a lens-grinding machine.

2. Description of the Related Art

[0002] It is known that when grinding a high-refraction plastic lens or the like by a conventional lens-grinding machine, the plastic lens produces an offensive smell owing to the effect of sulfur molecules contained in the plastic lens. Various deodorization systems have been developed to solve the problems resulting from such an offensive smell.

[0003] A deodorization apparatus disclosed in JP-U No. Hei 6-61444 deodorizes bad-smelling air having an offensive smell produced when a plastic lens and the like containing components that produce offensive smells at the time of being ground are ground by making a deodorization filter suck the bad-smelling air from a tank for storing a waste water (waste water tank) through a connection pipe provided separately from a drain hose.

[0004] A deodorization apparatus disclosed in JP-A No. Hei 5-345268 guides a bad-smelling gas produced by a lens-grinding machine into a body of deodorization device from an inlet opening disposed near a lens-grinding region on the lens-grinding machine through a flexible tube, and removes the bad-smelling gas by a deodorization filter which is a lamination of a dust filter, a paper filter and activated carbon for deodorization.

[0005] However, when the air having an offensive smell is sucked into the deodorization apparatus, waste water, cut chips and bubbles produced in the waste water are sucked together with the air into the deodorization apparatus.

[0006] Accordingly, there is a problem that the deodorization filter of the deodorization apparatus disclosed in JP-U No. Hei 6-61444 is clogged in a short operating time with highly humid gas, cut chips or the bubbles sucked through the connection pipe and is unable to function effectively.

[0007] The deodorization apparatus disclosed in JP-A No. Hei 5-345268 that sucks the bad-smelling gas by making the gas flow from the inlet opening disposed near the lens-grinding region into the body of the deodorization device through the flexible tube also has a problem that the waste water produced in the grinding process is sucked accidentally to be accumulated in the deodorization apparatus so that the deodorization apparatus is deteriorated and damaged.

[0008] Moreover, there is also a problem that a deodorizer is unable to function effectively because the bad-smelling air contains the waste water, the bubbles and the cut chips.

[0009] Besides, problems caused by the offensive smells are not radically solved because the offensive smells cannot be removed from the waste water storage tank.

[0010] Furthermore, the offensive smells cause troubles in the maintenance of the waste water tank storing the waste water produced by the grinding process for grinding the aforementioned high-refraction plastic lens and the like.

SUMMARY OF THE INVENTION

[0011] It is an object of the present invention to provide a deodorization system for a lens-grinding machine, which system is able to maintain sufficient deodorizing effect for a long operating time without clogging of its deodorization means by a waste water containing bubbles, cut chips and the like produced in a grinding process.

[0012] For achieving the aforementioned object, according to a first aspect of the present invention, a deodorization system for a lens-grinding machine for grinding a lens, which system includes a suction hose for sucking bad-smelling air from a grinding chamber and a waste water tank storing waste water produced in the grinding chamber through the waste water tank, deodorization means for deodorizing the bad-smelling air, which is connected to the suction hose, and separation means for separating the waste water, bubbles and cut chips contained in the bad-smelling air from the air and removing the same, which separation means is interposed between the suction hose and the deodorization means.

[0013] It is obtained the effect that the deodorization filter will not be clogged with the waste water, the bubbles and the like and hence the deodorization system is able to deodorize the bad-smelling air produced by the grinding process effectively, even if the air containing the waste water, bubbles, cut chips and the like is sucked and deodorized. In addition, since the bad-smelling air is sucked through the waste water tank, offensive smells produced by the grinding machine, as well as those produced in the waste water tank can be deodorized.

[0014] According to a second aspect of the present invention, there is provided a deodorization system further including a water storage tank for storing the waste water separated from the bad-smelling air by the separation means.

[0015] It is obtained the effect that the water storage tank keeps the components of the deodorization system from being wet with the waste water to prevent the deterioration and damaging of the system.

[0016] According to a third aspect of the present

invention, there is provided a deodorization system further including detection means for detecting the volume of the waste water stored in the water storage tank.

[0017] According to a fourth aspect of the present invention, there is provided a deodorization system in which the detection means is incorporated into the water storage tank.

[0018] According to a fifth aspect of the present invention, there is provided a deodorization system in which the detection means is incorporated into the separation means.

[0019] In the deodorization systems in the above three aspects from the third to the fifth of the present invention, it is obtained the effect that the volume of the waste water separated from the bad-smelling air by the separation means can be known without directly examining the water storage tank and hence the overflow of the waste water from the water storage tank can be prevented. Consequently, the deterioration and damaging of the deodorization system can be prevented and the maintenance of the components of the deodorization system can be facilitated.

[0020] According to a sixth aspect of the present invention, there is provided a deodorization system further including a fine filter capable of capturing the cut chips and moisture that are sucked together with the bad-smelling air from the grinding chamber and the waste water tank.

[0021] According to a seventh aspect of the present invention, there is provided a deodorization system in which the fine filter is interposed between and connected to the separation means and the deodorization means.

[0022] In the deodorization systems according to the sixth and the seventh aspects of the present invention, moisture and fine cut chips that could not have been separated from the bad-smelling air by the separation means can be separated and removed from the air. Consequently, it is obtained the effect that the cleanliness of the bad-smelling air supplied to the deodorization means is improved and thereby the life time of activated carbon, serving as a deodorizer of the deodorization system can be extended.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The above and other objects, features and advantages of the present invention will become apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a schematic front elevation of a deodorization system for a lens-grinding machine in a first embodiment according to the present invention;
Fig. 2 is a schematic front elevation of an internal structure of the deodorization apparatus included in the deodorization system shown in Fig. 1;
Fig. 3 is a sectional view of a centrifugal separator

included in the deodorization apparatus shown in Fig. 2 taken along a plane parallel to the paper substantially centered in the centrifugal separator;

Fig. 4 is a perspective view of an essential part of a separator body included in the centrifugal separator shown in Fig. 3;

Fig. 5 is a front elevation of an internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a second embodiment according to the present invention;

Fig. 6 is a front elevation of an internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a third embodiment according to the present invention;

Fig. 7 is a front elevation of an internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a fourth embodiment according to the present invention; and

Fig. 8 is a schematic front elevation of a deodorization system for a lens-grinding machine in a fifth embodiment according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(1) First Embodiment

Construction

[Lens-grinding Machine]

[0024] Referring to Fig. 1, reference numeral 1 designates a lens-grinding machine (lens grinder), and numeral 4 designates a lens as an object of grinding. The lens-grinding machine 1 has a grinding chamber 2 enclosing all the components of the lens-grinding machine 1 therein, a lens rotating shaft 3 disposed in the grinding chamber 2 to hold the lens 4 thereon and to rotate the same, a grindstone 5 for grinding the periphery of the lens 4, having an axis of rotation substantially parallel to the axis of the lens rotating shaft 3, and a nozzle 6 for spouting cooling water when grinding the lens 4 with the grindstone 5. The lens-grinding machine 1 is a well-known one. Only the least components of the lens-grinding machine 1 necessary for the description of the present invention are shown in Fig. 1.

[Cooling Water Circulating System]

[0025] Referring to Fig. 1, a cooling water circulating system A includes a waste water tank 7 disposed below the lens-grinding machine 1, a cover plate 7a covering the open upper end of the waste water tank 7, and a drain hose 8 for draining cooling water containing cut chips from the bottom of the grinding chamber 2 into the waste water tank 7. Waste water 9 is stored in the waste water tank 7. The cooling water circulating sys-

tem A has a pump 10 fixed to the cover plate (covering member) 7a with its suction port 10a immersed in an upper part in the waste water 9.

[0026] The pump 10 has a discharge port connected to the nozzle 6. When grinding a peripheral part of the lens (raw spectacle lens or the like) 4 with the grindstone 5, the waste water 9 stored in the waste water tank 7 is pumped up through a filter, not shown, and is spouted through the nozzle 6 again as cooling water onto a working part of the grindstone 5 in contact with the lens 4.

[0027] Shown also in Fig. 1 are the upper surface 9a of the waste water 9, bubbles 9b floating on the upper surface 9a of the waste water 9, a space 11 between the upper surface 9a of the waste water 9 and the covering plate 7a. The bubbles 9b are formed when the cooling water is drained from the grinding chamber 2 through the drain hose 8 into the waste water tank 7. The space 11 is filled up with bad-smelling air having an offensive smell produced when the lens 4 is ground.

[0028] One end of a suction hose 12 which is open to the space 11 is connected to the cover plate 7a. Another end of the suction hose 12 is connected to a dehydration filter (first separation means) 13. A deodorization apparatus (deodorization means) 15 is connected by another suction hose 14 to the dehydration filter 13.

[Dehydration filter 13]

[0029] The dehydration filter 13 includes a cylindrical vessel 16 having an open upper end, a cover 17 covering the open upper end of the cylindrical vessel 16, a filter element 18 attached to the cover 17, and a drain valve 19 attached to the bottom of the cylindrical vessel 16. The cover 17 is provided with an inlet opening 17a and an outlet opening 17b. The inlet opening 17a and the outlet opening 17b are isolated from each other by the filter element 18. The end of the suction hose 12 on the side of the dehydration filter 13 is connected to the inlet opening 17a. The end of the suction hose 14 on the side of the dehydration filter 13 is connected to the outlet opening 17b. That is, the bad-smelling air sucked through the inlet opening 17a into the dehydration filter 13 flows necessarily through the filter element 18 to the outlet opening 17b. The cover 17 is removed from the cylindrical vessel 16 to remove the filter element 18 from the cylindrical vessel 16, which facilitates work for cleaning the filter element 18 and replacing the same with another one.

[0030] The bad-smelling air sucked through the suction hose 12 and the inlet opening 17a into the dehydration filter 13 is filtered by the filter element 18. The filtered bad-smelling air is sucked through the outlet opening 17b into the suction hose 14. When the bad-smelling air passes through the filter element 18, most part of bubbles, cut chips and mist of waste water is captured by the filter element 18 and is stored in a lower

part of the cylindrical vessel 16. The waste water stored in the lower part of the cylindrical vessel 16 can be drained from the cylindrical vessel 16 by opening the drain valve 19.

[0031] Any other suitable filter may be used instead of the dehydration filter 13 mentioned in this embodiment, provided that the filter is capable of separating the bubbles, the cut chips and the mist of the waste water from the bad-smelling air.

[Deodorization apparatus 15]

[0032] As shown in Fig. 2, the deodorization apparatus 15 has an outer case 20 which is longer in the perpendicular direction than it is in the horizontal direction. The outer case 20 is provided with a side door 21 that opens and shuts in the directions of the arrows B in a lower part of a side wall thereof, and a top door 22 that opens and shuts in the directions of the arrows C in a top wall thereof. A centrifugal separator (second separation means) 23 is disposed in a lower part of the interior of the outer case 20. A water storage tank 24 is disposed under the centrifugal separator 23 in the outer case 20.

[Centrifugal Separator 23]

[0033] As shown in Fig. 3, the centrifugal separator 23 includes a main body 25 having a drawer space 25a in the lower part of the main body 25 and a storage chamber 25b over the drawer space 25a, and a separator body 26 disposed in the storage chamber 25b. The main body 25 is provided with an opening to which the end of the suction hose 14 whose another end is connected to the outlet opening 17b of the dehydration filter 13 is connected, and an opening to which a hose 40 is connected.

[0034] Referring to Figs. 3 and 4, the separator body 26 has a double tube constitution of an inner tube 27 and an outer tube 28 which has a diameter greater than that of the inner tube 27 and a connection hole 28a. And a cylindrical or annular passage (space) 29 is formed as a gas-liquid-separating passage with the inner tube 27 and the outer tube 28. The separator body 26 also has an annular bottom wall 30 joined to the lower ends of the inner tube 27 and the outer tube 28, and a disk-shaped cover plate 31 covering the open upper end of the outer tube 28. A small gap 32 for air passage is formed between the upper end of the inner tube 27 and the cover plate 31 by constituting the upper end of the inner tube 27 lower than that of the outer tube 28.

[0035] The bottom wall 30 of the separator body 26 is supported on tubular support members 33 having the shape of a tube and fixed to the bottom wall 25c of the main body 25. The bottom wall 30 of the separator body 26 is spaced from the bottom wall 25c of the main body 25 by the tubular support members 33. Therefore, the

bad-smelling air is able to flow through a space between the bottom wall 30 of the separator body 26 and the bottom wall 25c of the main body 25. As shown in Fig. 3, drain passages 33a are formed through the bottom wall 30 of the separator body 26, the bottom wall 25c of the main body 25 and the tubular support members 33. Water, cut chips produced by grinding operation and the like separated from the bad-smelling air by the separator body 26 are drained through the drain passages 33a into the water storage tank 24 described later.

[0036] The connection hole 28a is formed with its axis extended tangentially to the annular passage 29 in a lower part of the outer tube 28. The connection hole 28a is connected by a hose 34 to a connecting opening formed in the main body 25 to which the suction hose 14 is connected.

[0037] The bad-smelling air sucked from the suction hose 14 flows through the hose 34 tangentially into the annular passage (space) 29 before flowing into the storage chamber 25b and whirls in the annular passage 29. Moisture, the cut chips and the like having specific gravities greater than that of air are forced to move radially outward and pressed against the outer tube 28 by centrifugal force. The bad-smelling air thus cleared of the moisture and the cut chips flows through the small gap 32 into a central region of the separator body 26. Then the bad-smelling air flows through the space secured between the bottom wall 30 of the separator body 26 and the bottom wall 25c of the main body 25 by the tubular support members 33 into the storage chamber 25b as indicated by the arrows in Fig. 3. Finally, the bad-smelling air flows through the other connecting opening formed in the main body 25 into the hose 40.

[0038] The centrifugal separator 23 can separate the waste water which could not have been removed by the dehydration filter 13 from the bad-smelling air.

[Water storage tank 24]

[0039] The waste water and the cut chips drained through the drain passages 33a is stored in the water storage tank 24. The water storage tank 24 is placed in the drawer space 25a so as to be slidable to right and left direction in Fig. 2. The door 21 is opened and the water storage tank 24 can be pulled leftward out of the outer case 20.

[0040] A volume detection sensor (detection means) 35 is attached to an upper part of the water storage tank 24 to detect the increase of the volume of the waste water stored in the water storage tank 24 to a predetermined volume and the rise of the waste water level to a predetermined level. The volume detection sensor 35 may be disposed at a position on the side of the centrifugal separator 23. Upon the increase of the volume of the waste water stored in the water storage tank 24 to a predetermined volume, by detecting that, the volume detection sensor 35 inputs a detection signal to a control circuit (control means) 35a. When receiving the

detection signal, the control circuit 35a activates an informing device 35b, such as a buzzer, a light-omitting diode or a liquid crystal display, to inform an operator that the water storage tank 24 has been substantially fully filled up with the waste water, and stops a blower 39 which will be described later.

[Deodorization Device and the Associated Devices]

[0041] The deodorization apparatus 15 includes a deodorization device (deodorization means) 36 placed in the outer case 20 for deodorizing the bad-smelling air, a fine filter 37 detachably attached to an upper part of the deodorization device 36 for removing the moisture and the fine cut chips, a suction box 38 attached to a lower part of the deodorization device 36 for storing deodorized air temporarily, and the blower 39 disposed between the centrifugal separator 23 and the suction box 38 and held on the outer case 20 for making the air containing offensive smells flow. An impregnated activated carbon (a deodorizer as a body of deodorization means) 36a which absorbs the offensive smell is built-in the deodorization device 36. And the impregnated activated carbon 36a can be replaced by removing the fine filter 37. Additional separation and removal of the waste water from the air by the centrifugal separator 23, which water could not be separated and removed from the air by the dehydration filter 13 can extend the life time of the impregnated activated carbon.

[0042] In addition, it can not be used only the impregnated activated carbon 36a, but also any one of porous alumina ceramics, ceramic balls or photo catalysts using zinc oxide (ZnO), titanium oxide (TiO₂) or the like, or mixtures of impregnated activated carbon and some of those materials as the deodorizer.

[0043] And the fine filter 37 is capable of further removing the moisture and the fine cut chips which could not have been removed by the dehydration filter 13 and the centrifugal separator 23 from the air. The fine filter 37 can be easily taken out of the outer case 20 by opening the door 22 to replace the same with a new one.

[0044] The storage chamber 25b of the centrifugal separator 23 is connected to the fine filter 37 by the hose 40. The fine filter 37, the deodorization device 36 and the suction box 38 communicate with each other. Furthermore, a suction pipe 39a of the blower 39 is connected to the suction box 38 and a discharge pipe 39b of the blower 39 is connected to an opening formed in a side wall of the outer case 20.

[0045] In the constitution described above, the bad-smelling air discharged from the centrifugal separator 23 flows into the blower 39 through the hose 40, the fine filter 37, the deodorization device 36, the suction box 38 and the suction pipe 39a, and is discharged to the outside of the outer case 20 through the discharge pipe 39b.

[0046] If the volume detection sensor 35 inputs the

detection signal in ease of the increase of the volume of the waste water stored in the water storage tank 24 to the predetermined volume, the control circuit 35a activates the informing device 35b and stops the blower 39. Thus the overflow of the waste water from the water storage tank 24 can be prevented.

[Operation]

[0047] The operation of the deodorization system for a lens-grinding machine will be explained hereinafter.

[0048] Techniques for grinding a peripheral part of the lens 4 by the lens-grinding machine 1 is well-known and hence the description thereof will be omitted. When grinding the lens 4 in a globe type shape with the grindstone 5 of the lens-grinding machine 1, the pump 10 is operated. The pump 10 pumps up the waste water 9 through a filter, not shown, and to spout the waste water as cooling water through the nozzle 6 onto a part to be ground of the lens 4 by the grindstone 5. Consequently, the part of the lens 4 ground by the grindstone 5 is cooled.

[0049] The cooling water used for cooling washes off the cut chips from the lens 4, drops down the same below the lens 4 on cooling the part to be ground of the lens 4 by the grindstone 5. And this dropped cooling water is drained into the waste water tank 7 through the drain hose 8. Bubbles 9b of the cooling water are produced on the surface of the waste water 9 on draining the cooling water into the waste water tank 7.

[0050] The waste water 9 drained in the waste water tank 7 contains the cut chips of the lens 4. And the cut chips contained in the waste water 9 are deposited on the bottom of the waste water tank 7. On the other hand, the waste water 9 of the cooling water is pumped up from an upper layer thereof through the suction port 10a of the pump 10 and is spouted again as the cooling water through the nozzle 6 onto the part to be ground of the lens 4 by the grindstone 5.

[0051] Incidentally, supposing that the lens 4 is a plastic lens, sulfur molecules contained in the lens 4 produce a sharp offensive smell that assails the nostrils on grinding this plastic lens by the grindstone 5.

[0052] Therefore, when the lens 4 is made of a plastic material, the blower 39 is operated to generate a negative pressure on the suction side of the blower 39 in grinding process. The negative pressure affects the space 11 in the waste water tank 7 through the suction box 38, the deodorization device 36, the fine filter 37, the hose 40, the centrifugal separator 23, the suction hose 14, the dehydration filter 13 and the suction hose 12, and affects the grinding chamber 2 of the lens grinding machine through the drain hose 8.

[0053] Consequently, the bad-smelling air produced in the grinding chamber 2 when grinding the lens 4 is sucked into the blower 39 through the drain hose 8, the suction hose 12, the dehydration filter 13, the suc-

tion hose 14, the centrifugal separator 23, the hose 40, the fine filter 37, the deodorization device 36 and the suction box 38.

[0054] The bad-smelling air sucked into the suction hose 12 contains inevitably the waste water and the cut chips which are produced in the grinding process, and bubbles produced from the waste water. However, the bad-smelling air sucked into the suction hose 12 is sucked into the suction hose 14 from the outlet opening 17b after being filtered by the filter element 18 of the dehydration filter 13. Most part of the bubbles, the cut chips, the mist of the waste water and the like contained in the bad-smelling air is captured by the filter element 18 and stored in a lower part of the cylindrical vessel 16 when filtering the air by the filter element 18. The waste water stored in the lower part of the cylindrical vessel 16 is drained from the cylindrical vessel 16 to outside by opening the drain valve 19.

[0055] When the bad-smelling air from which the most part of the bubbles, the cut chips, the mist of the waste water and the like is removed flows into the centrifugal separator 23, the bad-smelling air whirls in the annular passage 29. Then the waste water still contained in the bad-smelling air adheres to the inner tube 27 and the outer tube 28 as condensation, the condensed waste water drops down onto the bottom wall 30 and dropped waste water further drops down into and is stored in the water storage tank 24 which is arranged below through the drain ports (drain passages) 33a. If the bad-smelling air still contains the cut chips, bubbles or the like, they are forced to move radially outward and pressed against the outer tube 28 by centrifugal force, and the cut chips, the bubbles or the like together with the condensation of the waste water drop down into and is stored in the water storage tank 24 which is arranged below through the drain ports (drain passages) 33a. Upon the increase of the volume of the waste water or the cut chips stored in the water storage tank 24 to the predetermined volume, by detecting that, the volume detection sensor 35 inputs the detection signal to the control circuit (control means) 35a. Consequently, the control circuit 35a stops the blower 39 and activates the informing device 35b, such as a buzzer, a light-emitting diode or a liquid crystal display, to inform the operator that the water storage tank 24 is substantially fully filled up with the waste water.

[0056] The operator opens the door 21, pulls out the water storage tank 24 outside the outer case 20, empties the tank 24 and returns the tank 24 in its place. Then, the control circuit 35a cancels the information of the information device 35b informing the state that the tank 24 is full filled and allows the blower 39 to move.

[0057] The bad-smelling water flowing into the centrifugal separator 23 and removed of the waste water flows through the small gap 32 into a central region of the separator body 26. Then the bad-smelling air flows down through the interior of the inner tube 27 into the storage chamber 25b and flows through the hose 40

into the fine filter 37. The fine filter 37 further filters the fine dust and the moisture contained in the bad-smelling air. When the bad-smelling air filtered by the fine filter 37 flows into the deodorization device 36, the impregnated activated carbon 36a of the device 36 adsorbs the offensive smell contained in the bad-smelling air. Thus, the deodorized air is sucked through the suction box 38 into the blower 39 and is discharged through the discharge pipe 39b into the atmosphere. Moreover, since the fine filter 37 captures and removes the fine dust (the fine cut chips contained in bubbles 9b floating on the waste water 9 stored in the water storage tank 7) and the moisture, the impregnated activated carbon 36a as the deodorizer is able to maintain a long life time.

[0058] The discharge pipe 39b may be connected to the grinding chamber 2 by a hose to return the filtered and deodorized air into the grinding chamber 2. When the filtered and deodorized air is returned to the grinding chamber 2, the atmosphere of the room in which the lens-grinding machine 1 is installed will not be contaminated by the offensive smell even if the filtered and deodorized air has a slight offensive smell.

[0059] The dehydration filter 13 may be disposed above the cover plate 7a of the waste water tank 7, the drain valve 19 of the dehydration filter 13 may be connected to an upper part of the waste water tank 7 by a hose and the waste water stored in the dehydration filter 13 may be returned through the drain valve 19 into the waste water tank 7. Furthermore, the waste water stored in the water storage tank 24 may be returned into the waste water tank 7 through a hose by a pump, both are not shown. If the waste water (cooling water) contains a defoaming agent, the defoaming agent can be saved when the stored waste water is thus returned into the waste water tank 7.

(2) Second Embodiment

[0060] An internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a second embodiment according to the present invention will be described with reference to Fig. 5. The deodorization apparatus has an outer case 20, and an impact separator 50 installed in a lower part of the interior of the outer case 20. The waste water separated from bad-smelling air by the impact separator 50 is stored in the water storage tank 24. The impact separator 50 includes a case 51, separation plates 52 and 53 extending from the top wall 51a of the case 51 near to the bottom wall 51b of the same, and the impact separator 50 is able to separate the waste water, the cut chips or the like from the air by making the air colliding with the separation plates 52, 53. The suction hose 12 (or the suction hose 14) shown in Fig. 1 is connected to an inlet opening formed in a side wall of the case 51. The bad-smelling air having an offensive smell (or having an offensive smell and containing the bubbles, the cut chips and the like) and sucked into the impact separator 50 through the suction hose 12 (or the suction hose 14) impacts the separating plate 52. The bad-smelling air impacted the separating plate 52 flows in turbulent currents and the turbulent currents of the bad-smelling air further collides with the separation plate 53. Consequently, components of the waste water stored in the bad-smelling water adhere as waste water drops on the separation plates 52 and 53, and the waste water drops drip onto the bottom wall 51b. In this time, if the cut chips and the bubbles are contained in the bad-smelling air, the bubbles and the cut chips adhere to the separation plates 52 and 53 and drop together with the waste water drops. The bottom wall 51b is provided with a drain hole, not shown, to drain the waste water and the like into the water storage tank 24.

[0061] The separator body 26 of the centrifugal separator 23 shown in Fig. 3 is put on the fine filter 37 with the inner tube 27 of the body 26 directly communicating with the fine filter 37. In the body 26 shown in Fig. 3, the drain passages 33a are formed in the bottom wall 30. In the body 26 according to the second embodiment, the bottom wall 30 is not provided with any drain hole and the annular passage 29 is connected to a water storage tank, not shown, by a discharge hose, not shown.

[0062] When the deodorization system is not provided with a device corresponding to the dehydration filter 13, the suction hose 12 shown in Fig. 1 is connected to a part of the case 51, and most part of the fine cut chips contained in the bubbles 9b floating on the surface of the waste water 9 stored in the waste water tank 7 is separated from the bad-smelling air by the impact separator 50 or the separator body 26 of the centrifugal separator 23. The fine cut chips that could not have been removed by the impact separator 50 nor the separator body 26 of the centrifugal separator 23 are captured and removed together with the moisture from the bad-smelling air by the fine filter 37. The life time of the impregnated activated carbon 36a as the deodorizer can be extended by thus capturing and removing the fine dust (the fine cut chips contained in the bubbles 9b floating on the surface of the waste water 9 stored in the waste water tank 7) and the moisture by the fine filter 37.

[0063] When the deodorization system is provided with the dehydration filter 13, the filter 13 may be disposed above the cover plate 7a of the waste water tank 7, the drain valve 19 of the filter 13 may be connected to an upper part of the tank 7 by a hose and the waste water stored in the filter 13 may be returned through the drain valve 19 into the tank 7. Moreover, according to this embodiment, the waste water stored in the water storage tank 24 and that separated by the separator body 26 from the bad-smelling air may be returned through a hose, not shown, into the tank 7 by a pump, not shown. In this case, if the cooling water contains a defoaming agent, the defoaming agent can be saved when the stored waste water is thus returned into the

tank 7.

(3) Third Embodiment

[0064] An internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a third embodiment according to the present invention will be described with reference to Fig. 6. As shown in Fig. 6, the deodorization apparatus is not provided with any device corresponding to the separator body 26 of the centrifugal separator 23 included in the deodorization apparatus in the second embodiment, and the hose 40 in the second embodiment is connected to the fine filter 37. The deodorization apparatus is not provided with any parts corresponding to the water storage tank 24 and the door 21. As shown in Fig. 6, a drain pipe 54 is connected to the bottom of the case 51 of the impact separator 50, the drain pipe 54 is projected outside from the outer case 20, and a faucet 55 is connected to the free end of the drain pipe 54. The faucet 55 is opened to drain the waste water stored in the bottom of the case 51.

[0065] When the deodorization system is not provided with any device corresponding to the dehydration filter 13, the suction hose 12 shown in Fig. 1 is connected to a part of the case 51, and the most part of the fine cut chips contained in the bubbles 9b floating on the surface of the waste water 9 stored in the waste water tank 7 is separated from the bad-smelling air by the impact separator 50. The fine cut chips that could not have been removed by the impact separator 50 are captured and removed together with moisture from the bad-smelling air by the fine filter 37. The life time of the impregnated activated carbon 36 as the deodorizer, can be extended by thus capturing and removing fine dust (the fine cut chips contained in the bubbles 9b floating on the surface of the waste water 9 stored in the tank 7) and the moisture by the filter 37.

[0066] When the deodorization system is provided with the dehydration filter 13, the filter 13 may be disposed above the cover plate 7a of the tank 7, and the drain valve 19 of the filter 13 may be connected to an upper part of the tank 7 by a hose. Then the waste water may thereby be returned through the drain valve 19 into the tank 7. The waste water stored in the bottom of the impact separator 50 may be returned through a hose, not shown, into the tank 7 by a pump, not shown. In this case, if the cooling water contains a defoaming agent, the defoaming agent can be saved when the stored waste water is thus returned into the tank 7.

(4) Fourth Embodiment

[0067] An internal structure of a deodorization apparatus included in a deodorization system for a lens-grinding machine in a fourth embodiment according to the present invention will be described with reference to Fig. 7. As shown in Fig. 7, the deodorization apparatus

15 includes parts different in shape and arrangement from those of the deodorization apparatus 15 in the second embodiment. That is, in this embodiment, an elongated blower 39 is set in a vertical position, the suction side of the blower 39 is connected to a suction box 38 by a hose 56. The deodorization apparatus 15 in this embodiment is not provided with any parts corresponding to the drain pipe 39b, and a plurality of discharge holes, not shown, are formed in a part of the outer case 20 facing the blower. The discharge holes are covered with a discharge filter 57, and the air discharged from the blower 39 is discharged outside after being filtered by the discharge filter 57.

[0068] Furthermore, the deodorization apparatus 15 in this embodiment is provided with a vertically elongated water storage tank 24 and an impact separator 50 having a vertically elongated came 51 provided with a single separating plate 52. The impact separator 50 is disposed in an upper part of the deodorization apparatus 15, the deodorization device 36 is disposed beside the separator 50, the water storage tank 24 is disposed below the separator 50, and the blower 39 is disposed beside the tank 24.

[0069] Thus, the separator 50 and the tank 24 are disposed in a vertical arrangement, and the deodorization apparatus 15 has a compact construction.

[0070] The deodorization system in the fourth embodiment was used practically. The most part of substances stored in the tank 24 was the waste water scarcely containing the bubbles. By colliding the bad-smelling air with the separation plate 52, it can be done to extinguish the most part of the bubbles contained in the air. The volume of the waste water stored in the tank 24 after grinding one hundred lenses was about 1.1 liters. If the waste water (cooling water) contains a defoaming agent, the defoaming agent can be saved when the deodorization system, similarly to those in the first to the third embodiments, returns the waste water removed from the bad-smelling air and stored in the dehydration filter 13 and in the tank 24 through a hose, not shown, by a pump, not shown, to the waste water tank 7.

(5) Fifth Embodiment

[0071] A deodorization system in a fifth embodiment according to the present invention will be described with reference to Fig. 8. As shown in Fig. 8, a funnel like separator 60 for separating the waste water and the bad-smelling air from each other is disposed between the drain hose 8 in the first embodiment and the cover plate 7a of the waste water tank 7 in the first embodiment. The suction hose 12 is connected to this separator 60.

[0072] The separator 60 has a tapered part 61 tapered in a manner such that the diameter of its lower part is smaller than that of its upper part, a cylindrical part 62 connected to the lower end of the tapered part

61, and a top wall 63 covering the open upper end of the tapered part 61. And the cylindrical part 62 penetrates the cover plate 7a of the tank 7 and is hermetically fixed to the cover plate 7a. A lower end part of the drain hose 8 is inserted in a penetrated hole 63a formed in the center of the top wall 63 so as to extend into the cylindrical part 62. A small annular gap 64 is formed between the lower end part of the drain hose 8 and the cylindrical part 62.

[0073] When a negative pressure is applied through the suction hose 12 to a space in the tapered part 61 of the separator 60 while the cooling water as the waste water is flowing down through the drain hose 8 into the waste water tank 7, the bad-smelling air in the grinding chamber 2 and in the tank 7 is separated from the cooling water as the waste water flowing down in the drain hose 8 and is sucked through the drain hose 8 and the annular gap 64 into the space in the tapered part 61. Then, the bad-smelling air which is sucked into the space in the tapered part 61 is guided to the deodorization apparatus 15 after the dehydration filter 13, and is discharged outside after being deodorized in the same way as the first embodiment.

Claims

1. A deodorization system for a lens-grinding machine, said deodorization system including a suction hose (12, 14) for sucking bad-smelling air from a grinding chamber (2) and a waste water tank (7) storing waste water drained from the grinding chamber (2) through the waste water tank (7) and a deodorization means (36, 36a) for deodorizing the bad-smelling air, said deodorization means (36, 36a) being connected to the suction hose (12, 14) characterized by separation means (13, 23, 50) for separating the waste water, bubbles and cut chips from the bad-smelling air and removing the same, said separation means being interposed between the suction hose (12, 14) and the deodorization means (36, 36a).
2. The deodorization system according to claim 1 further comprising a water storage tank (24) for storing the waste water separated from the bad-smelling air by the separation means (23, 50).
3. The deodorization system according to claim 2 further comprising detection means (35) for detecting the volume of the waste water stored in the water storage tank (24).
4. The deodorization system according to claim 3, wherein said detection means (35) is incorporated into the water storage tank (24).
5. The deodorization system according to claim 2,

wherein said detection means (35) is incorporated into the separation means (23, 50).

6. The deodorization systems according to claim 1 further comprising a fine filter (37) capable of capturing the cut chips and moisture that are sucked together with the bad-smelling air from the grinding chamber (2) and the waste water tank (7).
7. The deodorization system according to claim 6, wherein the fine filter (37) is interposed between and connected to the separation means (23, 50) and the deodorization means (36, 36a).

FIG. 1

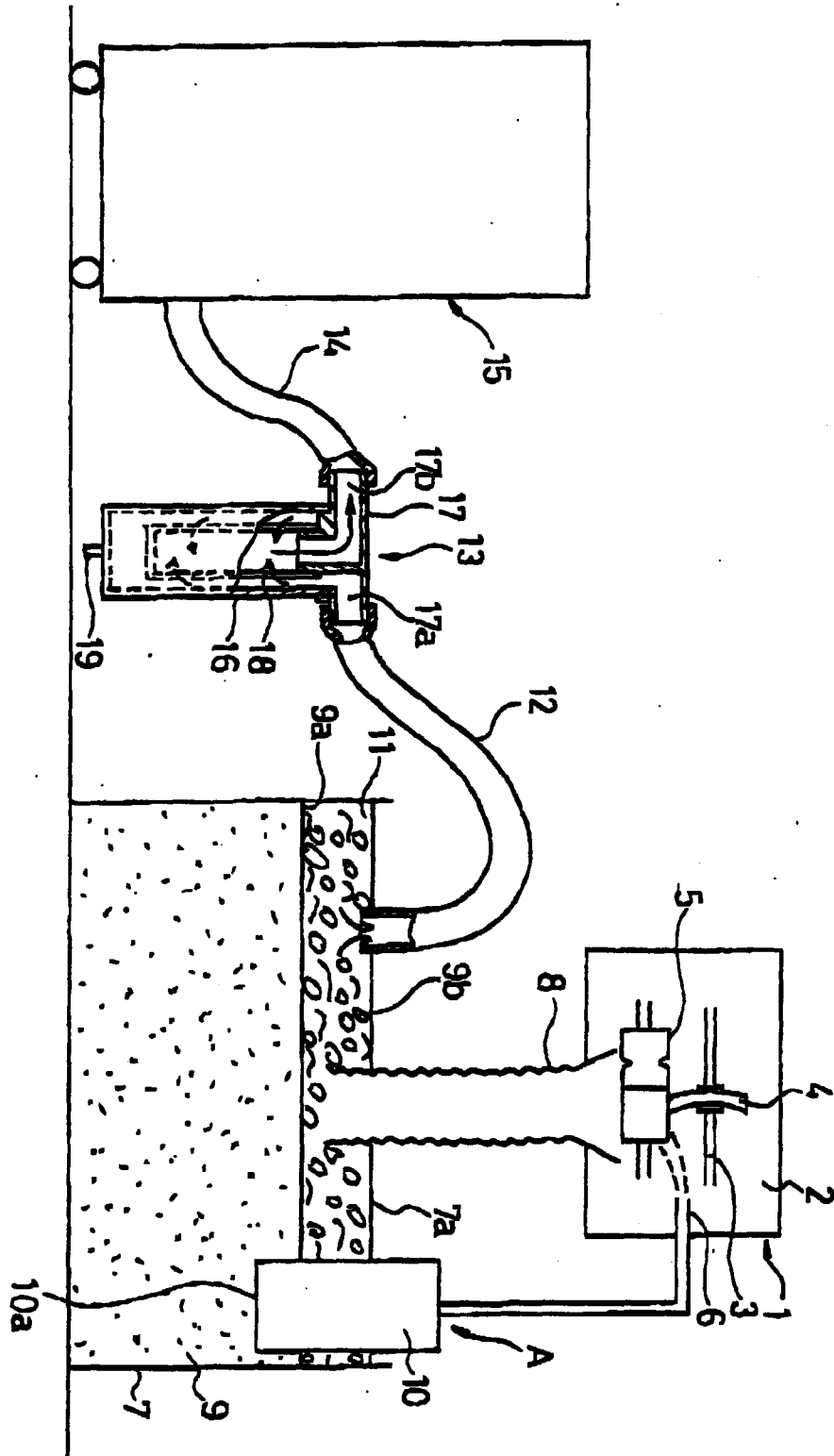


FIG. 4

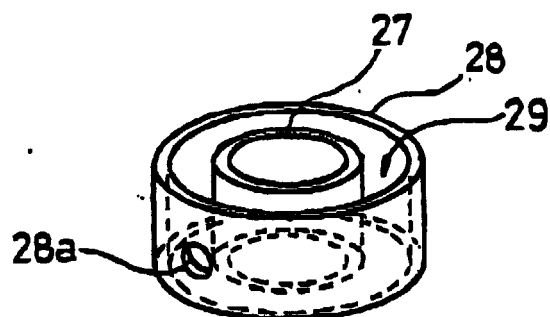


FIG. 5

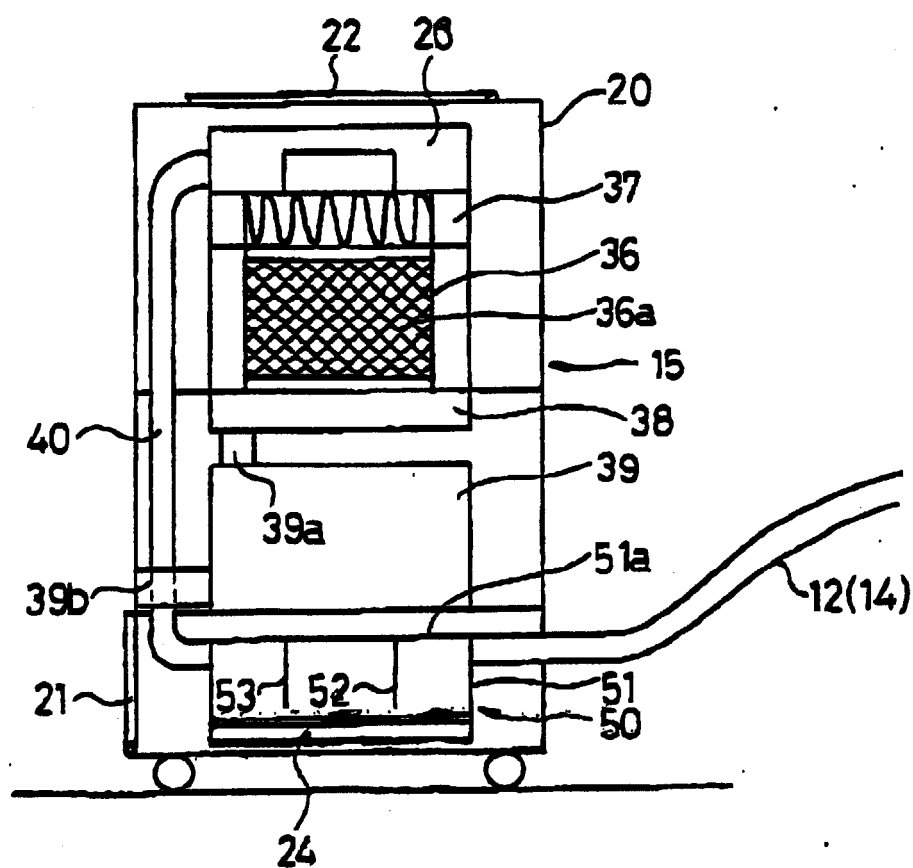


FIG. 6

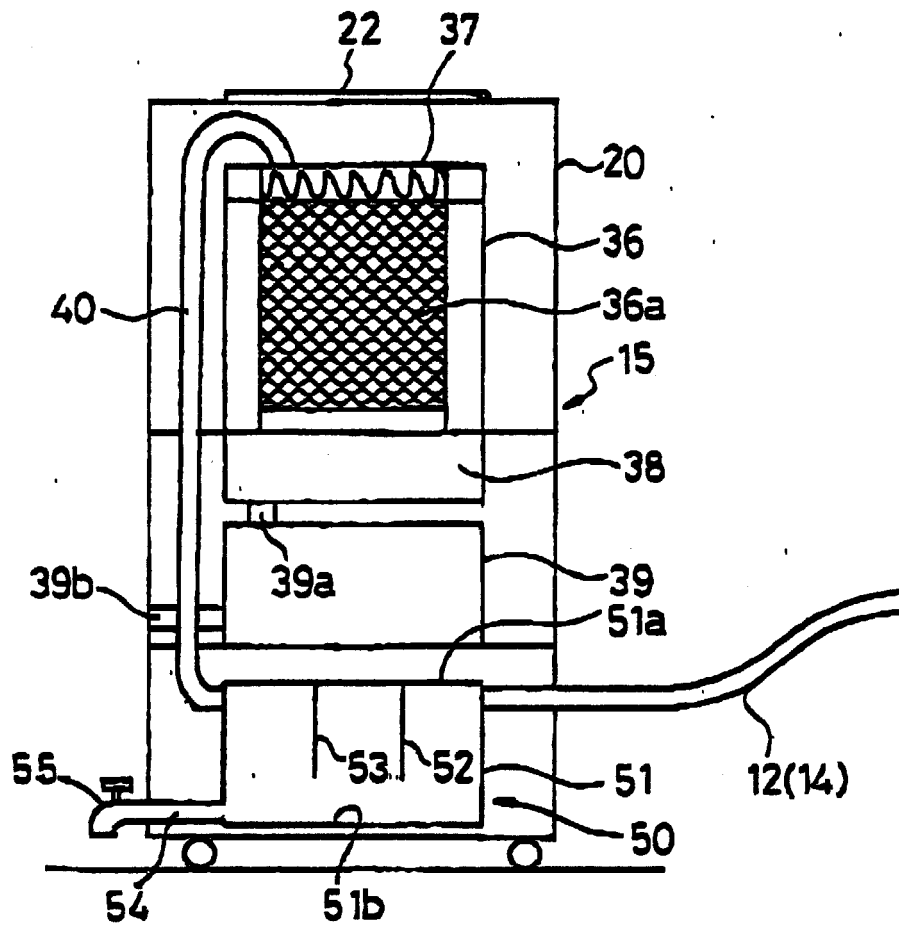


FIG. 7

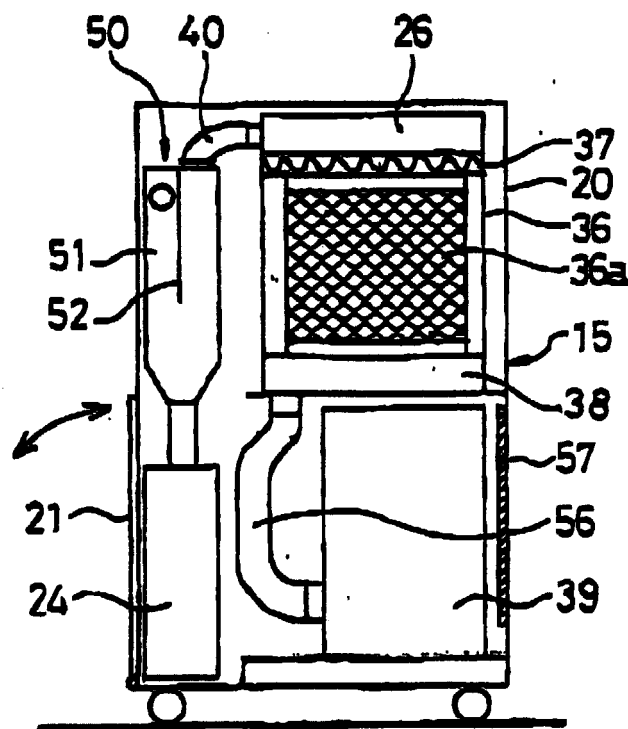
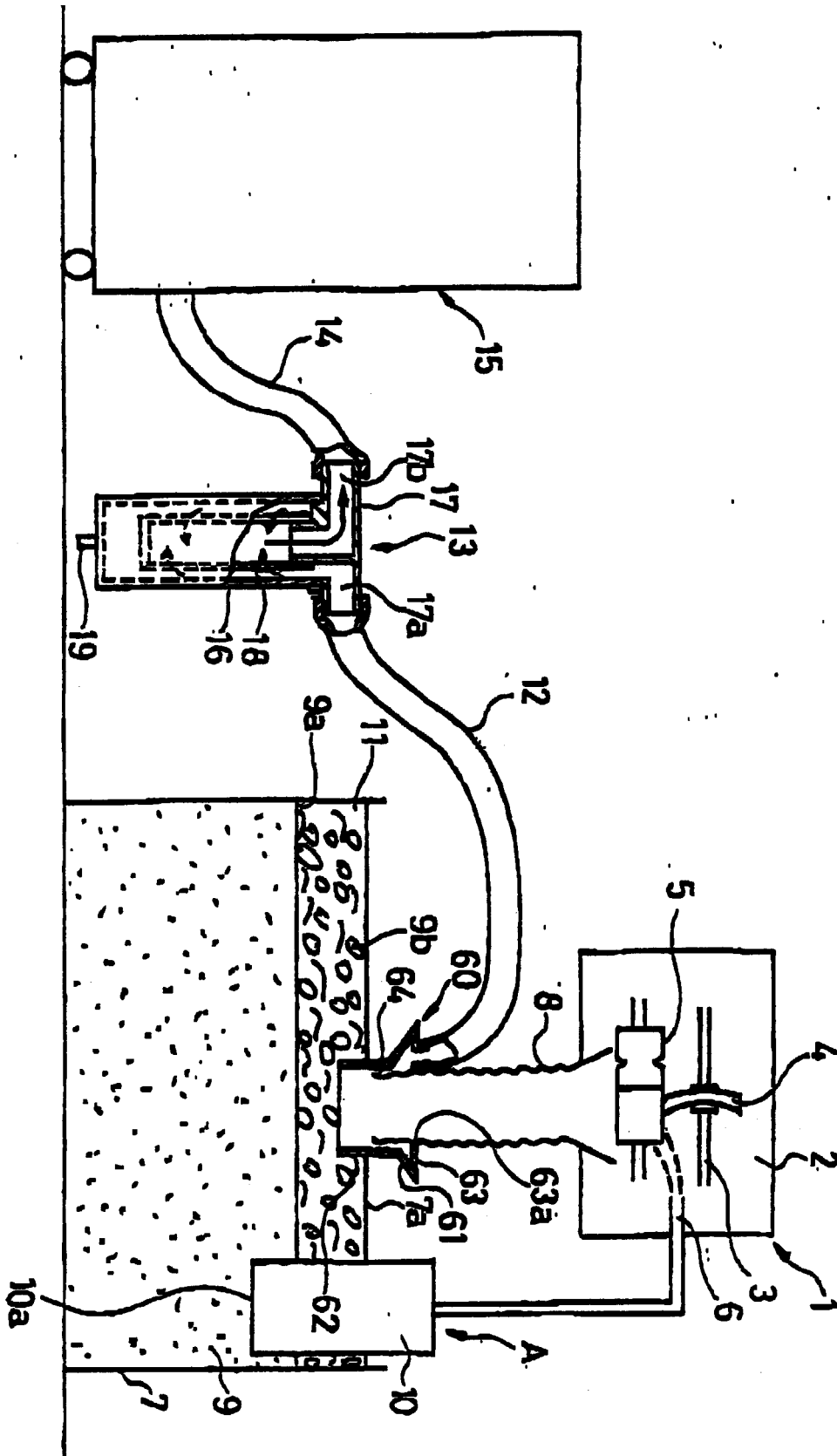


FIG. 8





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EUROPEAN SEARCH REPORT

Application Number
EP 00 25 0110

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 44 11 537 A (WERNICKE & CO GMBH) 12 October 1995 (1995-10-12) * column 2, line 59 - line 65; figures * -----	1	B24B9/14 B24B55/02 B24B55/06
D,A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 186 (M-1585), 30 March 1994 (1994-03-30) -& JP 05 345268 A (SEIKO EPSON CORP), 27 December 1993 (1993-12-27) * abstract; figures * -----	1	
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			B24B B23Q
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 July 2000	Examiner Garella, M
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05-07-2000

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