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(54) Service apparatus particularly for road, railroad, subway tunnels or the like

(57) A service apparatus (10) particularly for road, railroad, subway tunnels or the like, comprising a frame (11) for supporting means for cleaning at least one longitudinal portion of a wall (12) of a tunnel (13); the frame is associated with guiding means (27a,27b) and with means for advancement along the longitudinal extension of the tunnel, adjacent to the wall portion.

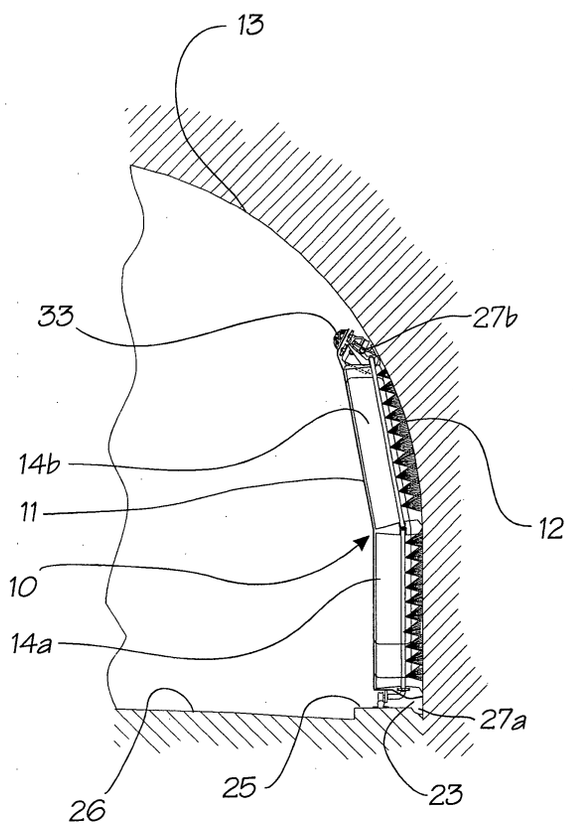

Fig. 3

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Description

[0001] The present invention relates to a service apparatus particularly for road, railroad, subway tunnels or the like.

[0002] As is known, in recent years, especially following the many road accidents that have occurred, sometimes with very severe consequences, road tunnel safety authorities have issued a series of particularly restrictive standards regarding the construction and maintenance of these tunnels and monitoring and signaling at their entrance and inside them.

[0003] One of the requirements with which the operators of tunnels, for example highway tunnels, must comply is to paint the internal walls in white up to a height of four meters and keep them perfectly clean.

[0004] In this manner, also as a consequence of an increase in light sources and in their efficiency, visibility has increased considerably and accordingly so has safety, by utilizing the reflective power of the large surfaces located at the sides of the roadway.

[0005] However, visibility conditions inside tunnels decrease rapidly owing to the degradation of the reflective power of the walls caused by dirt and smog generated by the passage of vehicles, particularly heavy goods vehicles.

[0006] Therefore, in order to keep the walls clean, operators are forced to wash the internal walls of tunnels by using high-pressure jets, with considerable problems linked especially to safety.

[0007] The cleaning operations in fact require a lane reduction, entailing risks for motorists and maintenance workers.

[0008] Moreover, wall maintenance entails rather high costs because it is very frequent and difficult to schedule owing to the variability of atmospheric conditions.

[0009] The aim of the present invention is to solve or substantially reduce the problems linked to the maintenance of the internal walls of road, railroad, subway tunnels or the like.

[0010] Within this aim, an object of the present invention is to provide an apparatus for maintaining the internal walls of tunnels that does not entail lane reductions during its use.

[0011] Another object is to provide an apparatus that cleans effectively the internal walls of tunnels.

[0012] Another object is to provide an apparatus that is capable of moving automatically and/or by remote control.

[0013] Another object is to provide an apparatus that can also act as an indicator and/or detector of any dangerous situations occurring inside the tunnel.

[0014] Another object is to provide an apparatus that has a simple structure and is easy to use.

[0015] Another object is to provide an apparatus that provides advantages in terms of cost reduction for maintaining the internal walls of tunnels and has a low cost.

[0016] This aim and these and other objects that will become better apparent hereinafter are achieved by a service apparatus particularly for road, railroad, subway tunnels or the like, characterized in that it comprises a frame for supporting means for cleaning at least one longitudinal portion of a wall of a tunnel, such frame being associated with guiding means and with means for advancement along the longitudinal extension of the tunnel, adjacent to the wall portion.

[0017] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limitative example in the accompanying drawings and figures, wherein:

Figure 1 is a rear view of an apparatus according to the invention;
Figure 2 is a view of the apparatus of Figure 1 without its housing;
Figure 3 is a transverse sectional view of the apparatus of Figures 1 and 2, applied to a road tunnel;
Figures 4 and 5 are enlarged views of two different portions of the apparatus shown in Figure 3.

[0018] With reference to the figures, a service apparatus particularly for road, railroad, subway tunnels or the like, according to the invention, is generally designated by the reference numeral 10.

[0019] The apparatus 10 comprises a supporting frame 11 for means for performing maintenance on a longitudinal portion of a wall 12 of a road tunnel 13 that is arranged adjacent to it.

[0020] The maintenance means comprise means for cleaning a portion of wall 12, which in turn comprise brushes, described in detail hereinafter, and nozzles 15 for spraying detergent liquid.

[0021] The maintenance means comprise two lower brushes 14a and two upper brushes 14b, which are arranged so as to have a substantially vertical axis and are rotatably coupled to the frame 11, so that the upper brushes 14b are slightly inclined so as to follow substantially the curvature of the vault of the tunnel 13.

[0022] The lower brushes 14a are motorized because they are connected by means of a first belt drive 16 to a first electric motor 17, transmitting motion through a transmission with universal joints, not shown for the sake of simplicity, to the upper brushes 14b.

[0023] The spray nozzles 15 are arranged along vertically elongated ducts 18, which are arranged laterally to the brushes 14 and are connected by means of tubes 19 to a reservoir 20, which is vertically elongated, is arranged between the lower brushes 14a and the upper brushes 14b, and contains the detergent liquid, and to a hydraulic pump 21.

[0024] The frame 11 is further provided with an external housing 22, except on the part that faces the portion of wall 12, in order to allow the brushes 14a and 14b and the spray nozzles 15 to act on the wall 12, limiting

the projection of liquid onto the roadway 26.

[0025] The housing 22 comprises, below the lower brushes 14a, a longitudinally elongated tray 23 for recovering detergent liquid by means of a suction pump, not shown, thus providing a hydraulic circuit for recovering the used detergent liquid.

[0026] As an alternative, a longitudinal discharge channel 24 can be provided below the wall portion 12, along the sidewalk 25 of the roadway 26.

[0027] The guiding means are constituted by two rails, a lower one 27a and an upper one 27b, which are respectively fixed to the sidewalk 25 and to the wall 12 of the tunnel 13, and on which there slide respectively first guiding rollers 28, which are rotatably coupled below the frame 11, and second guiding rollers 29, which are associated with contrast rollers 30 and are rotatably coupled to the frame 11 in an upward region.

[0028] Advantageously, the contrast rollers 30 are motorized by means of a second transmission 31, which is connected to a second electric motor 32.

[0029] In particular, the upper rail 27b is connected to an electrical line, so that an electrical contact is provided between the upper rail 27b and the contrast rollers 30 in order to supply power to the second electric motor 32.

[0030] The advancement means are thus constituted by the second electric motor 32, which by actuating the contrast rollers 30, which cooperate with the second guiding rollers 29, actuate the advancement of the apparatus 10.

[0031] Moreover, the apparatus 10 can comprise transducers for position control and a backup battery for emergency operation.

[0032] Indicator lights 33 that trace the outline of said apparatus 10 are further arranged on the housing 22, in an upward region and laterally.

[0033] It is thus evident that the apparatus 10 can be used to keep clean the longitudinal portion of the wall 12 of the road tunnel 13 by using the brushes 14a and 14b, which act mechanically on the wall 12, and the detergent liquid sprayed by the nozzles 15.

[0034] A road tunnel 13 can be provided with two apparatuses 10 arranged on the two mutually opposite lower walls or with a single apparatus 10 that runs along the entire arch of the tunnel 13.

[0035] The operation of the apparatus 10 can be controlled remotely by the user or can be programmed according to specific timings or according to the cleanliness of the wall, which is optionally detected by suitable devices.

[0036] The apparatus 10, however, can also have service functions.

[0037] It can in fact be provided with a plurality of devices and means that are particularly suitable for service functions, such as means for indicating and/or overseeing any critical and/or dangerous situations, such as television cameras, sirens, luminous signs, flashing signs, or the like, means for detecting any obstacles along the advancement path, such as photocells, radar or the like, gas and/or smoke detectors.

[0038] In practice it has been observed that the present invention has achieved the intended aim and objects.

[0039] An apparatus has in fact been provided that allows to solve the main problem of cleaning the inside walls of road tunnels in accordance with traffic safety conditions and with low costs.

[0040] Moreover, the apparatus 10 can be used as an indicator, detector or monitor to be placed proximate to building yards or dangerous situations.

[0041] The apparatus can be programmed and operated from outside the tunnel, with advantages in terms of cost reduction and easy use.

[0042] The present invention is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0043] The technical details may be replaced with other technically equivalent elements.

[0044] The materials, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

[0045] The disclosures in Italian Patent Application No. PD2001A000164 from which this application claims priority are incorporated herein by reference.

[0046] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A service apparatus particularly for road, railroad, subway tunnels or the like, **characterized in that** it comprises a frame for supporting means for cleaning at least one longitudinal portion of a wall of a tunnel, said frame being associated with guiding means and with means for advancement along the longitudinal extension of said tunnel, adjacent to said wall portion.

2. The apparatus according to claim 1, **characterized in that** said means for cleaning a wall portion comprise brushes and nozzles for spraying detergent liquid.

3. The apparatus according to claim 2, **characterized in that** it comprises two pairs of motorized brushes, a lower one and an upper one, which are arranged so that their axis is substantially vertical, said brushes being coupled rotatably to said frame, the upper brushes being slightly inclined so as to follow the curvature of the vault of the tunnel.

4. The apparatus according to claim 3, **characterized in that** said lower brushes are kinematically connected by means of a first belt drive to a first electric motor, said lower brushes transmitting motion to said upper brushes by means of a universal joint.

5. The apparatus according to claims 2 to 4, **characterized in that** said nozzles are arranged on vertically elongated ducts arranged laterally to said brushes and connected by means of a tube to a reservoir that contains a detergent liquid and to a hydraulic pump.

6. The apparatus according to claim 5, **characterized in that** said reservoir is vertically elongated and is arranged between said pairs of lower and upper brushes.

7. The apparatus according to one or more of the preceding claims, **characterized in that** said frame is provided with an external housing except in the portion that faces the tunnel wall.

8. The apparatus according to one or more of the preceding claims, **characterized in that** said housing comprises, below said brushes, a tray that is elongated substantially longitudinally and is designed to recover the detergent liquid by means of a suction pump so as to provide a liquid recirculation circuit.

9. The apparatus according to claim 1, **characterized in that** said guiding means are constituted by two rails, a lower one and an upper one, which are fixed respectively to the sidewalk of the passageway and to the wall of the tunnel, and on which there slide respectively first guiding rollers, which are rotatably coupled below said frame, and second guiding rollers, which are associated with contrast rollers rotatably coupled in an upward region of said frame.

10. The apparatus according to claim 9, **characterized in that** said contrast rollers are motorized.

11. The apparatus according to claim 10, **characterized in that** said contrast rollers and said upper rails provide an electrical contact for supplying power to the electric motor suitable to motorize said contrast rollers, said upper rail being connected to an electrical line.

12. The apparatus according to one or more of the preceding claims, **characterized in that** said sidewalk is provided with a discharge channel for the detergent liquid.

13. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises transducers for position control.

14. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises a backup battery for emergency operation.

15. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises outline indicator lights arranged on said housing.

16. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises means for indicating and/or overseeing any critical and/or dangerous situations.

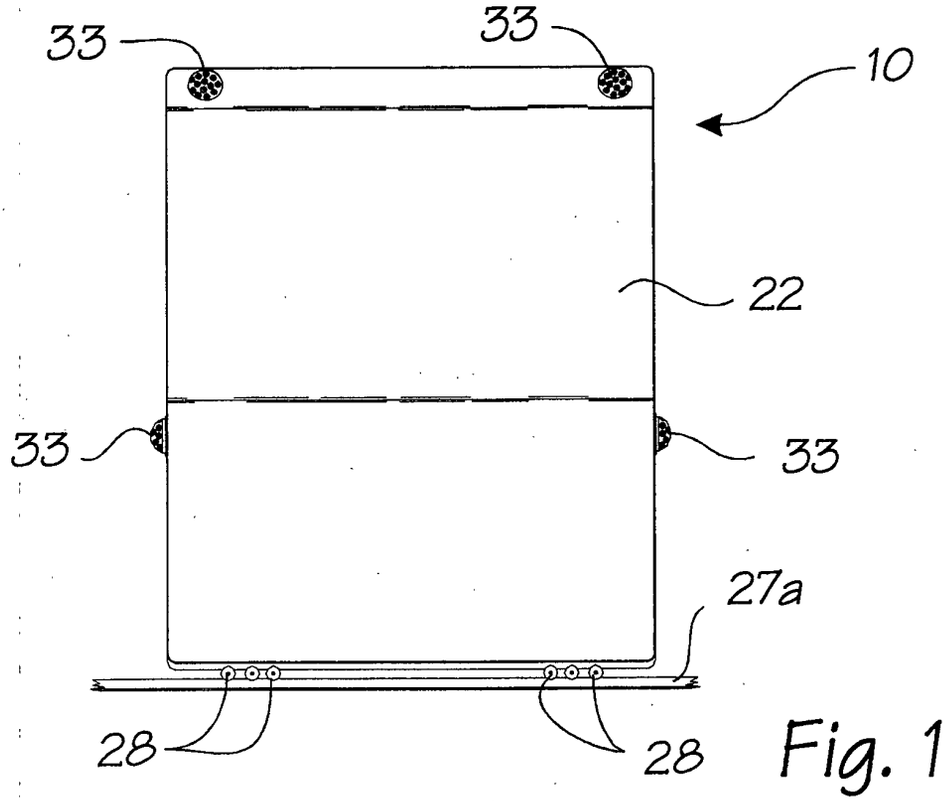
17. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises means for detecting any obstacles along the advancement path.

18. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises gas and/or smoke detectors.

19. The apparatus according to one or more of the preceding claims, **characterized in that** it is associated with means for time-controlled operation programming.

20. The apparatus according to one or more of the preceding claims, **characterized in that** said apparatus is arranged on each one of the two lower side walls of a tunnel.

21. The apparatus according to one or more of claims 1 to 19, **characterized in that** it lies along the entire arch of the tunnel.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27a
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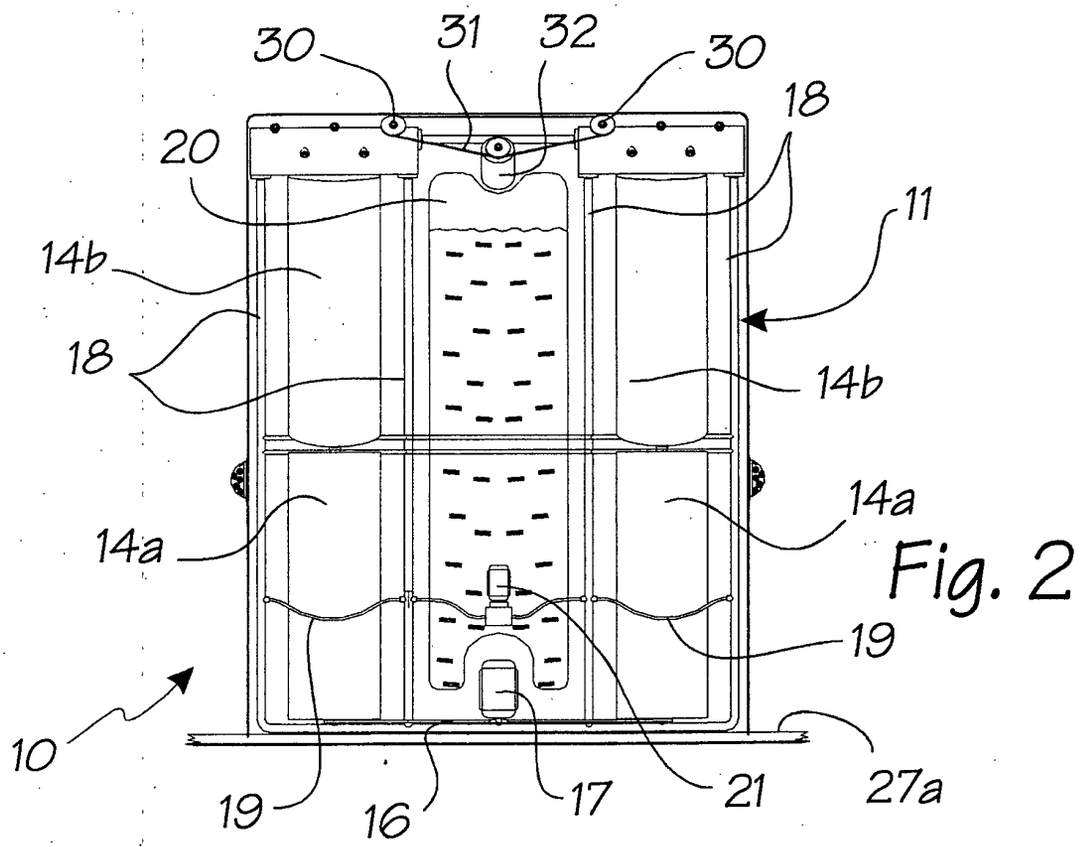
Fig. 1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14b
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14b
14a
14a
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17
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27a

Fig. 2

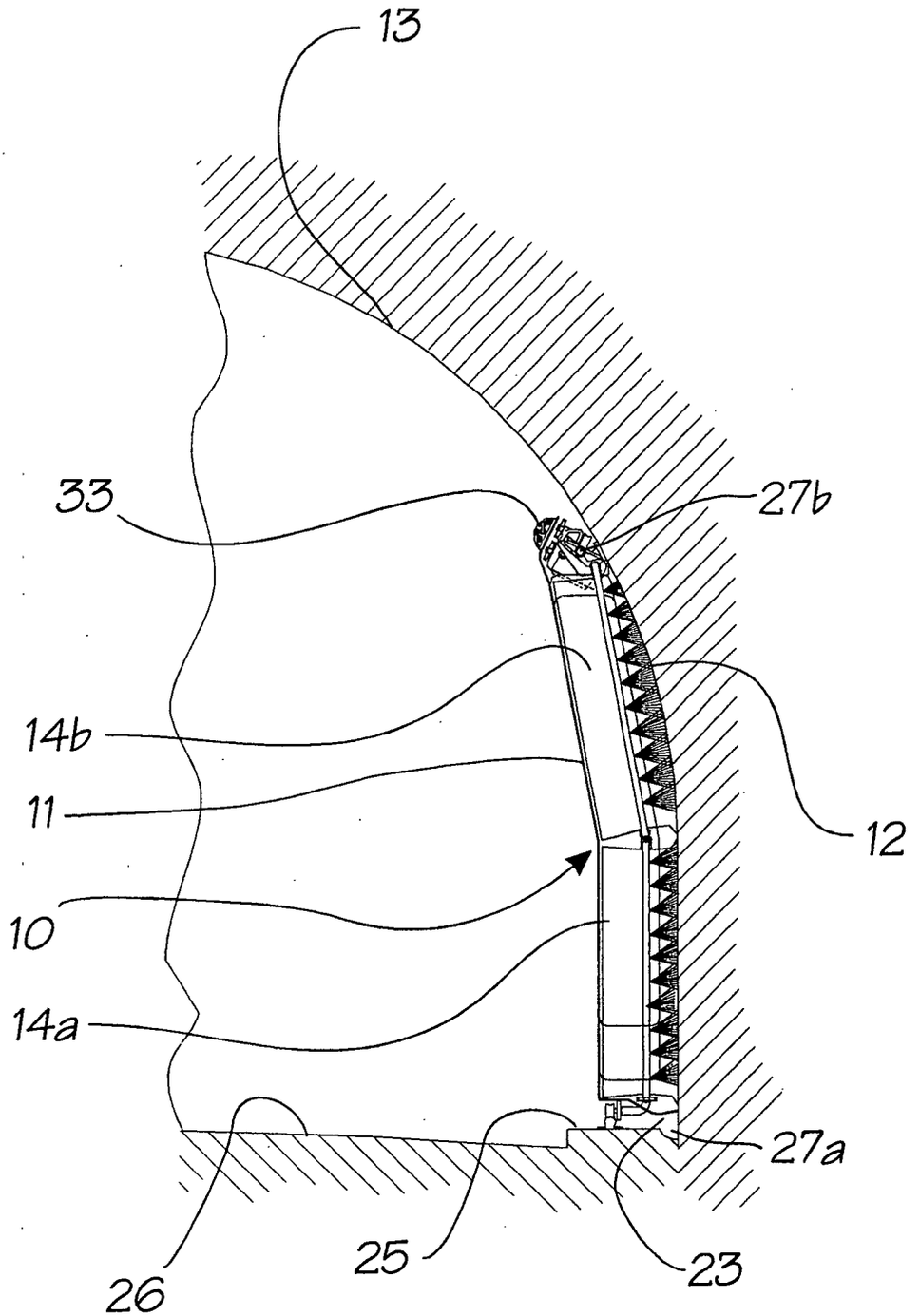

Fig. 3

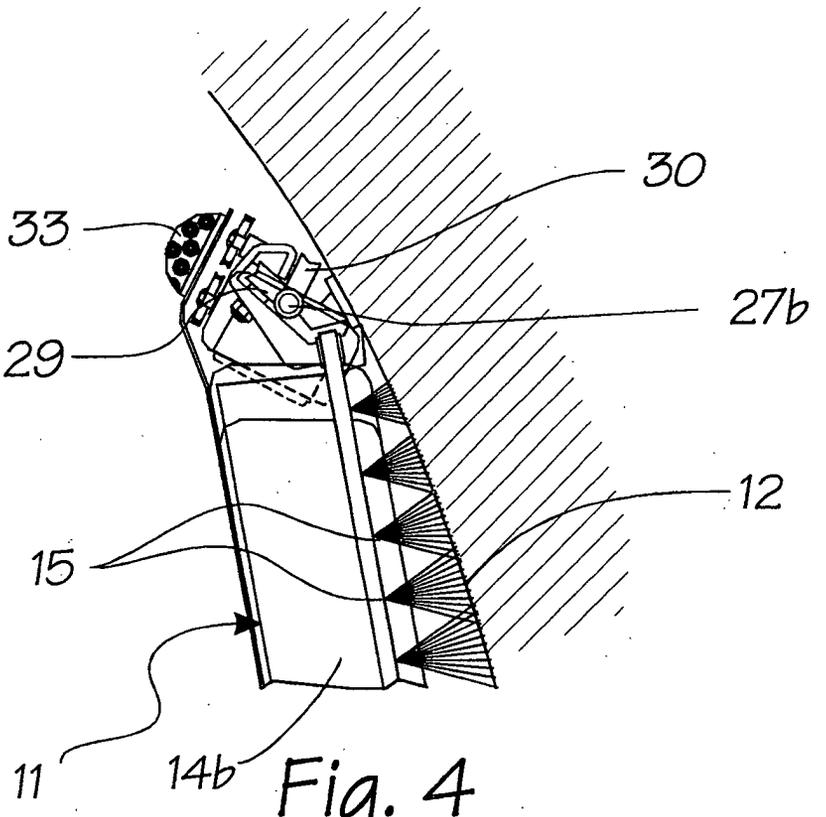

Fig. 4

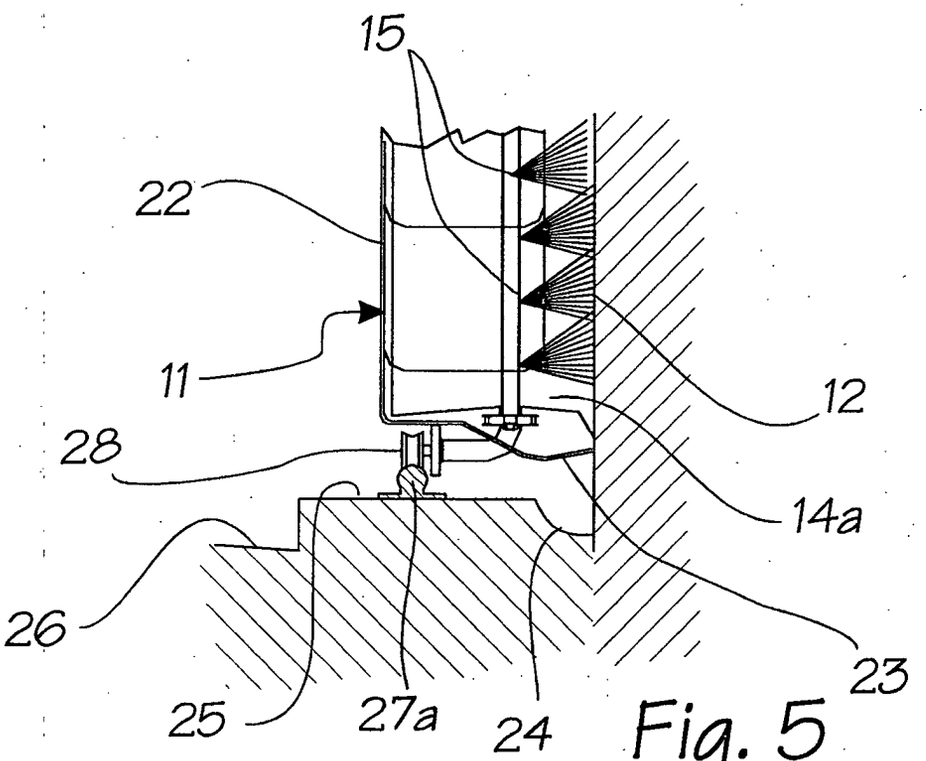

Fig. 5