

(19)



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(11)

EP 1 122 382 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
22.09.2004 Bulletin 2004/39

(51) Int Cl.7: **E04H 4/16**

(21) Application number: **01101590.6**

(22) Date of filing: **25.01.2001**

(54) **Robotised pool cleaner**

Robotisierter Schwimmbeckenreiniger

Nettoyeur de piscine robotisé

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**

(30) Priority: **04.02.2000 IT MI000174**

(43) Date of publication of application:
08.08.2001 Bulletin 2001/32

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(56) References cited:
**EP-A- 0 169 589 FR-A- 2 729 995
FR-A- 2 781 243 US-A- 5 454 129
US-A- 5 842 243 US-A- 6 017 400**

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Description

[0001] This invention generally relates to devices for cleaning swimming pools and/or basins, canalizations and the like, and more particularly is an object of the present invention to provide a remotely-controlled automatic pool cleaner powered by electrical batteries.

[0002] There are known several manually propelled pool cleaners such as those disclosed in US-A-3 979 788 and US-A-4 692 956, all equipped with a hose connected with a pressure or vacuum source.

There are further known completely automated (also called robotised) electric or electronic pool cleaners, that are either remotely controlled or properly programmed, but such devices need a cable to be connected to an electric power source, with such cable creating "umbilical" constraints to the device and hindering the movements thereof and increasing the costs and the weight to be carried.

[0003] From US-A-5 842 243 on which the preamble of claim 1 is based there is known a manually-propelled pool cleaner i.e. a cleaner equipped with a long pole or rod used by the operator to manually move the apparatus in the swimming pool, provided with a buoyant case for housing a battery supplying electrical power to the cleaner pump with a simple cable connecting the floating case with the cleaner.

[0004] US-A-6 017 400 discloses an underwater cleaning device for cleaning the floor of a water basin, including a navigational system and a remote control system coupled to the navigational system and controlling the movement of the vehicle, in which an umbilical cable is used to conduct electric power for feeding the cleaning device from a console located on the shore of the basin to the vehicle.

[0005] EP-A-169 589, discloses a device for cleaning basins having vertical surfaces such as swimming pools, controlled by an operator on the edge of said swimming pool, and a source of electrical power for feeding the cleaner located in a housing resting on the pool edge and connected to a fixed source of voltage and to the cleaner through a first cable. The operator controls the cleaner through a control set connected by another cable to the feeding housing and from there to the cleaner through the first cable.

[0006] It is therefore an object of the present invention to overcome the above mentioned drawbacks and limitations of the prior art-devices through an improved pool cleaner of the self-propelled and remotely-controlled type.

[0007] The invention achieves the above mentioned objects through a swimming pool cleaner as claimed in claim 1. Further advantageous features are recited in the dependent claims.

[0008] In accordance with the invention there is provided a floating housing connected to and towed by the pool cleaner, which contains the electrical supply batteries, the remote control receiver and an electronic unit

such as a card for controlling the cleaner. The floating housing is connected to the cleaner by a short flexible and tensile resistant cable which supplies to this latter both the power for feeding the cleaning device and the control signals, if and when needed. In a presently preferred embodiment of the invention, the control circuits for the cleaner operations are located in the floating housing and the feeding cable comprises a plurality of conductors for carrying specific and suitably-timed feedings to the components of the self-propelled cleaner. This way the batteries can be easily maintained in a separate assembly from the body of the pool cleaner, thus obtaining assembly components of lower weight, that can be detached from one another and easily transported.

[0009] Since the cleaner does not need to be connected through an electric cable to a stationary point outside the pool, the pool cleaner in accordance with the invention can easily advance along channels and freely turn around pillars or floating "islands" in a swimming pool without any risk that the cable becomes entangled.

[0010] The invention will now be disclosed hereinbelow with reference to the attached drawings illustrating a nonlimiting embodiment thereof, in which:

Fig. 1 illustrates a schematic perspective and partially cross-sectioned view showing a cleaner according to the invention and illustrating its use;
Fig. 2 is a partial cross-sectioned view of the floating housing or shuttle; and
Fig. 3 is a block diagram illustrating an embodiment of the invention.

[0011] As illustrated in Figs. 1 and 3, a cleaner according to the invention comprises a self-propelled cleaning device 1 adapted to move over the surfaces 30 (both horizontal and vertical) of a swimming pool or basin 10 to be cleaned, a floating feeding source 11 inside which at least one battery 13 and a remote control signal receiver 15 are located, and a tensile-resistant cable 17 connecting the cleaning device with the power source 11. The system further comprises a remote control hand-held transmitter set 22 used by an operator 21 who moves along the edge of the swimming pool or basin. As illustrated later on in the description, the hand-held transmitter set 22 preferably includes also a receiver. In the following description, reference is made to a radio remote control system which is not to be understood as a limiting feature since the invention also applies to other types of remote control systems.

[0012] The self-propelled cleaner 1 comprises a case 3 equipped with a (transport) handle 8, the cleaner being provided with wheels 2, tracks or other motor-actuated locomotion means and housing cleaning devices such as pumps and/or brushes, the motor(s) for driving the wheels 2, and other components that are not illustrated in detail.

[0013] The cleaner 1 is adapted to climb the pool

walls, to go forwards-backwards, to turn right and left hand in a swimming pool or basin 10 of any size, indicatively in 1 - 50 m long and 1 - 50 m wide swimming pools. In the illustrated embodiment, the cleaner is controlled by the radio control transmitter 22 held by an operator on the edge of the swimming pool, although in other embodiments a programmed control device can be simply started and stopped through the transmitter 22.

[0014] The cleaner is fed from the shuttle 11 which is a sort of floating "island" containing - in this embodiment - two batteries 13 and an electronic circuit 15 with a transmitter and a receiver.

[0015] The shuttle further houses an electronic control unit such as a card and a radio receiver which receives - through an aerial 16 - control signals or pulses transmitted by the operator. More precisely, with reference to the embodiment illustrated in Fig. 3, the floating housing 11 contains a central control unit 28, typically a programmed microcontroller, connected to a control unit 31 for the pump and a control unit 32 for the motors. These units are adapted to generate supply voltages of 24 V, respectively for the main pump and the right and left traction motors. A further control unit 34 is connected to the microcontroller 28 and generates control signals (at a lower voltage than the 24 V battery), such as the water surface and the inclination of the cleaner 1, that is its attitude in the horizontal-vertical plane.

[0016] The electrical conductors for carrying the above mentioned power supplies voltages and control signals are connected to a watertight connector 33 in which a mating connector joined to a multi-lead cable 17 is fitted.

[0017] The microcontroller 28 is further connected to a transmitter-receiver 35, an A/D 36 4-channel converter and a voltage regulator 37. The batteries 13 are of rechargeable type through a watertight connector 24 and, still inboard of the floating housing, a battery voltage regulator 39 is provided.

[0018] The small set 22 housing the remote control set (Figs. 1 and 3) incorporates a transmitter-receiver 40, for example operating at 433.92 MHz, a buzzer 41, and is further equipped with a display 42 and a matrix keyboard 43, by which the operator can enter the controls.

[0019] The electronic control card of the cleaner, located in the shuttle or service island 11, allows the automatic operation of the cleaner by executing one or more main cleaning programs either defined in advance in accordance with the basin size and/or shape and stored in the control units. Alternatively suitable control signals are transmitted by the operator through radio signals from the hand-held control set 22 (up to a distance of about 30 m).

[0020] With reference to the cross-section shown in Fig. 2, the construction of a preferred embodiment of the shuttle 11 is illustrated in detail.

[0021] The shuttle 11 comprises two half-shells 11A

and 11B of a plastic material joined together along their peripheries provided with flanges 16A and 16B by turning the knobs of one or more screws 18 and with a seal gasket 19 being interposed between the flanges. The lower half-shell 11B has preferably a hydrodynamic profile in order to facilitate the shuttle displacement in the water and to prevent overloading the motors driving the cleaner. To the half-shell 11B there is further secured a peripherally extending member 25 of closed-cells spongy material having the dual function of buffering the shuttle and increasing its buoyancy.

[0022] On the shuttle top half-shell or cover 11A there is mounted a watertight connector 24 for connecting the batteries with a battery charger (not shown).

[0023] In an embodiment of the invention, not shown in the drawings, the shuttle can be provided with a propeller driven by an electric motor to facilitate the navigation thereof, if this becomes necessary: e.g. when an excessive power is drawn by the motors actuating the cleaner wheels.

[0024] Thanks to a battery voltage regulator in the control unit 39 the battery can be used until discharged to a predetermined level, after which the control unit 39 stops the cleaning device and generates a warning signal for the operator (through the buzzer). This way the operator can take advantage of the residual electrical power to recover the cleaner from any point of the swimming pool where the cleaner has been stopped.

[0025] In addition to its function of troubleshooting indicator, the display 42 of the remote control set 22 can visualise the operations being carried out by the cleaner, and moreover it can act as a display terminal when the operator programs the cleaner functions. The remote control set can display signals indicating the exhaustion of the batteries, which situation can activate an audible alarm, too. The operating cycle(s) of cleaner is (are) programmable both in respect of the duration and of the type of work, with a predetermined plurality of possible paths and time durations depending on the size and shape of the pools.

[0026] Although the invention has been illustrated with reference to preferred embodiments thereof, the invention is generally susceptible of other applications and modifications falling within its scope, as defined by the claims, as will be evident to the skilled of the art. For example, a pair of supply conductors can be used for carrying the feeding voltages, and another pair of conductors can convey information about the way they are to be distributed through control and drive circuits housed within the self-propelled cleaner.

Claims

1. A remotely controlled device for cleaning swimming pools, basins and the like including their vertical surfaces, comprising:

- a cleaner (1) adapted to move over the surfaces (30) to be cleaned under the control of an operator (21) on the edge of said swimming pool;
- a source of electrical power (11, 13) for feeding said cleaner(1), comprising at least one battery (13) and connected by a tensile-resistant cable (17) with said cleaner(1); said source of electrical power (11, 13) being housed in a floating housing (11) towed inside the swimming pool by said cleaner (1) through said cable (17);

characterised in that said cleaner is a self-propelled cleaner (1), and that said device further comprises a wireless remote control transmitter (22), and said housing (11) contains a receiver (35) for said wireless remote control transmitter (22), and an electronic unit or card controlling said cleaner (1).

2. A device as claimed in claim 1, **characterised in that** said floating source of electrical power (11, 13) comprises at least one battery (13).
3. A device as claimed in claim 1 or 2, **characterised in that** said self-propelled cleaner (1) comprises a case (3) equipped with a handle (8), the cleaner (1) being provided with motor-actuated locomotion means (2) and housing cleaning devices and at least one motor for driving said locomotion means (2).
4. A device as claimed in claim 2 or 3, **characterised in that** said housing (11) further contains a central control unit (28) and control circuits (31, 32, 34, 39) for said cleaner (1), one of said control circuit (39) including a voltage regulator adapted to stop the cleaning device and generate a warning signal when said battery has been discharged to a predetermined level.
5. A device as claimed in the preceding claims, **characterised in that** said tensile-resistant cable (17) is adapted for carrying both electrical power and information.
6. A device as claimed in claim 5, **characterised in that** said cable (17) contains conductors which carry voltages equal to the ones of said battery (13) and control signals for controlling the attitude of said cleaner, which signals are made up by voltages lower than the voltage of said battery (13).
7. A device as claimed in the preceding claims, **characterised in that** said floating housing (11) comprises two half-shells (11A, 11B) of plastic material that are joined together through screw (18) along their peripheries provided with flanges (16A, 16B) with an interposed sealing gasket (19).

8. A device as claimed in claim 7, **characterised in that** the lower of said half-shells has a hydrodynamic profile and carries a buffering peripheral element (25) of light material that increases the buoyancy of said housing (11).

9. A device as claimed in claim 7 or 8, **characterised in that** it further provides for a watertight connector (24) for the connection with a battery charger on the top half-shell (11A) and a watertight connector (33) for said feeding cable (17) on the lower half-shell (11B).

15 Patentansprüche

1. Ferngesteuerte Einrichtung zum Reinigen von Schwimmbecken, Wasserbecken und Ähnlichem einschließlich ihrer vertikalen Oberflächen mit

- einem zum Bewegen über die zu reinigenden Oberflächen (30) ausgelegten Reinigungsgerät (1), das von einer Bedienungsperson (21) am Rand des Schwimmbeckens gesteuert wird;
- einer elektrischen Energiequelle (11, 13) zur Speisung jenes Reinigungsgerätes (1), die wenigstens eine Batterie (13) aufweist und durch ein drehfestes Kabel (17) mit dem Reinigungsgerät (1) verbunden ist; jene elektrische Energiequelle (11, 13) ist in einem Schwimmkörper (11) untergebracht, der innerhalb des Schwimmbeckens durch das Reinigungsgerät (1) mittels des Kabels (17) geschleppt wird;

dadurch gekennzeichnet, daß das Reinigungsgerät ein selbstgetriebenes Reinigungsgerät (1) ist und daß diese Einrichtung weiter ein drahtloses Fernsteuergerät (22) aufweist und das Gehäuse (11) einen Empfänger (35) für jenes drahtlose Fernsteuergerät (22), sowie eine elektronische Einheit oder Karte zur Steuerung jenes Reinigungsgeräts (1) enthält.

2. Einrichtung nach Anspruch 1, **dadurch gekennzeichnet, daß** jene schwimmende elektrische Energiequelle (11, 13) mindestens eine Batterie (13) aufweist.
3. Einrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** jenes selbstgetriebene Reinigungsgerät (1) einen mit einem Handgriff (8) ausgestatteten Kasten (3) aufweist und das Reinigungsgerät (1) mit motorbetätigten Fortbewegungsmitteln (2) sowie Hausreinigungseinrichtungen und mindestens einem Motor zum Antrieb jener Fortbewegungsmittel (2) versehen ist.

4. Einrichtung nach Anspruch 2 oder 3,
dadurch gekennzeichnet, daß jenes Gehäuse (11) weiter eine zentrale Steuereinheit (28) und Steuerkreise (31, 32, 34, 39) für das Reinigungsgerät (1) enthält und einer dieser Steuerkreise (39) einen Spannungsregler beinhaltet, der zum Stoppen der Reinigungseinrichtung und zur Erzeugung eines Warnsignals ausgelegt ist, wenn die Batterie auf eine vorbestimmte Ladung entladen worden ist. 5
5. Einrichtung nach den vorhergehenden Ansprüchen,
dadurch gekennzeichnet, daß jenes drehfeste Kabel (17) zur Übertragung sowohl von elektrischer Energie als auch von Informationen ausgelegt ist. 10
6. Einrichtung nach Anspruch 5,
dadurch gekennzeichnet, daß jenes Kabel (17) Leiter enthält, die Spannungen gleich der Batteriespannung (13) und auch Steuersignale, die das Verhalten des Reinigungsgeräts steuern und die als niedrigere Spannungen als die Batteriespannung (13) konzipiert sind. 15
7. Einrichtung nach den vorhergehenden Ansprüchen,
dadurch gekennzeichnet, daß jener Schwimmkörper (11) zwei Halbschalen (11A, 11B) aus Kunststoff aufweist, die durch Schrauben (18) an ihrem mit Flanschen (16A, 16B) versehenen Umfang mit einem dazwischenliegenden Dichtungselement (19) miteinander verbunden sind. 20
8. Einrichtung nach Anspruch 7,
dadurch gekennzeichnet, daß die untere der Halbschalen ein hydrodynamisches Profil aufweist und ein stoßdämpfendes Umfangselement (25) aus leichtem Material trägt, das die Schwimmfähigkeit des Gehäuses (11) verbessert. 25
9. Einrichtung nach Anspruch 7 oder 8,
dadurch gekennzeichnet, daß sie außerdem mit einer wasserdichten Verbindung (24) für den Anschluss eines Batterieladegeräts an der oberen Halbschale (11A) versehen ist, sowie einer wasserdichten Verbindung (33) an der unteren Halbschale (11B) für das Speisekabel (17). 30

Revendications

1. Dispositif commandé à distance pour nettoyer des piscines, des bassins et analogues, en incluant leurs surfaces verticales, comprenant :
- un nettoyeur (1) adapté pour se déplacer sur les surfaces (30) à nettoyer sous la commande d'un opérateur (21) situé sur le bord de ladite

- piscine ;
- une source de courant électrique (11, 13) pour alimenter ledit nettoyeur (1), comprenant au moins une batterie (13) et connectée par un câble résistant à la traction (17) avec ledit nettoyeur (1) ; ladite source de courant (11, 13) étant logée dans une enceinte flottante (11) remorquée à l'intérieur de la piscine par ledit nettoyeur (1) par ledit câble (17) ;

caractérisé en ce que ledit nettoyeur est un nettoyeur auto-propulsé (1), et **en ce que** ledit dispositif comprend, de plus, un émetteur sans fil de commande à distance (22), et **en ce que** ladite enceinte (11) contient un récepteur (35) pour ledit émetteur sans fil de commande à distance (22), et une unité électronique ou une carte électronique commandant ledit nettoyeur (1).

2. Dispositif selon la revendication 1, **caractérisé en ce que** ladite source de courant flottante (11, 13) comprend au moins une batterie (13).
3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** ledit nettoyeur auto-propulsé (1) comprend un boîtier (3) doté d'une poignée (8), le nettoyeur (1) étant pourvu de moyens de déplacement actionnés par moteur (2) et logeant des dispositifs de nettoyage et au moins un moteur pour commander lesdits moyens de déplacement (2).
4. Dispositif selon la revendication 2 ou 3, **caractérisé en ce que** ladite enceinte (11) contient, de plus, une unité centrale de commande (28) et des circuits de commande (31, 32, 34, 39) pour ledit nettoyeur (1), l'un desdits circuits de commande (39) incluant un régulateur de tension adapté pour arrêter le dispositif de nettoyage et générer un signal d'alarme lorsque ladite batterie est déchargée à un niveau prédéterminé.
5. Dispositif selon les revendications précédentes, **caractérisé en ce que** ledit câble résistant à la traction (17) est adapté pour transporter à la fois du courant électrique et une information.
6. Dispositif selon la revendication 5, **caractérisé en ce que** ledit câble (17) contient des conducteurs qui transportent des tensions égales à celles de ladite batterie (13) et des signaux de commande pour commander l'attitude dudit nettoyeur, lesquels signaux sont constitués par des tensions inférieures à la tension de ladite batterie (13).
7. Dispositif selon les revendications précédentes, **caractérisé en ce que** ladite enceinte flottante (11) comporte deux demi-coques (11A, 11B) de matériau plastique qui sont raccordées ensemble par

des vis (18) sur leurs périphéries dotées de brides (16A, 16B) avec un joint d'étanchéité interposé (19).

8. Dispositif selon la revendication 7, **caractérisé en ce que** la plus basse desdites demi-coques présente un profil hydrodynamique et porte un élément tampon périphérique (25) constitué d'un matériau léger qui augmente la flottabilité de ladite enceinte (11). 5
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9. Dispositif selon la revendication 7 ou 8, **caractérisé en ce qu'il** prévoit, de plus, un connecteur étanche à l'eau (24) pour la connexion avec un chargeur de batterie sur la demi-coque supérieure (11A) et un connecteur étanche à l'eau (33) pour ledit câble d'alimentation (17) sur la demi-coque intérieure (11B). 15

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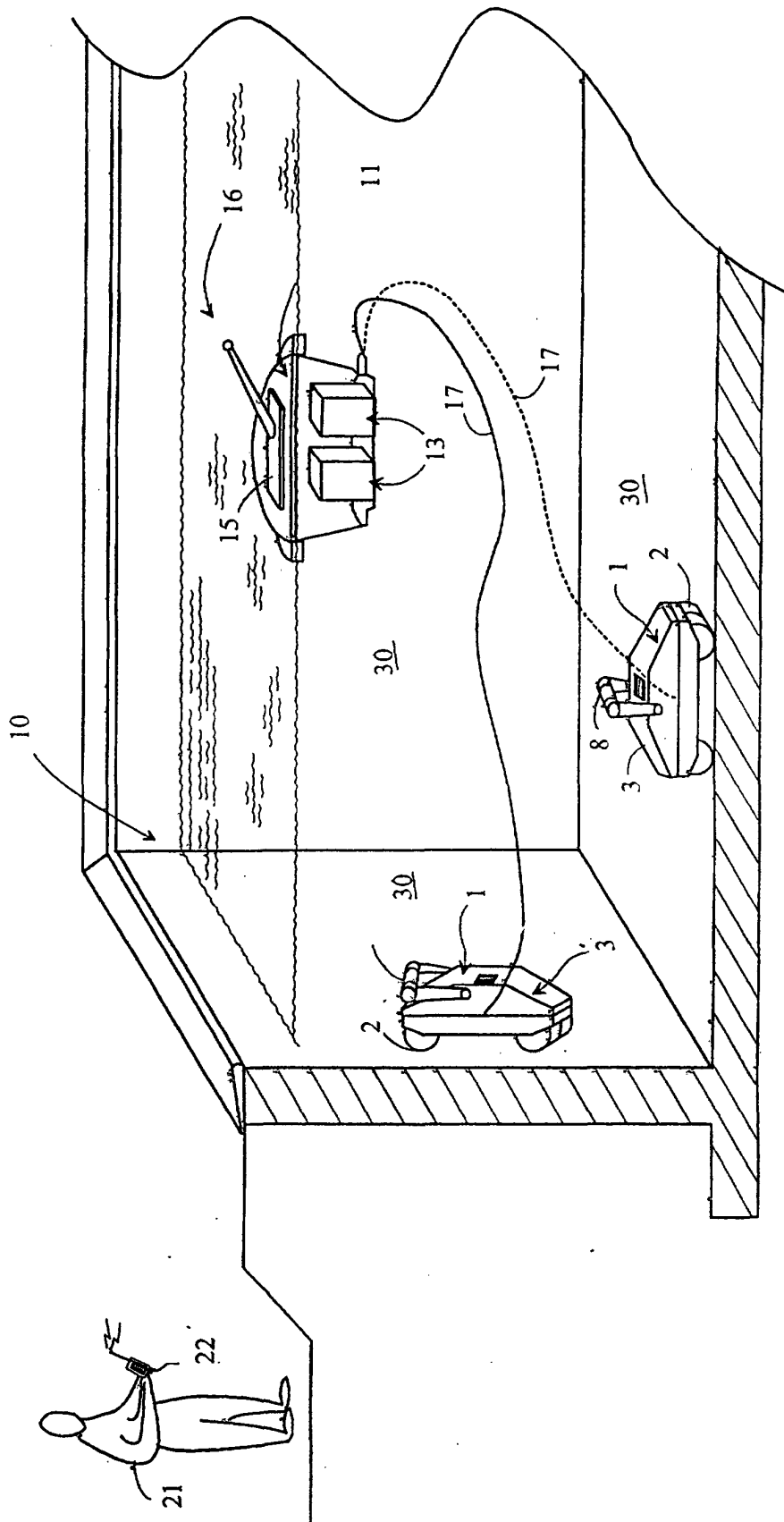


Fig. 1

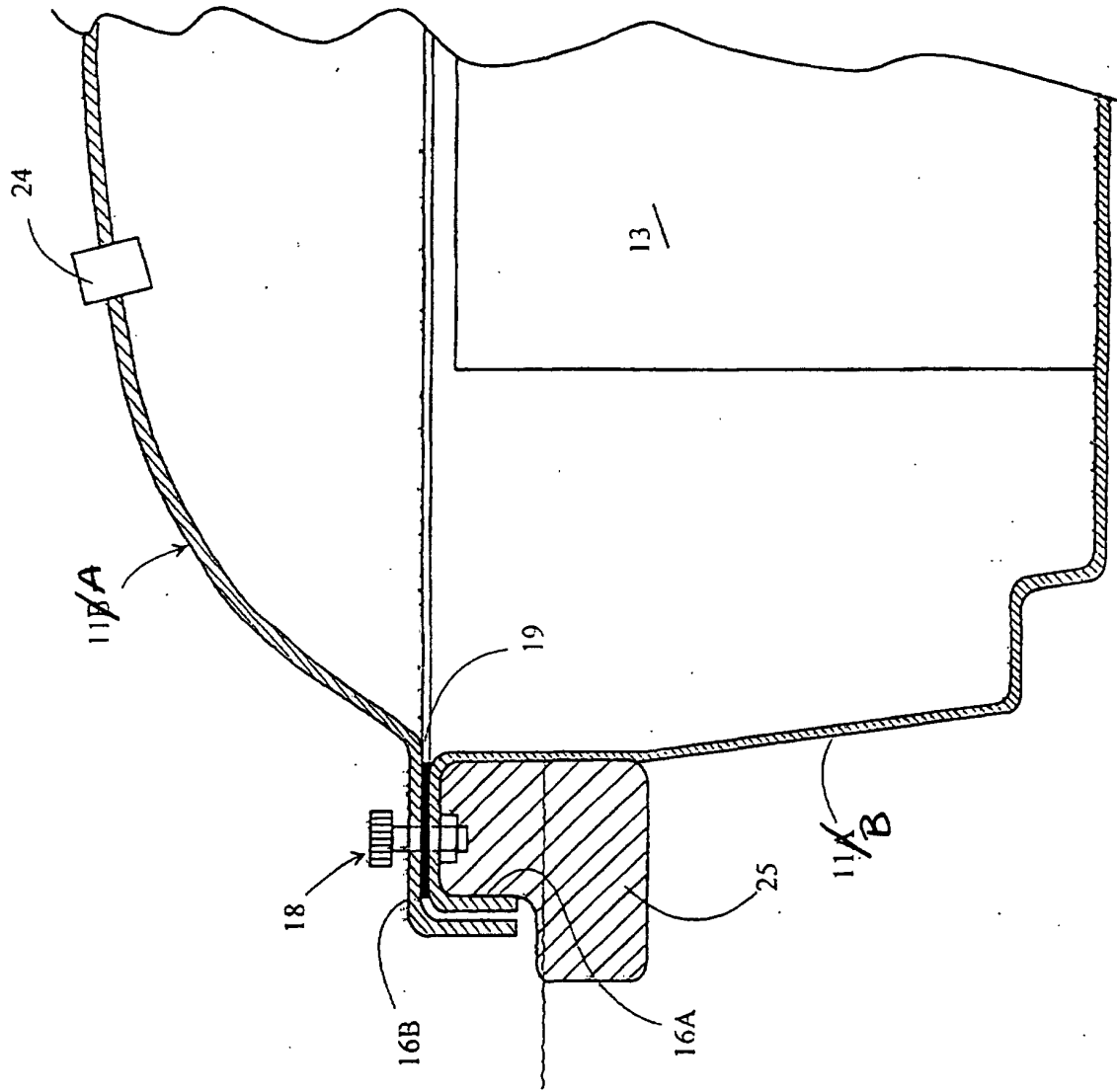


Fig. 2

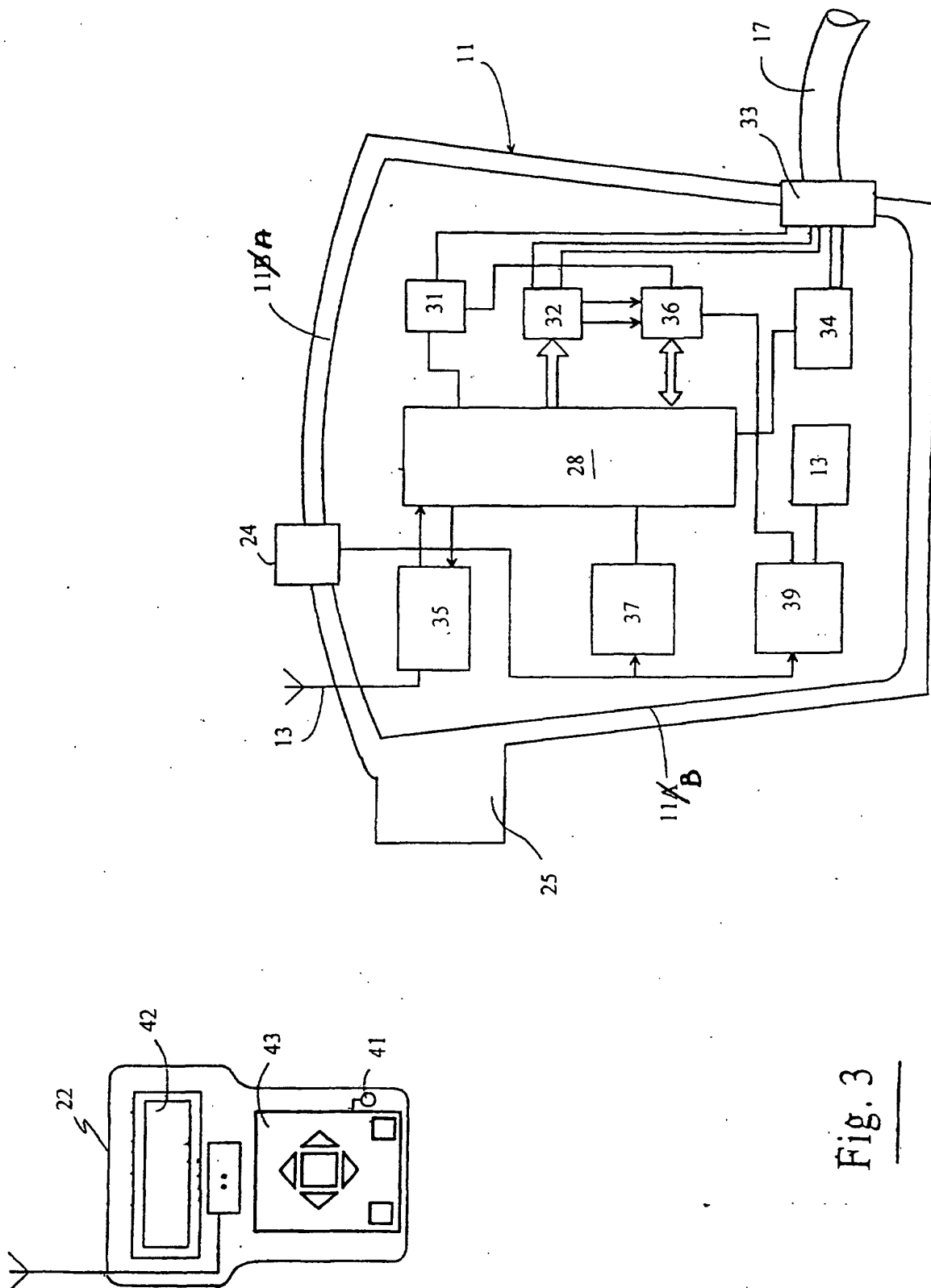


Fig. 3