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(54) FLOATING PUMP

(57) Floating pump comprising:
flotation means (1) on a liquid medium (A),
an axial or semi-axial flow pump (2) supported by the flotation means (1) comprising an inlet (3) and an outlet (4), comprising transmission means (5) which comprise a drive shaft (6) and are arranged in fluid communication with said inlet (3) and said outlet (4) of the axial or semi-axial flow pump (2), enabling the establishment of a flow of fluid to be pumped along a longitudinal axis (7) coinciding with the drive shaft (6), which in the working position, a first end (6') of the drive shaft (6), located in proximity to the outlet (4) of the axial or semi-axial flow pump (2), is in the submerged position, while a second end (6") of the drive shaft (6), opposite from the first end (6'), is in the non-submerged position, such that the orientation of the drive shaft (6) is inclined with respect to the surface of the liquid medium (A) whereon the flotation means (1) are located.

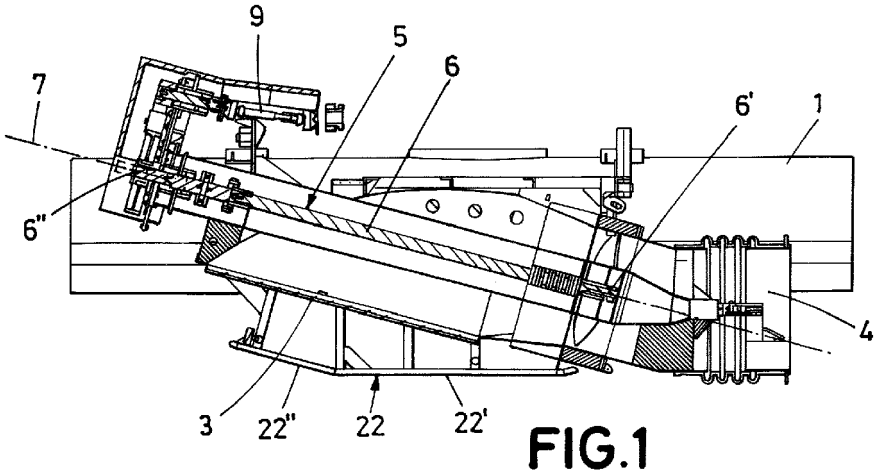

FIG.1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a floating pump, which has application in the pumping device industry.

BACKGROUND OF THE INVENTION

[0002] Currently, pumping devices are known which can be transported by means of a motor vehicle to a location where the drainage of a certain amount of water or liquid is required in a certain area.

[0003] This is especially useful in open-field areas where water accumulations have occurred after a storm, such that there is a large area of water that has to be drained.

[0004] An example of this type of pumping device can be found in European patent No. EP-1417416-B1, which describes a pump comprising its own flotation means for the floating arrangement thereof in a pond or flooded area, such that the pump enables the suction of the stagnant water for the evacuation thereof through a pipe to an area located at a distance outside the volume of liquid to be pumped.

[0005] Among the limitations of the pump described in the document cited in the previous paragraph is the fact that the watertightness of the pump transmission compartment is critical, in addition to the limitations it has in the orientation of the suction and discharge in relation to the total depth of the equipment during the operation thereof.

DESCRIPTION OF THE INVENTION

[0006] The present invention relates to a floating pump as defined in claim 1, which enables the aforementioned problems to be solved.

[0007] The floating pump proposed by the invention comprises flotation means on a liquid medium (A), as well as an axial or semi-axial flow pump supported by the flotation means comprising an inlet and an outlet for fluid to be pumped.

[0008] In the working position, said axial or semi-axial flow pump is at least partially submerged in the fluid to be pumped between said inlet and said outlet, and wherein the axial or semi-axial flow pump comprises transmission means which in turn comprise a drive shaft, wherein said transmission means are arranged in fluid communication with said inlet and said outlet of the axial or semi-axial flow pump, enabling the establishment of a flow of fluid to be pumped between said inlet and said outlet in the working position, along a longitudinal axis of the axial or semi-axial flow pump coinciding with the drive shaft, such that in the working position the rotation of the drive shaft produces the flow of the fluid to be pumped from the inlet to the outlet.

[0009] Therefore, according to the invention, in the working position of the floating pump, a first end of the drive shaft, located in proximity to the outlet of the axial or semi-axial flow pump, is in the submerged position, while a second end of the drive shaft, opposite from the first end, is in the non-submerged position, such that the orientation of the drive shaft is inclined with respect to the surface of the liquid medium (A) whereon the flotation means are located.

[0010] In this manner, the watertightness of the belt compartment is not critical if the seal of the gasket of the lower transmission guard is lost.

[0011] Likewise, the inclined shaft reduces the draft or depth of the equipment since it enables the suction and discharge to be oriented with a small angle of inclination and therefore the suction and discharge accessories can be positioned with a lesser effect on the total depth of the equipment.

[0012] It is envisaged that the floating pump comprises drive means of the drive shaft supported by the flotation means and that in the working position are outside the liquid medium (A), wherein said drive means are connected to the second end of the drive shaft by means of a mechanical transmission.

[0013] Likewise, the drive means can have an inclined orientation with respect to the drive shaft and the mechanical transmission can comprise a universal joint which enables the use of combustion engines in a substantially horizontal position.

[0014] The axial or semi-axial flow pump can comprise a tower plate which enables the alignment of the floating pump with a shaft extension and a guide plate to be verified, even in the working position, in other words, without having to remove the equipment from the water.

[0015] The possibility is envisaged of the floating pump comprising a pipe connected in a pivoting manner to the outlet of the axial or semi-axial flow pump, such that in the working position the drive means and the pivoting connection of the pipe are in proximity to the centre of flotation of the floating pump.

[0016] Likewise, it is envisaged that the drive means comprise an electric engine comprising a shaft, the orientation of which is parallel to that of the drive shaft.

[0017] The electric engine can be synchronous and be directly coupled to the second end of the drive shaft.

[0018] It is envisaged that the floating pump comprises a watertight protective structure for the drive means and the mechanical transmission, wherein said protective structure is supported by the flotation means. The protective structure is pivoting, enabling it to be opened in order to enable the inspection and service of the transmission without it needing to be removed.

[0019] The floating pump can comprise a conduit leading to the centre of the impeller element wherein it can suck in atmospheric air due to pressure differences at high pump speeds.

[0020] Likewise, it is envisaged that the axial or semi-axial pump comprises a hood which acts as a suction area, which in the working position protrudes above the

flotation level and can be filled with water, in other words, in order to prime during the operation of the pump.

[0021] It is envisaged that the flotation means comprise hollow floats compartmented in a watertight manner.

[0022] The pivoting connection between the pipe and the outlet of the axial or semi-axial flow pump may comprise a flexible coupling of the tubes with safety chains.

[0023] In this sense, according to one embodiment, the flexible coupling may have only one degree of freedom.

[0024] The possibility is envisaged of the floating pump comprising two lower support skids, wherein each lower skid comprises two segments with different orientations, wherein a first segment is parallel to the flotation level of the flotation means, and a second segment is parallel to the drive shaft.

DESCRIPTION OF THE DRAWINGS

[0025] To complement the description provided herein and for the purpose of helping to better understand the features of the invention according to a preferred practical embodiment thereof, said description is accompanied by a set of figures constituting an integral part of the same, wherein the following is depicted with an illustrative and non-limiting character:

Figures 1 and 2 show two longitudinal cross sections of the pump wherein it can be seen how the inclined shaft of the pump emerges from the water in order to be able to use transmissions with belts or chains, the belts/chains being above the flotation level.

Figure 3 shows an elevation view and another profile view of the pump floating on the flotation surface.

Figure 4 shows a longitudinal cross section wherein it can be seen how the pump shafts and the upper transmission portion with degrees of inclination can use universal joints in order to change the rotational angularity of an engine in a horizontal position to an upper transmission shaft with angularity.

Figure 5 shows a perspective view of the tunnel of the pump element having a "tower plate" which enables the verification of the alignment of the equipment with a shaft extension and a guide plate without having to remove the equipment from the water.

Figures 6 and 7 show two schematic elevation views of the general configuration of the equipment wherein the upper shaft of the belt transmission is in the direction of the discharge and the use of universal joints which can vary in length enables the centre of gravity of the equipment to be brought closer to the pivoting centre of the coupling for angular variation with the pipe.

Figure 8 shows a detail of the tunnel of the shaft which emerges from the water which can serve as a structural base in order to operate the equipment with electric engines without changes in the angle with respect to the transmission shafts.

Figure 9 shows an elevation view of an embodiment of the invention for cases wherein the pumps rotate at synchronous speed, the engine can be assembled directly in the tunnel of the pump and be coupled to the main shaft.

Figure 10 shows a view of the upper portion of the transmission guard which has a pivoting point enabling easy inspection and in turn enabling the geometry of the guard to be extended in order to protect the operators from motorised couplings or universal joints that rotate.

Figures 11 and 12 show an elevation view and a detail in perspective view of an embodiment wherein the pump element does not require a seal where the shaft of the pump emerges from the body since it has a closed tunnel around the shaft with external side accesses which let in more water than can come out through the inside of a water-lubricated bushing or restriction plate.

Figure 13 shows a longitudinal cross section of an embodiment which can have oil-lubricated tunnels.

Figure 14 shows an elevation view of the duct leading to the centre of the impeller element wherein atmospheric air can be sucked in due to pressure differences at high pump speeds.

Figure 15 shows an elevation view wherein the suction of the pump or "hood" can be seen which can protrude above the flotation level and can be "primed" or filled with water during the operation of the pump.

Figure 16 shows a longitudinal cross section of a detail of an embodiment wherein, since it does not have air inlets, the hood acts as a siphon since the pump suctions the trapped air and afterward only water enters, such that the siphon-type suction enables the pumps to be semi-submerged or slightly submerged in order to reduce the total draft or depth of the equipment.

Figure 17 shows a longitudinal cross section of the discharge of the pump which can be coupled to a discharge pipe by means of couplings which enable pivoting, enabling the discharge pipes to not be horizontal but rather inclined in order for them to emerge from the water at a dry anchoring point.

Figure 18 shows a perspective view of the tube leading to the pump which can perform the structural function of making an access walkway to the pump.

Figure 19 shows a detail of the tube leading to the pump which can perform the dual function of a cable tray for electrically operated pumps.

Figure 20 shows a perspective view of one of the floats.

Figure 21 shows an elevation view of one of the floats of the floating pump, which are hollow, but have separate compartments in order to reduce the risk of sinking if it is punctured.

Figure 22 shows a partially cross-sectioned detail in perspective view of a flexible coupling in order to

enable differences in angularity with the pipe.

Figure 23 shows a perspective view of a coupling which enables axial loads to be withstood and enables the watertightness and pressure of the pump to be maintained so that it can support the weight of pipes and water in cantilevered configurations.

Figure 24 shows an elevation view of one of the flexible couplings which has a chain or external safety cables in case of the failure of flexible elements so that the equipment does not break loose and float away without control.

PREFERRED EMBODIMENT OF THE INVENTION

[0026] In view of the outlined figures, it can be seen how in one of the possible embodiments of the invention the floating pump that the invention proposes comprises flotation means (1) on a liquid medium (A), as well as an axial or semi-axial flow pump (2) supported by the flotation means (1) comprising an inlet (3) and an outlet (4) for fluid to be pumped.

[0027] In the working position, said axial or semi-axial flow pump (2) is at least partially submerged in the fluid to be pumped between said inlet (3) and said outlet (4), and wherein the axial or semi-axial flow pump (2) comprises transmission means (5) which in turn comprise a drive shaft (6), wherein said transmission means (5) are arranged in fluid communication with said inlet (3) and said outlet (4) of the axial or semi-axial flow pump (2), enabling the establishment of a flow of fluid to be pumped between said inlet (3) and said outlet (4) in the working position, along a longitudinal axis (7) of the axial or semi-axial flow pump (2) coinciding with the drive shaft (6), such that in the working position the rotation of the drive shaft (6) produces the flow of the fluid to be pumped from the inlet (3) to the outlet (4).

[0028] In the working position of the floating pump, a first end (6') of the drive shaft (6), located in proximity to the outlet (4) of the axial or semi-axial flow pump (2), is in the submerged position, while a second end (6") of the drive shaft (6), opposite from the first end (6'), is in the non-submerged position, such that the orientation of the drive shaft (6) is inclined with respect to the surface of the liquid medium (A) whereon the flotation means (1) are located.

[0029] In this manner, the watertightness of the belt compartment is not critical if the seal of the gasket of the lower transmission guard is lost. Likewise, the inclined shaft reduces the draft or depth of the equipment since it enables the suction and discharge to be oriented with a small angle of inclination and therefore the suction and discharge accessories can be positioned with a lesser effect on the total depth of the equipment.

[0030] The floating pump comprises drive means (8) of the drive shaft (6) supported by the flotation means (1) and that in the working position are outside the liquid medium (A), wherein said drive means (8) are connected to the second end (6") of the drive shaft (6) by means of a mechanical transmission (9).

[0031] Said drive means (8) can have an inclined orientation with respect to the drive shaft (6) and the mechanical transmission (9) can comprise a universal joint (10) which enables the use of combustion engines (11) in a substantially horizontal position.

[0032] Likewise, the axial or semi-axial flow pump (2) can comprise a tower plate (12) which enables the alignment of the floating pump with a shaft extension (13) and a guide plate (14) to be verified, even in the working position, in other words, without having to remove the equipment from the water. The transmission is mounted on the tower plate (12), which can be seen in figure 5. The plate and the transmission have guides, which enables the transmissions to be mounted, guaranteeing alignment with the pump assembly.

[0033] Likewise, the floating pump comprises a pipe (15) connected in a pivoting manner to the outlet (4) of the axial or semi-axial flow pump (2), such that in the working position the drive means (8) and the pivoting connection of the pipe (15) are in proximity to the centre of flotation (16) of the floating pump.

[0034] The drive means (8) may comprise an electric engine (17) comprising a shaft (17'), the orientation of which is parallel to that of the drive shaft (6). Said electric engine (17) can be synchronous and be directly coupled to the second end (6") of the drive shaft (6).

[0035] As seen in the figures, the floating pump comprises a watertight protective structure (18) for the drive means (8) and the mechanical transmission (9), wherein said protective structure (18) is supported by the flotation means (1). The protective structure is pivoting, enabling it to be opened in order to enable the inspection and service of the transmission without it needing to be removed.

[0036] The floating pump comprises a conduit (19) leading to the centre of the impeller element wherein it can suck in atmospheric air due to pressure differences at high pump speeds.

[0037] Furthermore, the axial or semi-axial pump (2) comprises a hood (20) which acts as a suction area, which in the working position protrudes above the flotation level and can be filled with water, in other words, in order to prime during the operation of the pump.

[0038] Likewise, the flotation means (1) comprise hollow floats compartmented in a watertight manner.

[0039] The pivoting connection between the pipe (15) and the outlet (4) of the axial or semi-axial flow pump (2) may comprise a flexible coupling of the tubes with safety chains (21). The flexible coupling may have only one degree of freedom.

[0040] According to a preferred embodiment, the floating pump comprises two lower support skids (22), wherein each lower skid (22) comprises two segments (22', 22") with different orientations, wherein a first segment (22') is parallel to the flotation level of the flotation means, and a second segment (22") is parallel to the drive shaft (6).

[0041] The most relevant features of the invention are:

Inclined shaft of the pump
Universal joint transmission. In such case, the gearbox is outside of the water level
Motor and pivot of the pipe close to the centre of flotation and with the consequent stability
In the case of using synchronous engines, direct coupling to the transmission shaft
Compartmented, hollow floats in order to prevent sinking and beams in order to support floats
Flexible coupling of the tubes with safety chains

[0042] Lower skid with two angles, the first one parallel to the engine shaft and the second one parallel to the shaft of the pump.

[0043] Figures 1 and 2 show how the inclined shaft of the pump emerges from the water in order to be able to use transmissions with belts or chains, the belts/chains being above the flotation level. In this manner, the watertightness of the belt compartment is not critical if the seal of the gasket of the lower transmission guard is lost.

[0044] The pump has a lower skid with two resting angles. One angle corresponds to the horizontal position of the drive element or horizontal operating position of the equipment. The second angle corresponds to the angle of the shaft line. This enables the equipment to be pivoted during maintenance in order to extract the shaft lines and perform maintenance.

[0045] The lower skid has perforations whereon drag elements or accessories can be added in order to rest on the bottom during low tides. The lower skid has an angle in the tips thereof in order to enable dragging manoeuvres of the equipment in order to be able to insert and remove the pump from the water in areas with slopes and suitable ground. The skid has drag points on the tips thereof in order to prevent drag manoeuvres from structurally affecting the pump. The angularity in the skid in two main cross sections of the pump enables the equipment to pivot during manoeuvres for loading large equipment in order to be able to perform loadings in standardised containers or on truck platforms, reducing the height of the equipment and thus enabling loadings with assembled equipment that otherwise would have to be disassembled.

[0046] Figure 3 shows how the inclined shaft reduces the draft or depth of the equipment since it enables the suction and discharge to be oriented with a small angle of inclination and therefore the suction and discharge accessories can be positioned with a lesser effect on the total depth of the equipment.

[0047] The rear beams of the floats have a depressed shape leaving the engine stand extension free towards the discharge in order to enable the use of engines with different lengths without interference during the assembly.

[0048] The beams supporting the floats can also serve as bearing points for guardrails or canopies placed on top of the pump element.

[0049] The tip of the beams has pins for manoeuvres for lifting or anchoring the equipment.

[0050] The roof structure and guardrail are integrated in order to reduce the number of components.

[0051] The grate, pump, or discharge element can incorporate liquid-liquid and liquid-air heat exchange systems in order to be able to replace radiators with ventilation and thus increase the efficiency of the assembly. Unlike previous keel cooler systems, these envisage the possibility of cooling the air circuits (aftercooler or charge air cooler) of combustion engines. In the case of being integrated with a grate, pump or discharge, this element can fulfil a dual function with a single part.

[0052] The exchanger systems incorporating air cooling have a system for separating moisture through a duct to the lowest accumulation point in order to extract liquid accumulations in the exchangers. These can be extracted mechanically or they can use the pressure of the system in order to evacuate the liquid.

[0053] The pump can incorporate different types of pump elements since by submerging or partially submerging the pump, they do not require an additional vacuum priming system. The pumps of the floating system may include, but are not limited to, single- or multi-stage axial, semi-axial and radial pumps.

[0054] Figure 4 shows the pump shafts and upper transmission portion with degrees of inclination which can use universal joints in order to change the angularity of rotation of a Diesel engine in a horizontal position to an upper transmission shaft with angularity. In this configuration, combustion engines or electric engines can be easily adapted to the equipment.

[0055] Figure 5 shows the tunnel of the pump element having a "tower plate" which enables the verification of the alignment of the equipment with a shaft extension and a guide plate without having to remove the equipment from the water. This plate also enables the transmissions to be assembled guaranteeing alignment with the pump assembly.

[0056] The design can make use of belts or chains in the transmission system. The design can make use of V-drive marine transmissions. The design can use high-power toothed belts in order to maintain the toothed pulleys, the characteristic feature of which is that they are smaller than V-belts in order to transmit similar amounts of power. Having pinions with a smaller diameter combined with the arrangement of the equipment wherein the elevation of the pulley is above the water level or protected only with a partially submerged lower guard enables the assembly to be shorter in the total length thereof.

[0057] Figures 6 and 7 show the general configuration of the equipment wherein the upper shaft of the belt transmission is in the discharge direction and the use of universal joints which can vary in length enables the centre of gravity of the equipment to be brought closer to the pivoting centre of the coupling for angular variation with

the pipe. The closeness of these two points combined with a centre of flotation between them enables the vertical loads exerted by the tubes to not significantly affect the flotation of the equipment. This enables the pumps to be connected to tubes coming out of the water at couplings with a higher elevation ("cantilevered" pipe) and the pump can withstand the weight of the tubes filled with water without the change in angularity thereof being significant while maintaining low float lengths and reduced flotation volumes. Floating pump wherein the centre of flotation and the flexible discharge pivot or coupling are close in order to reduce changes in angularity between the off and on states when using rigid pipes that emerge from the water and apply load to the system. Pipe couplings can be submerged, semi-submerged or outside of the water.

[0058] Figure 8 shows the tunnel of the shaft which emerges from the water which can serve as a structural base in order to operate the equipment with electric engines without changes in the angle with respect to the transmission shafts. The belt has a sealed lower guard which prevents water from entering the belt compartment from waves or unforeseen events regarding flotation.

[0059] Likewise, figure 9 shows those cases wherein the pumps rotate at synchronous speed, the engine can be assembled directly in the tunnel of the pump and coupled to the main shaft. The difference with other pump systems is that there is no critical seal between the shaft and the engine.

[0060] Figure 10 shows the upper portion of the transmission guard which has a pivoting point enabling easy inspection and in turn enabling the geometry of the guard to be extended in order to protect the operators from motorised couplings or universal joints that rotate.

[0061] Figures 11 and 12 show how the pump element does not require a seal where the shaft of the pump emerges from the body since it has a closed tunnel around the shaft with external side accesses which let in more water than can come out through the inside of a water-lubricated bushing or restriction plate.

[0062] The pump has submerged anchoring points close to the centre of lateral areas to be anchored in strong current conditions without applying significant loads which tend to rotate the equipment.

[0063] Figure 13 shows an embodiment envisaging oil-lubricated tunnels.

[0064] Figure 14 shows the duct leading to the centre of the impeller element wherein atmospheric air can be sucked in due to pressure differences at high pump speeds. This duct can also be used to inject pressurised air or oxygen in order to use the impeller of the pump as means to dissolve it in the pumped flow. The high pumping pressure helps the absorption of oxygen.

[0065] Figure 15 shows the suction of the pump or "hood" which can protrude above the flotation level and can be "primed" or filled with water during the operation of the pump. Since it does not have air inlets, the hood acts as a siphon since the pump suctions the trapped air and afterward only water enters. The siphon-type suction enables the pumps to be semi-submerged or slightly submerged in order to reduce the total draft or depth of the equipment.

[0066] Figure 16 shows the flexible pivot which can be integrated with vanes or hydraulic elements of the pump element in order to reduce the number of parts.

[0067] Figure 17 shows the discharge of the pump which can be coupled to a discharge pipe by means of couplings which enable pivoting, enabling the discharge pipes to not be horizontal but rather inclined in order for them to emerge from the water at a dry anchoring point. The discharge of the pump can be straight and with degrees of inclination in order to facilitate the configuration of the discharge pipe. The pipe of the pump is the structural element for absorbing the axial loads and the longitudinal positioning of the equipment. The tube leading to the pump can have bends at the tips thereof so that the flexible couplings are in the most convenient range of angularity thereof. The discharge or receiving point of the pipe may have bends at the tips thereof so that the flexible couplings are in the most convenient range of angularity thereof.

[0068] Figure 18 shows the tube leading to the pump which can perform the structural function of making an access walkway to the pump.

[0069] Likewise, figure 19 shows the tube leading to the pump which can perform the dual function of a cable tray for electrically operated pumps.

[0070] Figure 20 shows the floats having a shape with which they can be made with low-cost filament winding processes, but the upper surface thereof is relatively flat to enable safe passage along them. The covers of the floats have a small edge in order to enable the placement of elements without them falling into the water due to vibration or movements. The size enables people to access the inside of the float compartments. The upper size can be large enough to enable a belt or chain to be placed on top of it without the risk of it falling off.

[0071] Figure 21 shows the floats of the floating pump, which are hollow, but have separate compartments in order to reduce the risk of sinking if it is punctured.

[0072] Figure 22 shows how the pump can have a flexible coupling in order to enable differences in angularity with the pipe but that these, in addition to withstanding axial loads of the equipment and maintaining the watertightness and pressure of the pump, can withstand the weight of pipes and water in cantilevered configurations. This can be done by reinforcements for the internal ball joints of the couplings, by external ball joints of the couplings or by structural reinforcement of the rubber elements.

[0073] Figure 23 shows how the pump can use a flexible coupling which only enables the upwards and downwards degree of freedom, simplifying anchoring since the pipe would have the structural strength to prevent the rotation of the equipment or a lateral pitching in the water. This enables the side anchors to be simple since this

coupling prevents the pipe from interfering with the side floats and causing structural damage.

[0074] The flexible coupling of the pipe may have a lower pivot plate which serves as a shield during towing manoeuvres.

[0075] Figure 24 represents the flexible couplings having a chain or external safety cables in case of the failure of flexible elements, in other words, so that the equipment does not break loose and float away without control.

[0076] In light of this description and the set of figures, a person skilled in the art will understand that the embodiments of the invention that have been described can be combined in multiple ways within the object of the invention. The invention has been described according to preferred embodiments thereof, but for the person skilled in the art, it will be evident that multiple variations can be introduced in said preferred embodiments without departing from the object of the invention as has been claimed.

Claims

1. Floating pump comprising:

flotation means (1) on a liquid medium (A),
an axial or semi-axial flow pump (2) supported by the flotation means (1) comprising an inlet (3) and an outlet (4) for the fluid to be pumped, such that in the working position, said axial or semi-axial flow pump (2) is at least partially submerged in the fluid to be pumped between said inlet (3) and said outlet (4), and wherein the axial or semi-axial flow pump (2) comprises transmission means (5) which in turn comprise a drive shaft (6), wherein said transmission means (5) are arranged in fluid communication with said inlet (3) and said outlet (4) of the axial or semi-axial flow pump (2), enabling the establishment of a flow of fluid to be pumped between said inlet (3) and said outlet (4) in the working position, along a longitudinal axis (7) of the axial or semi-axial flow pump (2) coinciding with the drive shaft (6), such that in the working position the rotation of the drive shaft (6) produces the flow of the fluid to be pumped from the inlet (3) to the outlet (4),
characterised in that
in the working position of the floating pump, a first end (6') of the drive shaft (6), located in proximity to the outlet (4) of the axial or semi-axial flow pump (2), is in the submerged position, while a second end (6") of the drive shaft (6), opposite from the first end (6'), is in the non-submerged position, such that the orientation of the drive shaft (6) is inclined with respect to the surface of the liquid medium (A) whereon the flotation means (1) are located.

2. The floating pump according to claim 1, comprising drive means (8) of the drive shaft (6) supported by the flotation means (1) and that in the working position are outside the liquid medium (A), wherein said drive means (8) are connected to the second end (6") of the drive shaft (6) by means of a mechanical transmission (9).

3. The floating pump according to claim 2, wherein the drive means (8) have an inclined orientation with respect to the drive shaft (6) and the mechanical transmission (9) comprises a universal joint (10) which enables the use of combustion engines (11) in a substantially horizontal position.

4. The floating pump according to any of the preceding claims, wherein the axial or semi-axial flow pump (2) comprises a tower plate (12) which enables the alignment of the floating pump with a shaft extension (13) and a guide plate (14) to be verified, even in the working position.

5. The floating pump according to any of claims 2 to 4, comprising a pipe (15) connected in a pivoting manner to the outlet (4) of the axial or semi-axial flow pump (2), such that in the working position the drive means (8) and the pivoting connection of the pipe (15) are in proximity to the centre of flotation (16) of the floating pump.

6. The floating pump according to claim 2, wherein the drive means (8) comprise an electric engine (17) comprising a shaft (17'), the orientation of which is parallel to that of the drive shaft (6).

7. The floating pump according to claim 6, wherein the electric engine (17) is synchronous and is directly coupled to the second end (6") of the drive shaft (6).

8. The floating pump according to any of claims 2 to 7, comprising a watertight protective structure (18) for the drive means (8) and the mechanical transmission (9), wherein said protective structure (18) is supported by the flotation means (1).

9. The floating pump according to any of the preceding claims, comprising a conduit (19) leading to the centre of the impeller element wherein atmospheric air can be sucked in due to pressure differences at high pump speeds.

10. The floating pump according to any of the preceding claims, wherein the axial or semi-axial pump (2) comprises a hood (20) which in the working position protrudes above the flotation level and can be filled with water during the operation of the pump.

11. The floating pump according to any of the preceding

claims, wherein the flotation means (1) comprise hollow floats compartmented in a watertight manner.

12. The floating pump according to any of claims 5 to 11, wherein the pivoting connection between the pipe (15) and the outlet (4) of the axial or semi-axial flow pump (2) comprises a flexible coupling of the tubes with safety chains (21).

13. The floating pump according to claim 12, wherein the flexible coupling has only one degree of freedom.

14. The floating pump according to any of the preceding claims, comprising two lower support skids (22), wherein each lower skid (22) comprises two segments (22', 22") with different orientations, wherein a first segment (22') is parallel to the flotation level and a second segment (22") is parallel to the drive shaft (6).

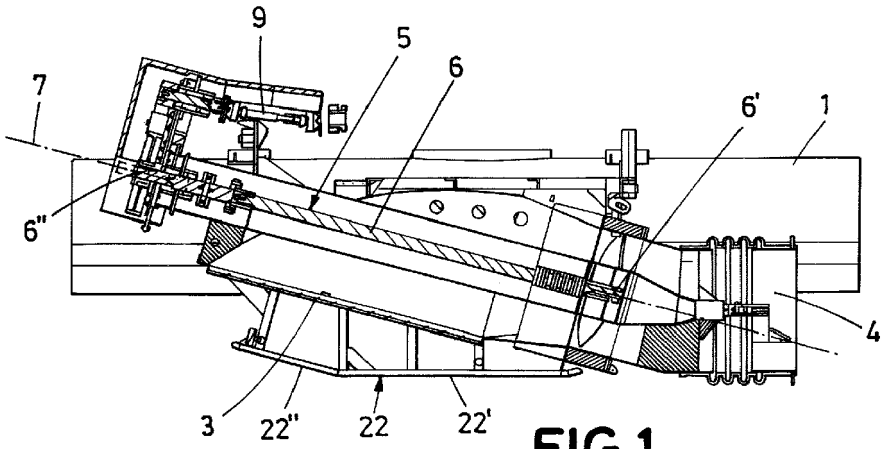

FIG.1

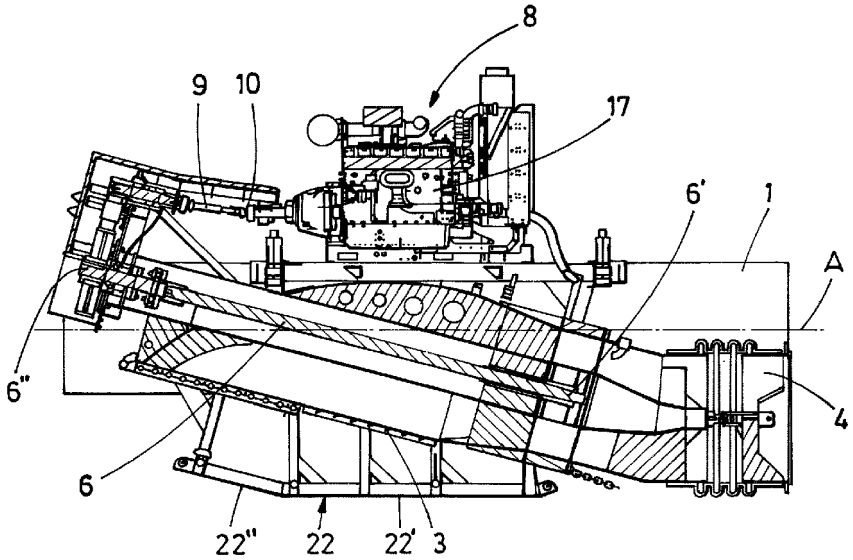

FIG.2

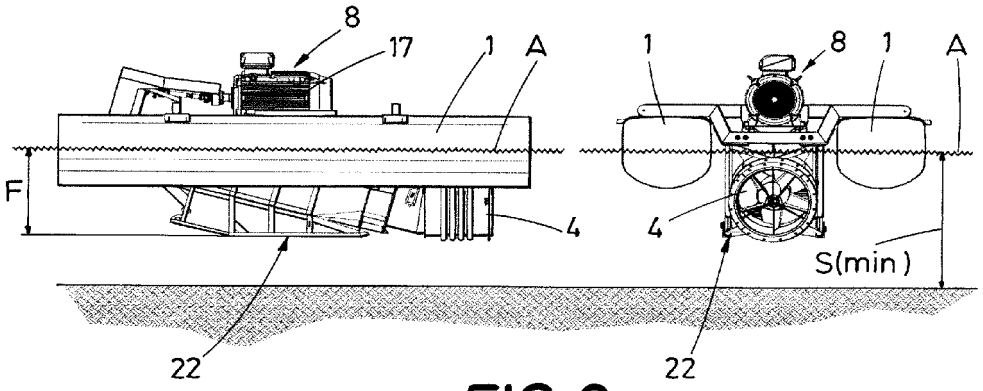

FIG.3

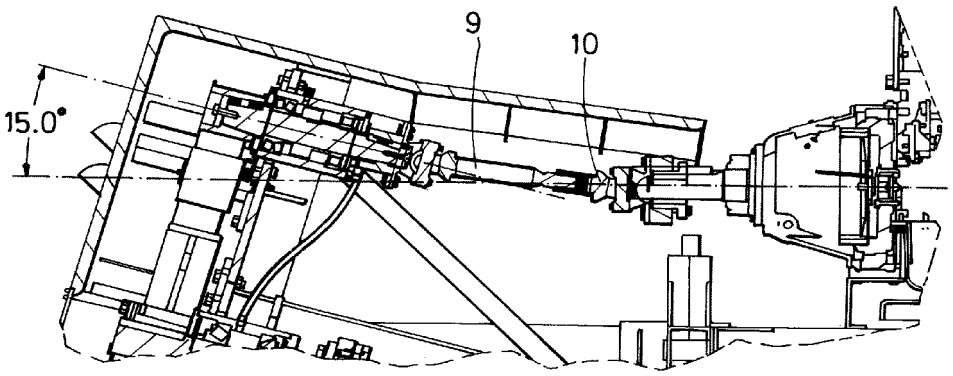

FIG.4

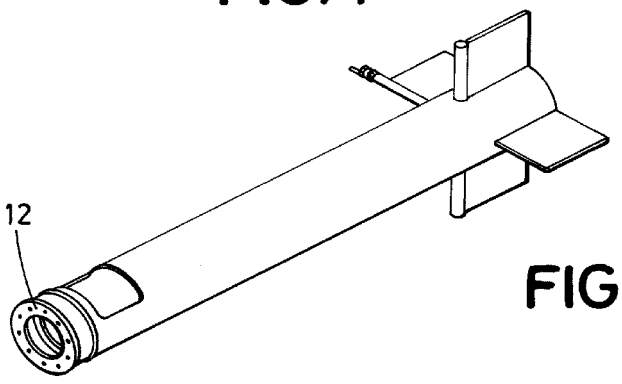

FIG.5

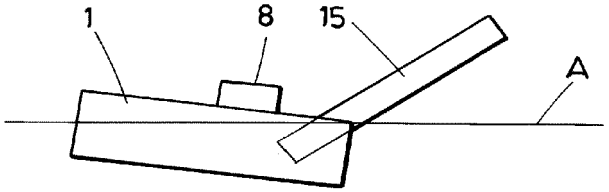

FIG.6

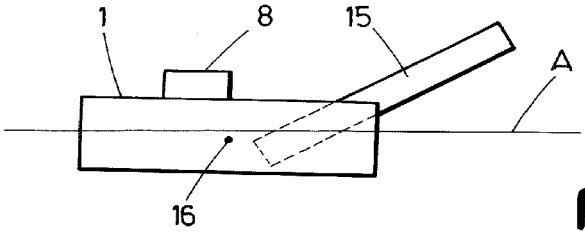

FIG.7

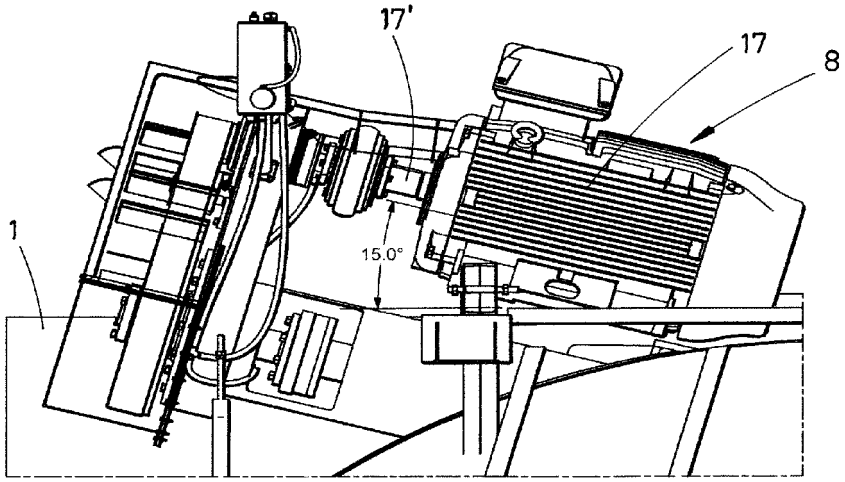

FIG.8

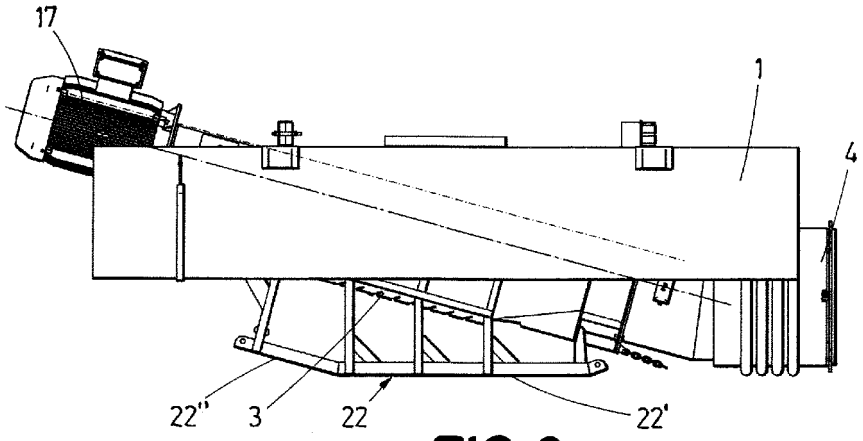

FIG.9

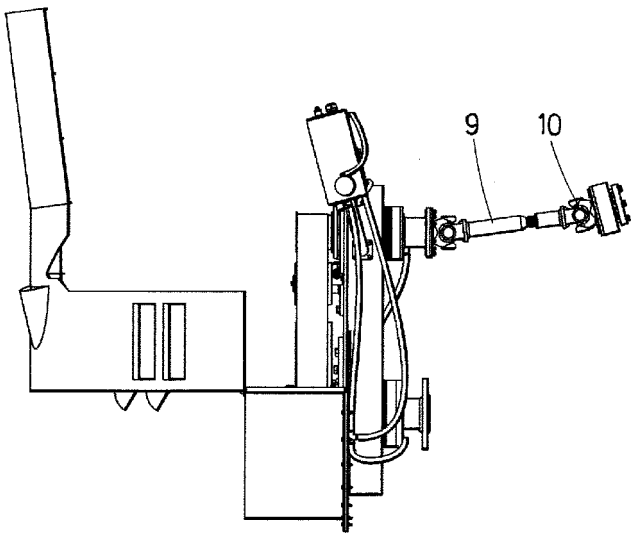

FIG.10

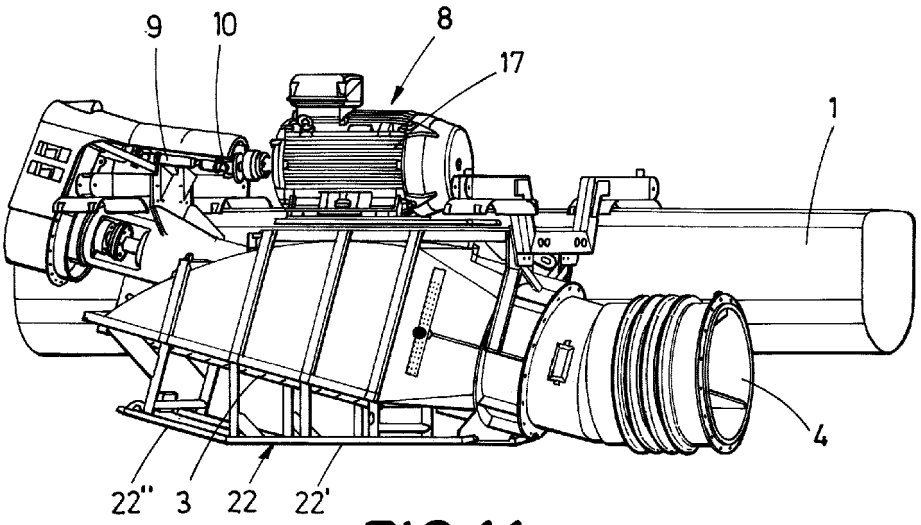

FIG.11

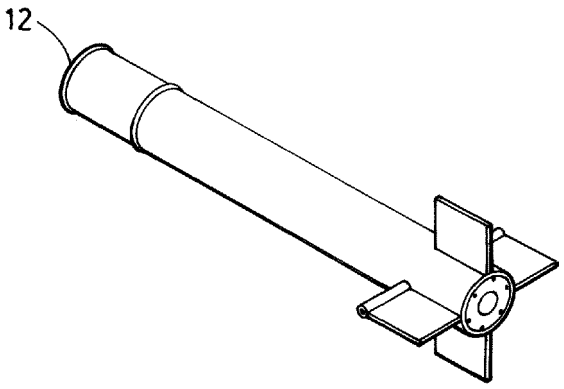

FIG.12

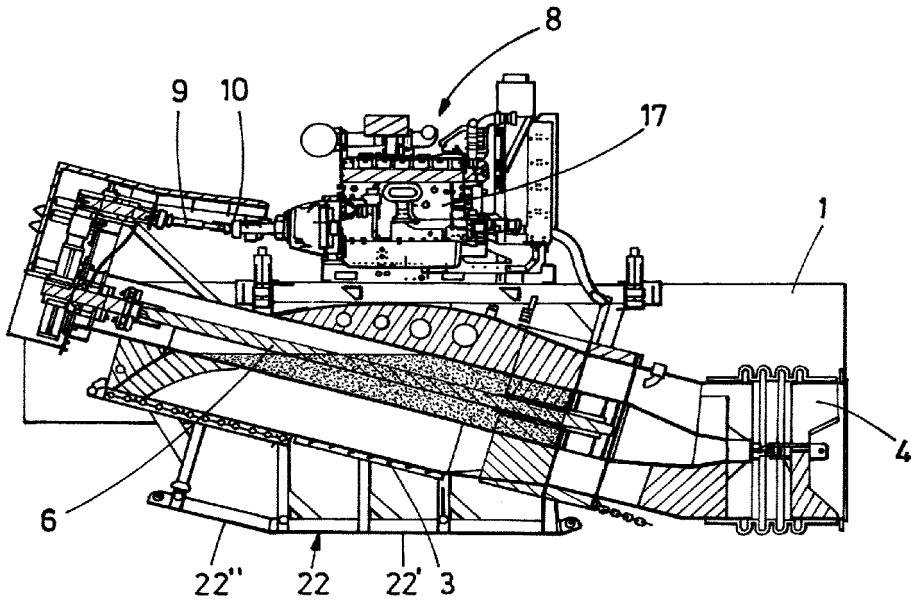

FIG. 13

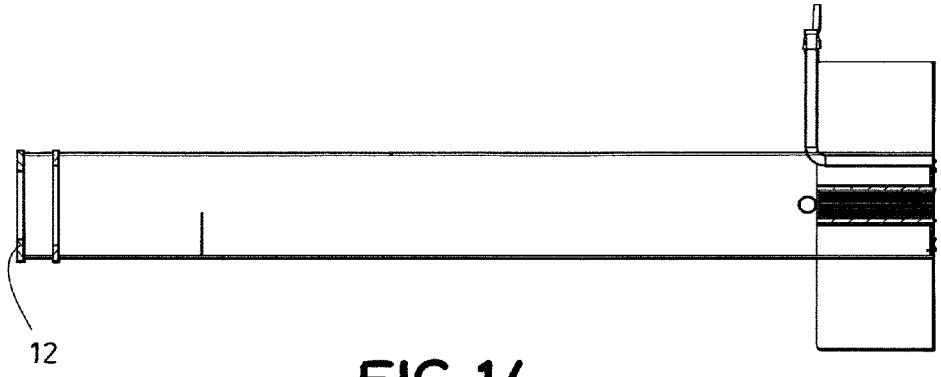

FIG. 14

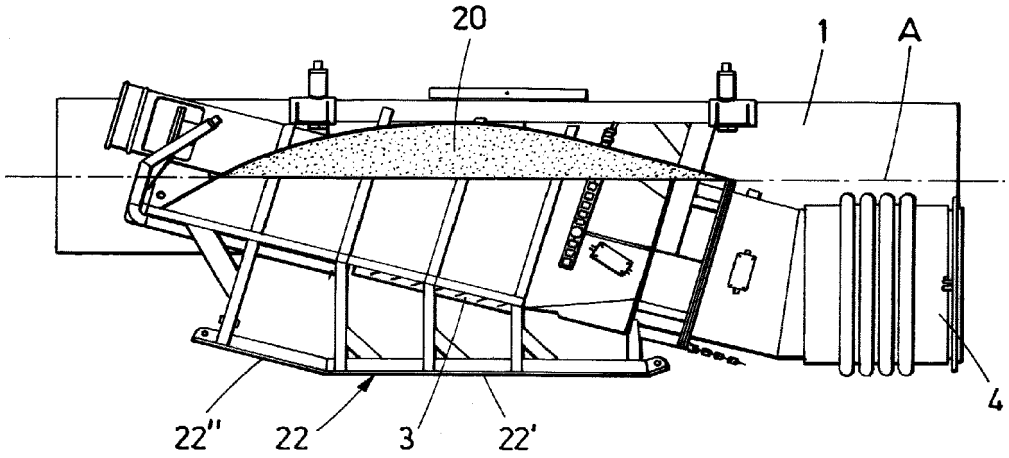

FIG.15

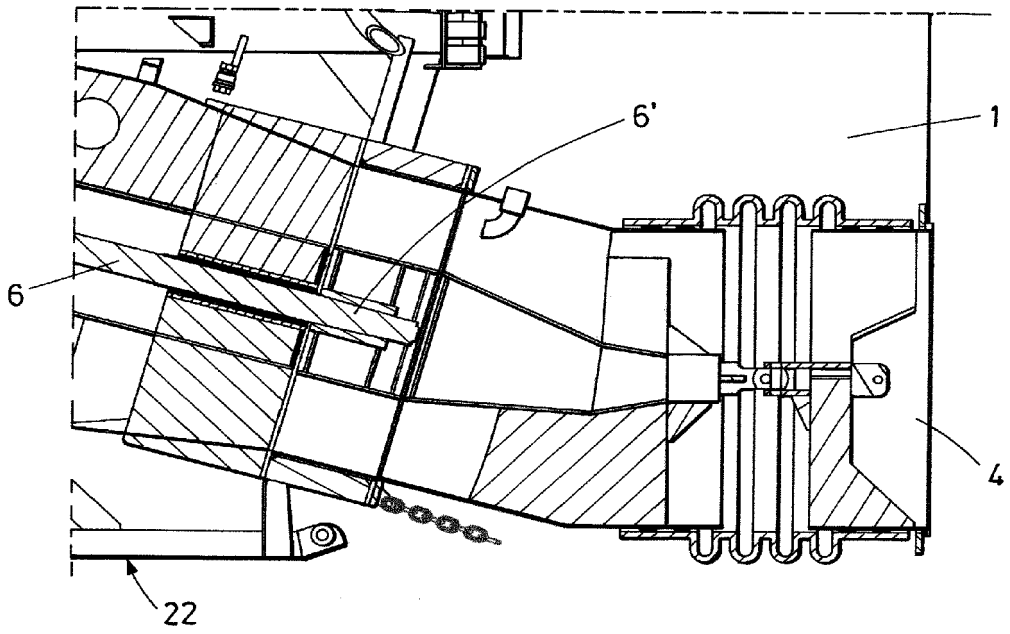

FIG.16

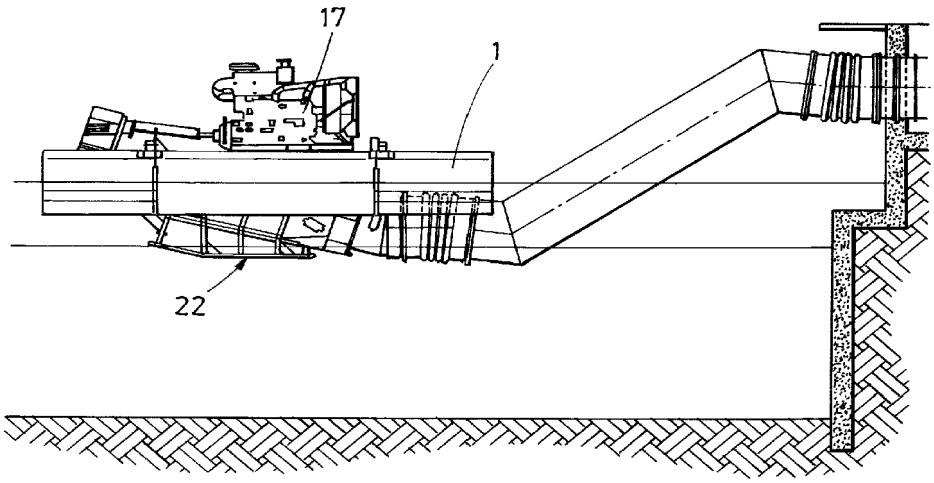

FIG.17

FIG.18

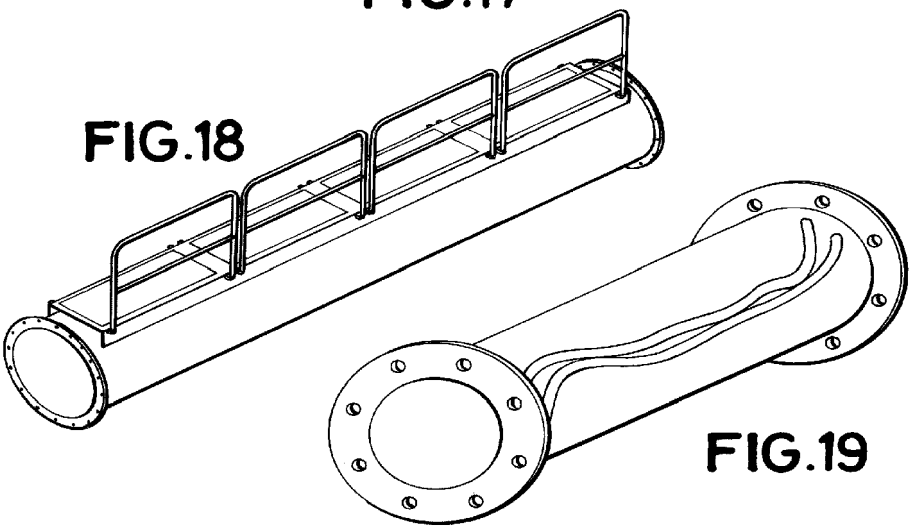

FIG.19

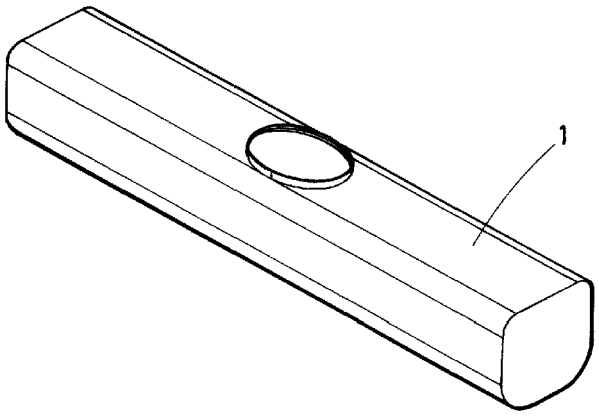

FIG.20

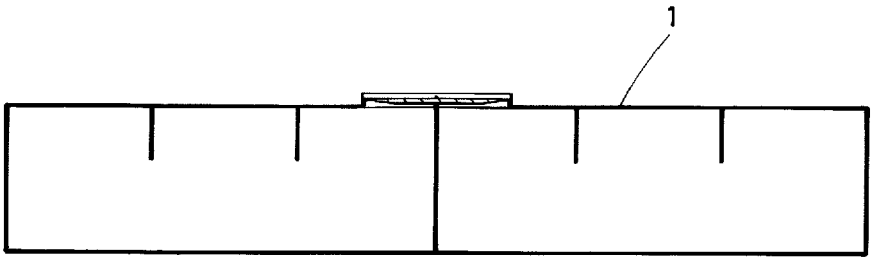

FIG.21

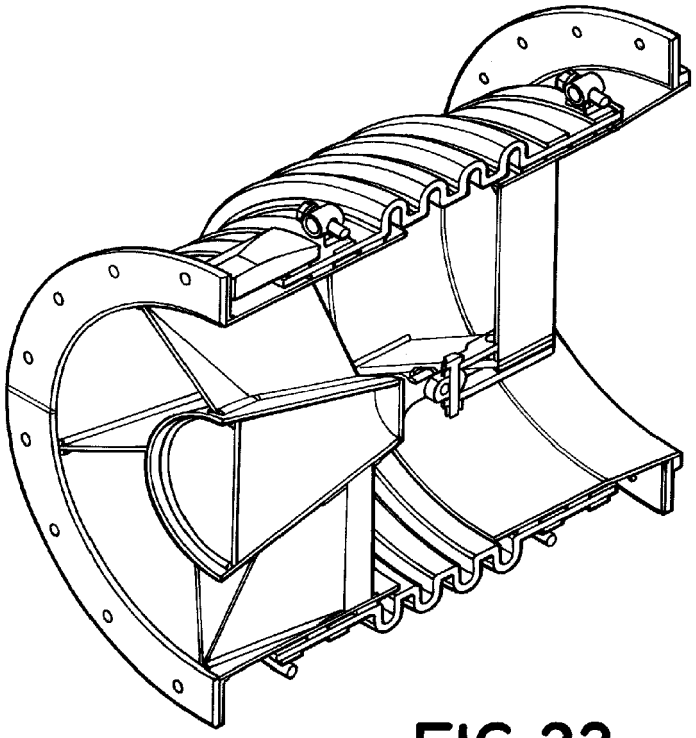

FIG.22

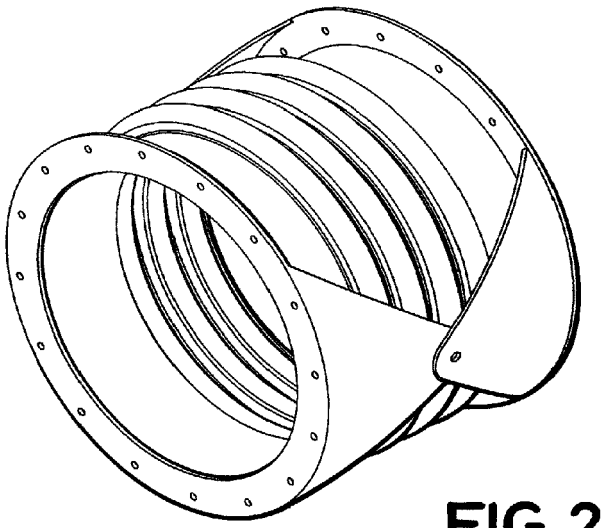

FIG.23

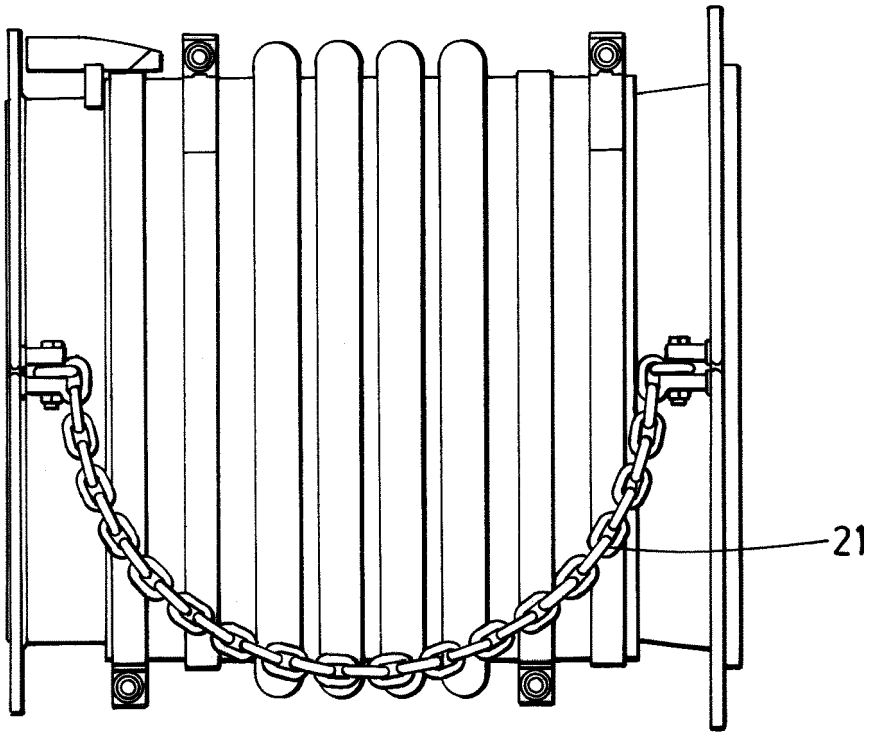

FIG. 24

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 8326

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 2003/143082 A1 (THIRIEZ ERIC [CO]) 31 July 2003 (2003-07-31) * paragraphs [0031] - [0045]; figures 1-8 *	1-14	INV. F04D3/00 F04D13/02 F04D13/06 B63B35/44
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F04D
B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 July 2021	Nobre Correia, S

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