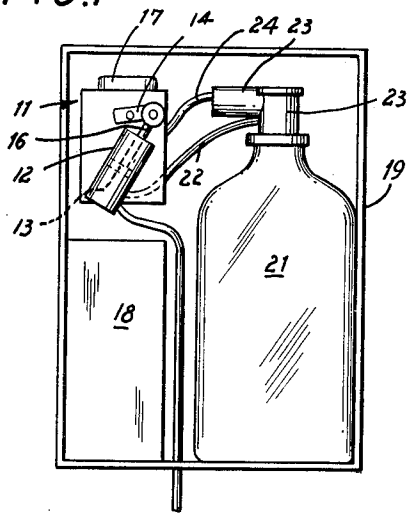
Oct. 23, 1962 H. D. BRAILSFORD 3,059,586

EFFLUENT SAMPLER

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FIG. 1



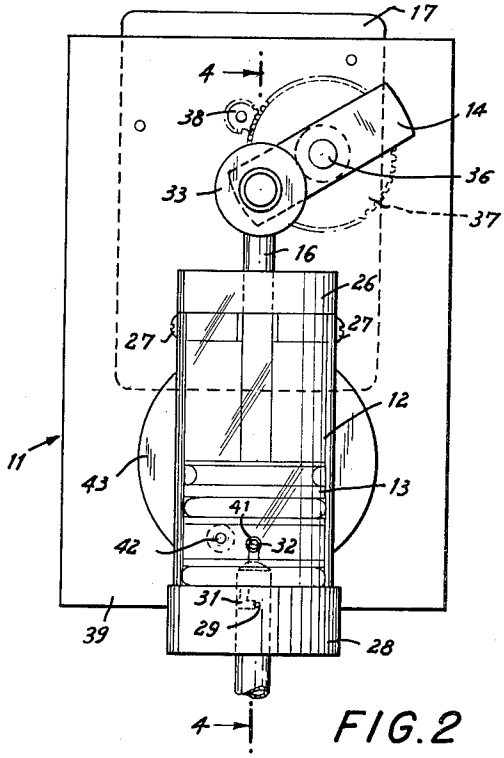
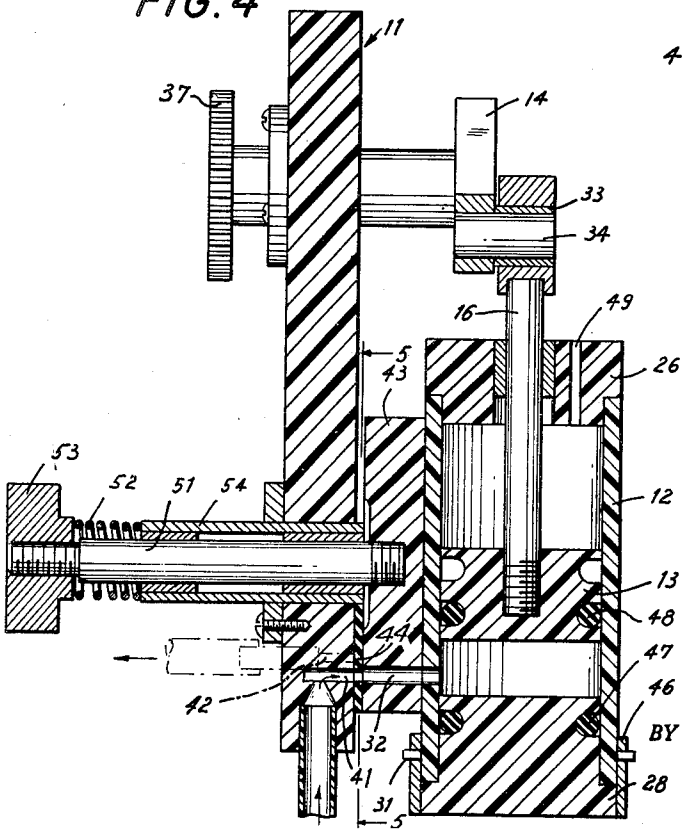


FIG. 2

FIG. 4



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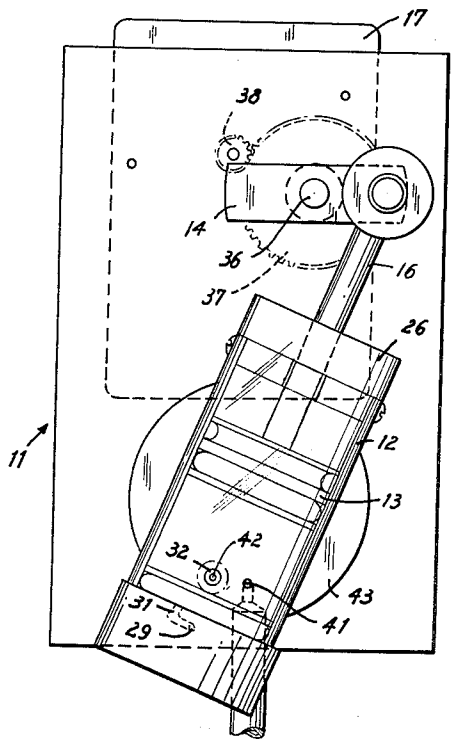
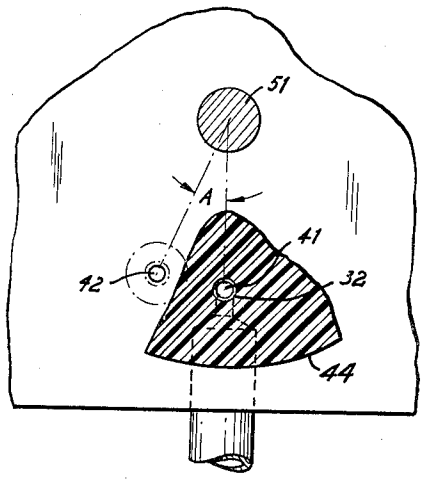


FIG.3

FIG.5



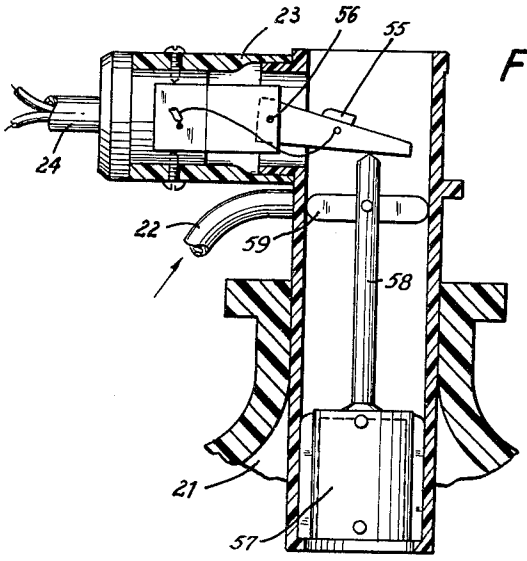


FIG.6

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EFFLUENT SAMPLER

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This invention relates to a pumping mechanism and, more particularly, to apparatus for continuously pumping an effluent into a sample container unattended and in a location remote from commercial sources of electrical power.

The usual purpose of an instrument of the type with which this invention is concerned is to obtain samples of water to be tested for purity or for the presence of particular chemicals. Because of the fact that such tests are frequently performed on streams or other bodies of water located down stream from sources of contamination, such as chemical plants and where commercial electrical power is not available, it is common to take only occasional samples of water for analysis. By means of the present invention water may be sampled practically continuously for a long period of time, for example, twenty-four hours. The invention includes a battery-operated motor driving a pump to draw water from a stream or other source and place it in a sample container. By means of a float switch the pump motor is turned off when the container is full, thus, preventing the pump from operating for a longer period than is desired and from spilling water into the interior of the structure within which the pump and sample container are housed. The pump itself is of novel construction especially adapted to operate without attention and without further contaminating the liquid to be tested.

While the main object of the invention is to provide an improved effluent sampler for unattended operation, other objects will become apparent upon reading the following specifications together with the drawings in which:

FIG. 1 shows an effluent sampler according to the invention;

FIG. 2 shows a front elevational view of the effluent sampler pump of FIG. 1;

FIG. 3 shows a view similar to that in FIG. 2 but at a different point in the pumping cycle;

FIG. 4 shows an enlarged cross-sectional side view of the pump taken on line 4—4 of FIG. 2;

FIG. 5 is an enlarged view of the inlet and outlet channels of FIG. 2;

FIG. 6 shows a cross-sectional view of the float switch of FIG. 1.

The effluent sampler in FIG. 1 consists of a pump 11 having a cylinder 12 with an internal, reciprocating piston 13. The piston is operated by an eccentric 14 attached to the piston rod 16. The eccentric, in turn, is rotated by an electric motor 17 energized by batteries (not shown) within an enclosed section 18 of the complete sampler housing 19.

A sample container 21 is also located within the housing and the outlet channel of the pump 11 is connected to it by a tube 22. A float switch enclosure 23 is located in the mouth of the container 21 to hold a float switch in position at the neck of the container so as to be operated when the liquid reaches a pre-determined level. The float switch within the enclosure 23 is connected to the motor 17 by means of a cable 24 to turn the motor 17 off when the float switch is actuated.

FIG. 2 shows the pump 11 in greater detail. The cylinder 12 is made of an inert material such as acrylic or polyethylene plastic and its upper end is sealed by an end plug 26 fastened in place by a pair of screws 27. The lower end of the cylinder is sealed by a cap 28 which is attached to the cylinder by means of a pair of bayonet pins 29 cooperating with slots 31 which serve as hooks

in the periphery of the cap. There is an aperture 32 in the rear wall of the cylinder 12 to permit liquid to flow into and out of the cylinder under the pumping action of the piston 13.

Instead of being attached to the piston by means of a wrist pin as is usually done, the piston rod 16 is screwed directly into the piston 13, thereby preventing any relative motion between the two. The outer end of the piston rod 16 extends through an opening in the end plug 26 and terminates in a self-lubricating bearing 33 which fits over a crank pin 34 attached to the crank arm, or eccentric, 14. The eccentric 14 is rotated by means of a short shaft 36 to which is attached a large crank gear 37. The crank gear 37, in turn, meshes with a pinion 38 on the shaft of the motor 17.

Both the motor 17 and the cylinder 12 are supported on a support block, or plate 39 in which there are two channels: an inlet channel 41 and an outlet channel 42. In the position of the cylinder shown in FIG. 2 the aperture 32 in the rear wall of the cylinder 12 is directly over the end of the inlet channel 41 and in this position the liquid to be sampled is drawn up through the channel 41 into the lower portion of the cylinder 12 as the eccentric 14 rotates in a clockwise direction.

FIG. 3 shows a later stage in the operation of the pump after the eccentric 14 has passed through an angle of about 120° from the position shown in FIG. 2. In FIG. 3 the piston 13 has been drawn up to its uppermost position within the cylinder 12 and has started back down again. Because of the fact that the piston 13 is solidly attached to the piston rod 16, the entire cylinder 12, as well as the piston rod 16 and the piston 13, must tilt from side to side as the eccentric 14 rotates. Thus, in FIG. 3 the cylinder 12 has been rotated to such a position that the aperture 32 is directly over the outlet channel 42 instead of being over the end of the inlet channel 41. As the crank 14 continues to rotate the piston 13 is forced downward within the cylinder 12 and the liquid that was previously drawn into the lower portion of the cylinder is expelled into the outlet channel 42.

Because of the fact that the angle of tilt of the cylinder 12 changes only slightly while the piston is moving from very near the top of its range of travel down to near the bottom of the range, the aperture 32 continues to overlap the end of the outlet channel of 42 at least partially during almost half of each cycle of operation. Then, as the piston 13 nears the bottom of its range of travel, the displacement of the eccentric 14 shifts the angular position of the cylinder 12 rather rapidly back to the position shown in FIG. 2. As a result the aperture 32 in the cylinder 12 moves quickly across the dead space between the inlet and outlet channels 41 and 42, and does this while the piston 13 remains almost stationary at the very bottom of its range of travel, and moves back in the reverse direction when the piston is close to the top of its range of travel.

FIG. 4 shows some of the elements of the pump 11 in greater detail. The cylinder 12 is mounted on a circular piece 43 and has a flat rear surface which presses against a synthetic rubber gasket, or washer, 44, which is attached to the front surface of the supporting plate 39 to seal the inlet and outlet channels 41 and 42 and the aperture 32 of the cylinder 12. The removable cap 28 permits easy cleaning of the interior of the cylinder 12. The cap 28 comprises a plastic cylindrical part that fits within the end of the cylinder 12 and an outer metal ring 46 that fits over the outer end of the cylinder 12 and is firmly attached to the cylindrical part of the cap 28. A synthetic rubber O-ring 47 provides a seal between the end cap 28 and the inner wall of the cylinder 12 and a similar O-ring 48 prevents liquid from leaking past the piston 13 into the upper end of the cylinder 12. As may

be seen in FIG. 4 an opening 49 is provided in the end plug 26 to allow air to move freely into and out of the upper portion of the cylinder 12 as the piston 13 moves up and down. This prevents the alternate formation of pressure and vacuum in the upper section of the cylinder which would interfere with operation of the pump.

A shaft 51 extends through the plate 39 and is screwed to the circular member 43. This shaft serves the two-fold purpose of providing a pivot for the movement of the cylinder 12 in place against the plate 39. In order to assist in the latter purpose a spring 52 is compressed between a knob 53 at the outer end of the shaft 51 and a bearing support 54. The pressure of the spring 52 urges the shaft 51 to the left (as it appears in FIG. 4) and so draws the surface of the circular member 43 tightly against the gasket 44. The knot 53 may be removed to disassemble the whole pump for cleaning.

FIG. 5 shows an enlarged view of a portion of the plate 39 indicating the geometrical relationship between the locations of the shaft 51 and the ends of the inlet channel 41, which passes through the washer 44, and the outlet channel 42. The ends of these latter channels must be located at approximately equal radial distances from the axis of the shaft 51. The angle A between lines drawn through the centers of the shaft 51 and the two channels 41 and 42 should be sufficient to place the inlet and outlet channels 41 and 42 far enough apart so as to prevent the aperture 32 in the cylinder 12 (not shown in this figure) from overlapping both the inlet and outlet channels at the same time. The angle A will normally be slightly less than the total angle through which the cylinder 12 is tilted as it is rotated back and forth by the motion of the eccentric 14 about a center line bisecting the angle A.

By virtue of the resilience of the washer 44 and the fact that there are no moving valves in the pump and, thus, no requirement for priming of the pump, it is possible for the pump to permit the passage of such things as pieces of string that are liable to get sucked up into the inlet channel 41. If the string is too long to go into the lower section of the cylinder 12 in one stroke, it may be drawn up in two or three strokes. Between strokes the string may simply depress the surface of the washer 44, but this does not prevent satisfactory operation of the pump. Similarly, other solid material may become wedged in the washer without interrupting the flow of liquid.

FIG. 6 shows the float switch 55 in its enclosure 23. The switch itself is a simple mercury switch connected to the cable 24 and pivoted on a pin 56. The outlet channel from the pump is connected to the tube 22 which terminates below the switch 55. Liquid from tube 22 trickles down inside the housing 23 and flows past the float 57.

The float 57 is simply a cylinder that is open at the bottom and closed at the top. A rod 58 extends from the top of the float 57 and presses against the underside of the switch 55. As the level of liquid within the sample container 21 rises, air trapped within the float 57 causes the float to move upward with the rising liquid and finally causes the switch 55 to be actuated, thus, turning up the power to the motor 17. A plurality of stabilizing pins 59 extend out from the post 58 to keep the float 57 from tilting as it moves up and down.

While this invention has been described with reference to a particular embodiment, it will be understood by those skilled in the art that modifications may be made therein without departing from the scope of the invention as defined by the following claims.

What is claimed is:

1. An effluent sampler pump comprising a cylinder closed at one end and having a flat external surface parallel to its axis; a piston reciprocally movable therein; a connecting rod rigidly attached to said piston and extending beyond the other end of said cylinder; a support member having a flat surface; pivotal mounting means holding said cylinder on said support member with the flat surface of said cylinder against the flat surface of said support member and allowing at least limited pivotal movement of said cylinder parallel to said flat surface; a flat resilient washer located between and in contact with said flat external surface of said cylinder and said flat surface of said support member, said pivotal means comprising a shaft extending through said support member, a shoulder on said shaft on the side of said support member opposite said cylinder, and a spring compressed between said shoulder and said support member to force the flat surface of said cylinder firmly against said flat resilient washer and said flat resilient washer against the flat surface of said support member; an opening extending through the flat surface of said cylinder near the closed end; an inlet channel extending through the flat surface of said support member and through said flat washer and overlapping the opening in said cylinder when said cylinder is pivoted to one side of a center line; an outlet channel extending through the flat surface of said support member and through said flat washer and overlapping the opening in said cylinder when said cylinder is pivoted to the other side of said center line; and an eccentric rotatably supported by said support member and connected to said connecting rod to move said piston back and forth within said cylinder and to pivot said rod and piston and cylinder from side to side of said center line.

2. An effluent sampler pump comprising a hollow plastic cylinder closed at one end having a flat external side parallel to its axis; a closure member comprising a solid, grooved plastic cylinder fitting into and closing one end of said hollow cylinder, a synthetic rubber ring held within the groove of said solid cylinder and sealing the annular space between said solid and hollow cylinders, and a ring surrounding said solid cylinder and affixed thereto, said ring having a plurality of hooks, and a corresponding plurality of pins extending from said hollow cylinder to engage said hooks so as to removably hold said solid cylinder in place to permit the same to be removed to clean said hollow cylinder; a solid plastic piston reciprocally movable in said hollow cylinder; a connecting rod rigidly attached to said piston and extending beyond the other end of said cylinder; a support member having a flat surface; a flat resilient washer attached to said flat surface of said support member; pivotal mounting means holding said cylinder on said support with the flat side of said cylinder against said flat washer and allowing at least limited pivotal movement of said cylinder; an opening extending through the flat wall of said cylinder near the closed end; an inlet channel extending through the said flat surface of said support member and through said flat washer and overlapping the opening in said cylinder when said cylinder is pivoted to one side of a center line; an outlet channel extending through the flat surface of said support member and through said flat washer and overlapping the opening in said cylinder when said cylinder is pivoted to the other side of said center line; and an eccentric rotatably supported by said support member and connected to said connecting rod to move said piston back and forth within said cylinder and to pivot said rod and piston and cylinder from side to side of said center line.

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