Oct. 13, 1942. C. F. PROUDMAN ET AL 2,298,627

TANK SAMPLER

Filed Jan. 5, 1940

FIG. 1

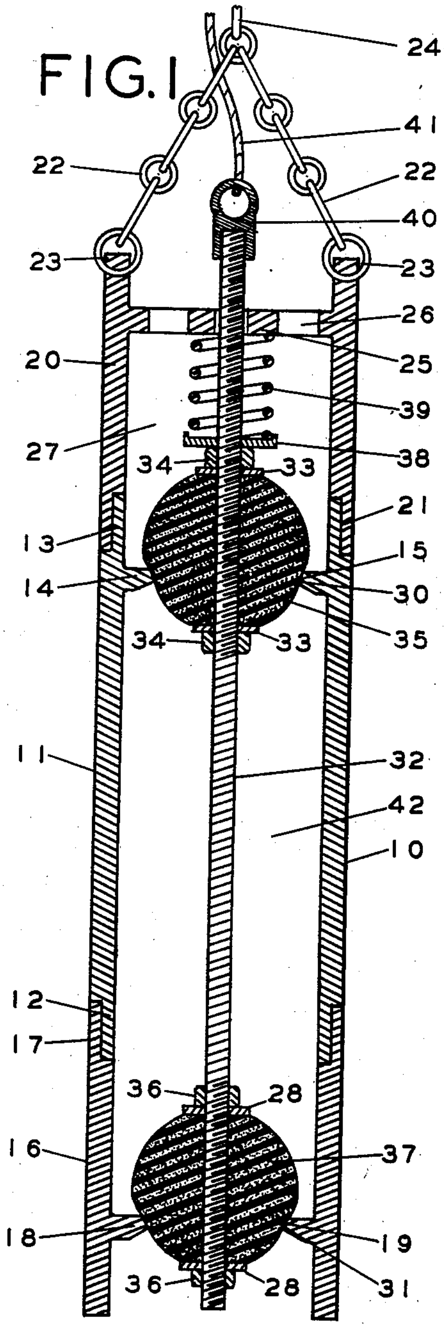
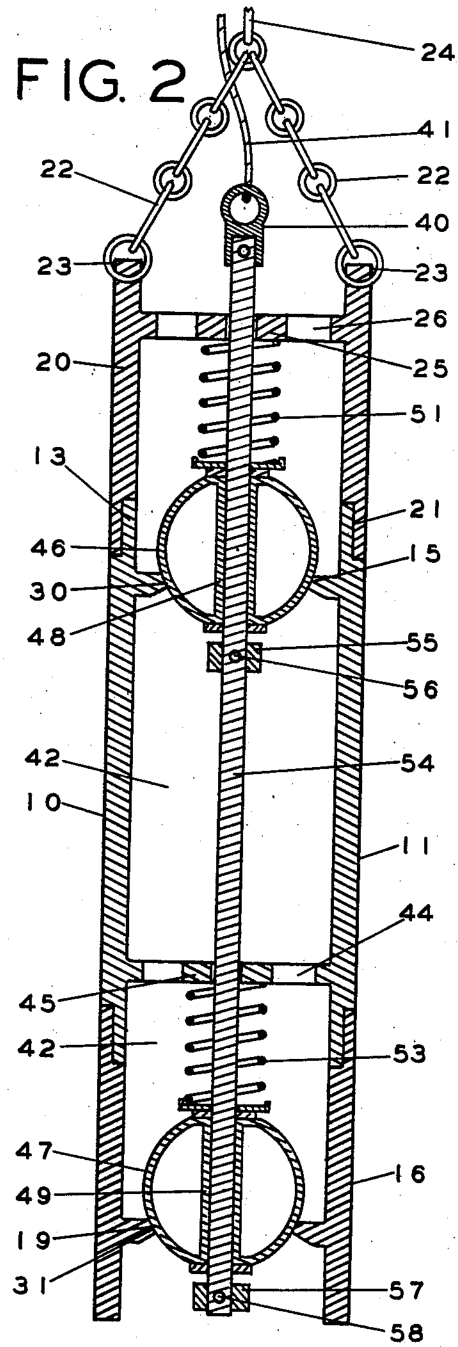



FIG. 2





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## TANK SAMPLER

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Application January 5, 1940, Serial No. 312,502

1 Claim. (Cl. 137—18)

This specification relates to a device for withdrawing samples of fluids from tanks or other receptacles in which they may be stored. In particular, the device is adapted for use in plants for the treatment of sewage, wherein it is necessary to have constant check of the content of tanks containing liquid having more or less solid matter in suspension therein.

In may sewerage purification plants, sludge is mixed with sewerage effluent and the mixture placed in tanks for the duration of certain bacterial and chemical action. Sediment accumulates in the tanks and knowledge of the degree of sedimentation obtained from time to time is vital to the proper control and efficiency of the plant.

We are aware that devices have been designed to withdraw samples of liquid from tanks. We have found, however, that many of these devices are defective in operation when used in a tank having matter suspended in the liquid. Many devices of the prior art have inlet ports of such small area, or are so designed as to result in a "filtering action" on the liquid to be tested and thus the sample obtained is not true; or they do not positively retain the sample taken at the desired level, or they are rendered inoperative when the valves are held from closing because of sediment deposited on the valve seats.

A general object of our invention is to provide a practical device which can be used to obtain true samples of liquid having matter in suspension therein.

A principal object of the invention is to provide flexible, resilient, compensating valves, in a tank sampler, which valves will close tightly, even if sediment is deposited upon the valve seats.

A further object of the invention is to provide valve mechanism in a tank sampler which, in opening the valves at any level in the tank, serves to balance the exterior pressure of the liquid being sampled and thus secure easy opening of the valves.

A further object of the invention is to provide adequate port area to secure a true sample of liquids having suspended matter therein, and provide, by balancing, for holding the relatively large port valves closed against pressures encountered in deep tanks, all without excessive weight of valves and device.

A further object of the invention is to provide mechanism which enables the tank sampler to be placed in the tanks with its control valves positively closed and means to open the valves at any desired level in the tank and then positively close the valves after the sample has entered the sampler and means to withdraw the sampler from the tank without loss or contamination of the sample obtained.

A further object of the invention is to provide valves which normally are substantially spherical in shape and therefore are self-aligning in the valve ports.

A further object of the invention is to provide valves of a contour permitting reversal to provide new surfaces as wear may occur.

A further object of the invention is to provide a tank sampler in which the upper and lower valves are opened simultaneously and thus permit the escape of air from the upper valve of the sampler at the same time as the liquid sample is entering through the lower valve.

To these and other ends the characteristic features and advantages of our improvement will more fully appear in the following description and the accompanying drawing in illustration thereof.

In the drawing in which like reference numerals designate like parts

Fig. 1 is a cross section taken on a vertical plane through the center of one form of the device.

Fig. 2 is a cross section taken on a vertical plane through the center of a modified form of the device.

Referring to Fig. 1, reference numeral 10 designates the exterior shell or casing of the device and is made up of a central portion 11 having shouldered ends 12 and 13 and a solid top 14 provided with a port 15. The casing 10 includes a lower portion 16 having a shoulder 17 at its upper end and a solid bottom 18 provided with a port 19. The central portion 11 and the lower portion 16 of the casing 10 make a tight joint at the shoulders 12 and 17 and this joint may be secured by a frictional press fit, by screw threads, transverse pins or otherwise. Above the casing 10 is mounted the frame 20 which is secured to the upper end of the casing 11 at the shouldered joint 21. The supporting chains 22 are connected to the frame 20 as shown at 23 and are in turn supported by the chain 24 which is raised or lowered to position the device within the tank.

A horizontal yoke or head 25 is placed near the upper end of the frame 20 and is provided with openings 26 to permit free passage from outside the device into the space 27.

The upper port 15 in the casing 10 is surrounded by the valve seat 30 and the lower port

19 is surrounded by the valve seat 31. Centrally positioned within the ports 15 and 19 is the solid actuating rod 32 and in the form shown in Fig. 1 this rod is threaded at each end.

Mounted on the rod 32 between the washers 33 and the nuts 34 is the upper valve 35 which is normally spherical in shape and made from a relatively soft, yielding, resilient material, such as sponge rubber. Also mounted on the rod 32 between the washers 28 and the nuts 36 is the lower valve 37 which is likewise normally spherical in shape and made from a relatively soft, yielding, resilient material, such as sponge rubber.

It will be understood that the terms "yielding" or "yieldable" and "resilient" as applied to the material from which the valves are made refer to and describe material which will be temporarily indented or deformed by sediment on the valve seats and thereby secure the sealing of the valves under this condition.

From the construction described it will be noted that the valves 35 and 37 are fixed in relation to the rod 32, and because of the resilient, yielding nature of the material of which they are formed, the valve seat engaging surfaces of the valves need not of necessity be fixed in relation to each other, and a displacement of one seating surface, or a part thereof, will not affect the seating of the other valve.

The spring washer 38 is supported by the upper nut 34 and the compression spring 39 is positioned between the washer 38 and the head 25. The spring 39 maintains, through the rod 32, a constant pressure on both valves 35 and 37 and serves to positively hold them on their respective seats. The upper end of the rod 32 projects through the head 25 and makes threaded engagement with the cap 40. Attached to the cap 40 is the cord 41, by means of which the rod 32 is lifted and the ports 15 and 19 are opened. Closure of the ports is effected upon release of tension in the cord 41.

It will be noted that when the ports 15 and 19 are sealed by the valves 35 and 37, the space 42 within the casing 10 is isolated.

It will be noted that the valves 35 and 37 are normally substantially spherical in shape and since these valves are made of flexible, resilient material they are deformed slightly by the pressure of the spring 39 acting through the rod 32, as shown in Fig. 1.

In using the device to obtain samples of liquid which has solid matter in suspension, more or less sediment is apt to be deposited on the valve seats at the time of the inflow of the sample into the device. The flexible nature of the valves compensates for such obstruction on the valve seat and causes the ports to be positively sealed when the valves are closed. This is a most important feature of our invention. It is pointed out that many devices of the prior art are defective in this respect, since a deposit of sediment on one valve seat will serve to hold either one or both valves open.

It will be noted that the rod 32 is aligned in the device by the valves 35 and 37 and since these valves are spherical in shape, they are self aligning in the valve ports. This construction results in a liquid tight device being obtained at a minimum of cost, no expensive machining of valves, valve stems, valve guides or valve seats being required.

In operation the device, with the valves closed, is lowered into the tank of liquid to be sampled and supported at the desired level by the chain 24, which may be conveniently marked for the distance the device is immersed in the tank. The cord 41 is drawn upwardly thus lifting the valves from their seats and providing two passages to the interior space 42 in the casing 10. Air will flow out of the upper port 15 while the sample of liquid will flow into the space 42 through the lower port 19. Because of balanced pressures to be presently described, the ports 15 and 19 can be made very large and thereby avoid any "filtering action" on the sample which obviously would result in obtaining other than a true sample.

The effective exterior surface of the valves 35 and 37 is substantially alike and therefore the pressure of the liquid, which in a deep tank is of considerable moment, is balanced through the solid rod 32 so that the amount of tension required in the cord 41 to open the valves is merely that necessary to overcome the downward pressure of the spring 39. The spring 39 is designed for a pressure somewhat less than the total weight of the empty device when submerged in the tank or, expressed somewhat differently, the strength of the spring 39 must be less than the downward pull on the chain 24 when the device is submerged in the tank preliminary to taking the sample. The balancing of the valves coupled with positive reseating, whereby large ports may be used, is a most important feature of the invention.

In the above description the valves have been specified as made of sponge rubber and we have found this material very satisfactory for use in taking samples of watery fluids. Other materials possessing the necessary characteristics may, of course, be substituted and in using our device for obtaining samples of oil or fluids which attack rubber, other suitable material for the valves would be used.

In Fig. 2 we have shown a modified form of the device which embodies some of the features described above.

In this form the casing structure is similar to that shown in Fig. 1, except that an additional strut 45 is provided within the interior 42 of the casing 10. The holes 44 through the strut 45 afford a free passage between the upper and lower portions of space 42 intermediate of the valves. The upper valve 46 and the lower valve 47, as shown in Fig. 2, may be formed of metal and may be either solid, or hollow as shown. Central bushings 48 and 49 are important if the valves are hollow.

It is pointed out that the valves 46 and 47 may be made up with central bushings or sleeves (as shown at 48 in the upper valve of Fig. 2) having fixed thereon a ball of flexible material corresponding to the valves of Fig. 1. The valves may likewise be made hollow with a solid exterior wall of rubber.

Valve 46 is held upon the seat 30 by the compression spring 51 and valve 47 is held upon seat 31 by the compression spring 53. The solid rod 54 is centrally positioned in the valves and makes sliding liquid tight engagement with the bushings 48 and 49. The collar 55 is fixed to the rod 54 by the pin 56 and the collar 57 is likewise fixed to the rod 54 by the pin 58.

From the construction shown it will be noted that the valves 46 and 47 are self aligning in their respective valve ports and they will independently compensate for sediment or other obstruction which may be deposited on the valve seats.

In the device shown in Fig. 2, the lower spring

53 must be of sufficient strength to overcome the pressure of the liquid in the tank when the device is immersed and the upper spring 51 must be of sufficient strength to positively reseat the upper valve. The combined strength of the two springs must not, however, exceed the weight of the entire device when same is immersed in the liquid prior to taking a sample.

In operation the device of Fig. 2 is lowered into the tank to the desired level, with the valves closed, and is supported by the chain 24. An upward pull on the cord 41 will move the rod 54 upwardly and cause the collar 55 to contact the valve 46 and the collar 57 to contact the valve 47. Continued pull on the cord 41 will lift both valves from their seats and open both ports in the device and thus obtain the desired sample. Release of tension on the cord 41 will cause both valves to close and thereafter the device is withdrawn from the tank.

As an alternative construction, it is pointed out that the tank sampler for testing liquids having solids suspended therein may be constructed with rigid valves and flexible, yielding valve seats and thus obtain many of the important features specified above.

We claim:

A sampler for a tank containing a sediment bearing fluid, like sewage effluent, comprising in combination, a casing; a chamber within said casing; valve ports of substantially similar area at the top and bottom of said chamber; a valve for each port; an actuating and balancing rod engaging said valves, said pair of valves being fixed in spaced relation on said rod; said valves being composed of a material sufficiently yieldable to permit each valve to seat independently of the effect of sediment entrapped between either valve and its seat; spring means acting on said rod to hold said valves in closed position during the placing of said sampler at the desired level in said tank and means attached to said actuating rod to move said valves and effect positive simultaneous opening and closing of said ports to secure in said chamber a true sample of said fluid from said level in said tank.

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