

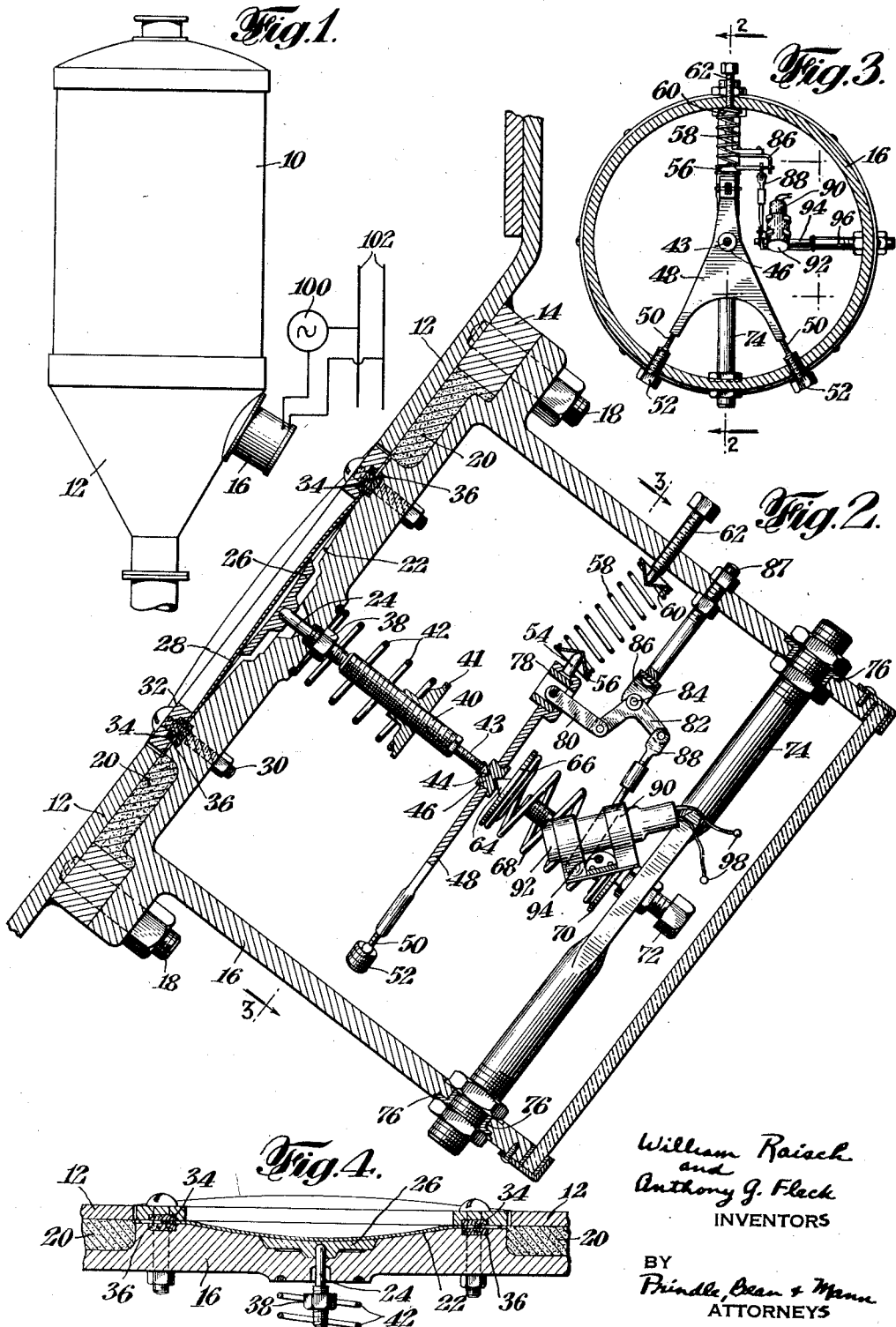
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W. RAISCH ET AL

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CONTROL DEVICE FOR PRESSURE TANKS

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WILLIAM RAISCH, OF FOREST HILLS, AND ANTHONY G. FLECK, OF BROOKLYN, NEW YORK, ASSIGNORS TO MUNICIPAL SANITARY SERVICE CORPORATION, A CORPORATION OF NEW YORK

CONTROL DEVICE FOR PRESSURE TANKS

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This invention relates to control means adapted to be operated by a very light pressure, as a fraction of an ounce exerted either by a gas, a liquid or a semi-solid, but which is further adapted to withstand a very high pressure, such as a pressure in the order of 100 pounds to the square inch.

The illustrative example of our invention which we show in the accompanying drawing is a form of control intended for use in connection with sewage disposal where the solid material from a filter is collected in a tank and then is periodically blown out of the tank by high pressure. In such case, it is desirable to have a signalling or control device which will show the presence of liquids or solids in the bottom of the tank and operate under very slight pressure, but when the air pressure is exerted to drive the solids out, a very heavy pressure is applied, and it is important that the device be capable of indicating the fact that this pressure has been relieved by proper passage of the solid material through to the ultimate disposal point; for example, if the pipe has become clogged in such a way that all of the solids have been driven out of the collecting tank but the air pressure has not been relieved and the tank is then opened, a very serious accident may follow.

In carrying out our invention we have found that the desired results can be obtained by providing a diaphragm located in a wall of the collection tank in such a way as to be entirely unobstructed and in such a way that it will not serve to retain solids against it. Behind this diaphragm is a heavy casting having a cavity cut in its face of exactly the shape to which the diaphragm is to be permitted to expand and in the center of this casting is located a plunger, the surface of which is preferably shaped approximately to form a continuation of the curvature of the cavity of the casting. The dished-out cavity preferably

follows a catenary curve in cross section, but this is not absolutely essential. However, it is important that the cavity formed by the casting and the plunger be of such shape that the diaphragm when expanded can lie smoothly against it to be fully supported without risk of shearing. Connected to the plunger we supply a particularly delicate arrangement of levers adapted to operate an electrical switch which for the purposes of illustration is here shown as being a mercury tip switch.

In the drawing showing the illustrative examples, Fig. 1 is a diagrammatic view of a tank having our apparatus attached to it; Fig. 2 is a section on line 2—2 of Fig. 3, except that the switch which will be in front of the section line is included; Fig. 3 is a section on line 3—3 of Fig. 2, with the switch shown in the opposite position to that of Fig. 2, and Fig. 4 is a fragmentary view showing the diaphragm in the opposite position to that of Fig. 2.

The tank to which the device is here shown as applied is designated by the numeral 10 and has a conical bottom 12. Attached to the conical bottom 12 is welded a ring 14 to which is attached the cast iron cylindrical casing 16. This attachment is made by bolts 18 and between the walls of the bottom 12 and the casing 16 is supplied packing 20.

Concentric with the casing 16 a hole is formed in the wall of the tank and opposite this hole the casing 16 is dished out to form the cavity 22. A plunger 24 passes through the center of the end of the casting carrying a head 26 shaped so as to continue the curvature of the cavity 22 as is clearly shown in Fig. 4. The head 26 when in retracted position is supported directly by the main casting.

Covering the dished-out cavity 22 is a diaphragm 28 held in place by bolts 30 which pass through a ring 32 and through the end

of the casting 16. The edges of the diaphragm are sealed by packing and for this purpose we have found lead packing useful on the outside as indicated at 34 and rubber packing useful for the inside as indicated at 36. At the points where the bolts pass through the diaphragm, the diaphragm is slotted, to permit the edges of the diaphragm a slight movement and thereby prevent the diaphragm from being torn by heavy pressure. From this it is clear that the face of the diaphragm is freely exposed to the contents of the tank 10, and lies substantially in the same plane as the wall of the tank, and will be readily operated by any pressure exerted by such contents. Further, the recess formed for the diaphragm in the wall of the tank is very shallow so there is but little danger of solids being lodged against the diaphragm to prevent its returning when pressure is released.

Inward movement of plunger 24 (that is, movement in the direction of the diaphragm) is limited by a nut 38 screwed to the end of this plunger, and the outward movement of the plunger 24 is controlled by contact with the bar 40 on which is threaded plate 41 which holds a spring 42 under compression between itself and the end wall of casting 16, so that spring 42 is tensioning the plunger from the position shown in Fig. 2 to the position shown in Fig. 4. Threaded into the end of bar 40 is a pin 43 having a pointed end 44.

The end 44 of pin 43 is pressed against a circular block 46 carried by the plate 48 which serves as one arm of a toggle. The plate 48 is supported at the bottom by threaded ball feet 50 which fit into the cupped ends of two bolts 52 passing through the casing 16. At its upper end the plate 48 is bent to form a recess and beyond this recess is provided with a pin 54 which fits into the cavity of a plate 56 carried by a toggle spring 58. The opposite end of the toggle spring 58 is provided with a plate 60 similar to the plate 56 with which the pointed end of bolt 62 cooperates.

Pressing against block 46 from the opposite direction to the pin 43 in a point 64 carried by a plate 66. Tension is applied to the plate 66 by a spring 68 which in turn presses against a plate 70 threaded on bolt 72. Bolt 72 is mounted in a flattened portion of bar 74, the ends of which pass through brass bushings 76 in the casting 16. It will be noted that the tension of spring 42 and also of spring 68 can be varied at will; the tension of the first spring by turning the plate 41, and the tension of the second spring by changing the position of the plate 70 on the bolt 72. By this means a very delicate adjustment can be had which should be such as to hold plate 48 and toggle spring 58 normally in the position shown in Fig. 2.

Mounted in the recess at the upper end of plate 48 is a member 78 to which is pivoted a link 80 which connects with a bellcrank lever 82. The bellcrank lever 82 is mounted on a pin 84 carried by U-shaped member 86 which in turn is mounted on the end of bolt 87. The other end of bellcrank lever 82 is pivoted to a turnbuckle 88 which in turn is attached to the mounting 90 of the mercury tip switch 92 which is carried by and adapted to pivot relative to a pin 94 carried by bolt 96. Turnbuckle 88 and bolt 86 are adjusted so that when the plate 48 is in the position shown in Fig. 2 the switch is in the open position. If any pressure, even though very slight, is exerted on diaphragm 28, plate 48 and toggle spring 58 will be thrown over to the opposite position, thereby tilting the mercury switch to a closed position. The leads from the mercury switch are brought through the casing 16 in any desired way as indicated at 98. In addition to the delicate adjustment possible by having spring 42 pressing against spring 68, it will be seen that the tension on toggle spring 58 can readily be adjusted by turning bolt 62. Further, block 46 can readily be brought into exact alignment with point 44 of pin 43 through the adjustment of bolts 52. Thus if both bolts 52 are screwed in, block 46 will be raised, whereas, if one bolt is screwed in and the other screwed out, block 46 will be tipped over to one side. In a similar manner the position of bolt 72 can be adjusted, vertical adjustments being had through longitudinal movement of bar 74 and horizontal adjustments being had by slightly rotating this bar. The angular position of the device as a whole can also be modified materially without interfering with the action of the switch since the pitch of the switch relative to toggle plate 48 can readily be changed by adjusting turnbuckle 88 and bolt 87.

The operation of the mercury switch may be used either to operate an appropriate signal switch, as a bell, or a light, or to set other apparatus automatically into operation. For the purposes of illustration, we have shown in Fig. 1 a signal 100 operated by electrical energy received from line 102, with the circuit passing into the casing 16 where it is controlled by the mercury switch.

By the use of apparatus such as that described, we have found it possible to build a control which will withstand a pressure in excess of 100 pounds per square inch but which will be operated by a pressure substantially less than one ounce to the square inch and which will operate definitely and positively under all conditions. It is to be understood, of course, that this device may be used in many other fields of

activity than the one selected for the purpose of illustration.

What we claim is:

1. A device of the type having a pressure
5 operating means comprising a diaphragm
and a plunger operated by the diaphragm,
and an electrical switch operated by the
movement of such plunger which comprises
a toggle arm adapted to be moved by said
10 plunger having a bearing to receive said
plunger, and an adjustable mounting for
said toggle arm whereby said toggle arm
may be moved sideways and longitudinally
in a plane transverse the axis of the plunger.

15 2. A structure as specified in claim 1 in
which said toggle arm has an elongated base,
and its mounting comprises two separately
adjustable members adapted to support said
base on a line in a plane transverse the axis
20 of the plunger.

3 A structure as specified in claim 1 which
further includes a spring urged member
adapted to contact with said bearing on the
opposite side from said plunger, and ad-
25 justable means for supporting said spring
urged member whereby the same may be
moved to a desired aligned relation with
such plunger.

4. A device of the type having a pressure
30 operating means comprising a diaphragm
and a plunger operated by the diaphragm,
and an electrical switch operated by the
movement of such plunger which comprises
a toggle arm adapted to be moved by the
25 plunger, a toggle spring cooperating with
said toggle arm, a spring pressing against
said toggle arm towards said plunger, means
for varying the length of said plunger and
means for varying the tension of said two
40 springs.

5. The combination of a tank adapted to
receive and store substantial quantities of
solids and fluids having separate inlet and
outlet openings and adapted to withstand
45 high pressures, which tank has a minor por-
tion of a wall cut away to form an opening,
a rigid support member covering such open-
ing and substantially closing the same, said
support member having a dished-out cavity
50 and a plunger head recess, a plunger with a
head adapted to enter such recess having a
face shaped to form a smooth continuation
of the line of the dished-out cavity, a dia-
phragm covering said cavity carried by said
55 support members, a plunger having a head
adapted to fit in said recess, means for ten-
sioning said plunger toward said diaphragm,
and adjustable means whereby movement of
the said plunger may be caused to close an
60 electric circuit.

6. The combination of a tank adapted to
receive and store substantial quantities of
solids and fluids and having separate inlet
and outlet openings and adapted to with-
65 stand high pressure, a diaphragm freely ex-

posed to the contents of such tank and sub-
stantially forming a continuation of a wall
of such tank, a rigid member back of such
diaphragm having a cavity formed in it, a
plunger carried by said rigid member, said 70
rigid member having a recess to receive the
head of the plunger and the cavity surface
of such rigid member and the face of such
plunger being shaped to follow the curvature
of the diaphragm when the same is distorted 75
under pressure.

WILLIAM RAISCH.
ANTHONY G. FLECK.

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