May 10, 1949. G. V. CALABRESE 2,470,066

ELECTRODE ASSEMBLY

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Fig. 1

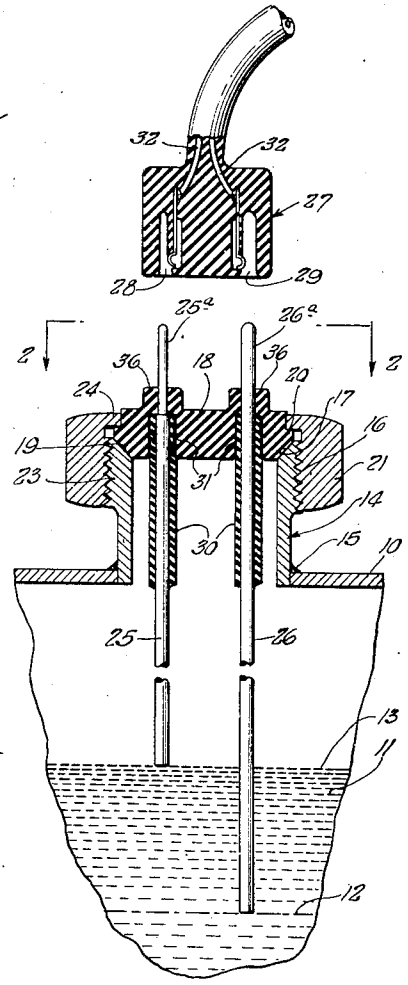


Fig. 3

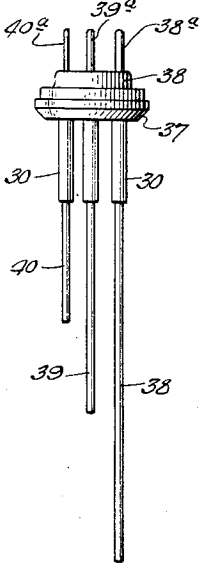


Fig. 2

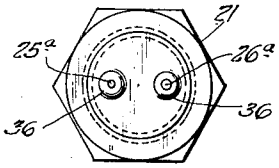
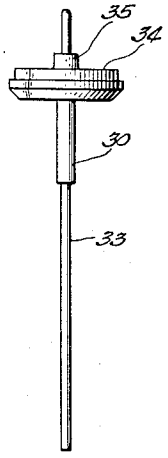


Fig. 4



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ELECTRODE ASSEMBLY

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4 Claims. (Cl. 174—152)

1

This invention relates to improvements in electrode assemblies for use in conjunction with signalling or control circuits.

In numerous industries it is desirable, in carrying out manufacturing or liquid treating operations, to maintain the level of liquids in tanks or other containers within predetermined limits. For example, in the dairy industry, milk often is directed into tanks for certain treatments and during which it is desirable to maintain the level between particular limits. In some such treatments, foam tends to form which it is likewise desirable to hold below limits. The present improvements relate to an electrode assembly, comprising one to three or more electrodes of selected length that project into the tank each for contact with the liquid or foam when at a predetermined level for effectuating actuation or deactuation of a control or signalling system. Thus when the improvements are employed in a signalling system, the rise or fall of a liquid to certain levels will energize or deenergize suitable signals and where the electrode assembly is employed in conjunction with a control system, the rise or fall of the liquid to levels determined by the particular electrodes employed will deenergize or energize respectively control-valve actuating means or a pump motor, for example, which regulates the supply of additional fluid to the tank in question. Ordinarily for mere upper and lower level control, a two electrode assembly is employed. However, two control electrodes may be combined, in the same assembly, with a third electrode which may be a part of a signal system whereby upon the arising of a certain condition, as for example, the formation of and rise of foam to a certain level, a signal will be actuated at an attendant's station. Variations in the number of electrodes in a particular electrode assembly of the improved type may thus be employed as conditions under which the assembly is used and the functions to be performed by the electrodes may require.

One object of the invention is to provide an electrode assembly comprising one or more electrodes which are adapted to be supported removably in position within a tank, vat or the like, and which assembly not only provides desirable electrical insulation for the electrode or electrodes but also provides a sanitary mounting for the same.

Another object of the invention is to provide an assembly comprising plural electrodes which may be of similar cross sectional area but which are provided with external terminals adapted

2

for use with a suitable jack or electrical contact plug which can be connected to the terminals only in the proper relation thereby insuring the correct electrical hook-up of the respective electrodes in the intended signal or control circuits.

Another object of the invention is to provide an electrode assembly comprising an electrical insulating disc-like support for one or more electrodes and which is adapted to be removably clamped in position by a pair of coacting threaded members and to provide a sanitary self-centering and self-aligning gasket or sealing member between said members.

Other objects of the invention relate to various features of construction and arrangements of parts which will be apparent from a consideration of the following specification and accompanying drawings, wherein

Fig. 1 is a broken sectional view of a tank having the improved electrode assembly mounted thereon, a cooperating jack being shown detached from the jack terminals.

Fig. 2 is a top plan view taken on line 2—2 of Fig. 1.

Fig. 3 is a side elevational view of an insulating disc of the electrode assembly which is provided with three electrodes.

Fig. 4 is a similar view illustrating a single electrode.

In the drawing, 10 indicates a tank for holding a liquid 11, the level of which is to be maintained within certain limits such as a lower limit indicated by line 12 and an upper limit indicated by line 13 which corresponds to the surface of the liquid 11 shown in the tank. The electrode assembly comprises a base 14 of tubular form, the lower end of which is adapted to be secured within an opening in a tank as by welding as indicated at 15. The upper portion of the base is externally threaded as indicated at 16, said upper portion being shown in Fig. 1 as somewhat thicker than the lower portion. The upper edge of the base 14 constitutes a seat 17 of inverted frusto-conical form.

A disc-like member 18 of insulating material is provided having a frusto-conical surface 19 at its lower edge and is arranged to be positioned upon the seat 17 of the base 14. The member 18 preferably is formed of a suitable insulating plastic which will not affect the taste or odor of the liquid such, as milk, within the tank. The upper margin of the disc 18 is rabbeted to form a shoulder 20. A tubular clamping member 21 which, as shown in Fig. 2 has an outer hexagonal surface, is internally threaded as indicated at

23 for coaction with the threads 16 of the base 14. The upper portion of the clamping member 21 is provided with an inwardly directed flange 24 which extends inwardly sufficiently for engagement with the shoulder 20 of the disc 18 whereby as the clamping member is screwed downwardly upon the base, with the disc 18 resting on the latter, the disc is pressed into sealing contact with the base by reason of the mating conical surfaces above described. By reason of the mating conical surfaces, the disc is self-centering as it is pressed downwardly by the clamping member as will be seen. The flange 24, which is of an internal diameter slightly greater than the diameter of the vertical wall of the annular rabbet, cooperates with said vertical wall in effecting the centering and alignment of the disc within the assembly.

The disc 18 is provided with one or more passages therethrough, depending upon the number of electrodes to be provided in that particular disc. In Fig. 1 the disc is shown provided with two electrodes 25 and 26 which preferably are formed of rods of stainless steel. Other material, depending upon the use to which the assembly is to be put, may be employed. The electrode or electrodes are fixed within the passages provided therefor in the disc 18 for preventing relative sliding movement of the electrodes through the disc as a jack is pressed into engagement with or removed from the ends of the electrodes projecting outwardly from the disc. The projecting ends 25*a* and 26*a* of Fig. 1 constitute jack terminals for electrical connection with a suitable jack such as is indicated by numeral 27 whereby the electrodes can be connected conveniently in proper electrical signalling or control circuits. As shown in Fig. 1, the terminals 25*a* and 26*a* are of different diameters which precludes connecting the terminals improperly with a jack by reason of the fact that the jack 27 as shown in Fig. 1, has terminal receiving sockets 28 and 29 which are of correlative diameters for receiving respectively the terminals 25*a* and 26*a*.

As shown in the drawings, each of the electrodes is provided with an insulating sheath 30. The sheath may be molded or cast directly upon the electrode or it may be formed of tubular material having passages of a diameter for snugly embracing the respective electrode. Where it is pre-formed and assembled upon the electrode, it preferably is of substantial length and suitable adhesive is used for insuring non-slipping relation between the sheath and the electrode. As shown in Fig. 1, the passages formed in the disc 18 for receiving the electrodes are enlarged at their lower portions for receiving the upper ends of the respective sheaths 30. Within the enlarged portions of the passages adhesive 31 may be employed to insure a secure bond between the sheaths and the disc thereby securing the electrodes against axial movement relative to the disc.

Where two electrodes are employed for maintaining the level of a liquid between predetermined limits, the electrodes are of the lengths required in the particular installation. As shown in Fig. 1, the shorter electrode is in contact with the upper surface of the liquid shown in the tank while the longer electrode extends to a level which may be assumed to be the lower level to which the liquid may be permitted to fall. The conductors 32 and 33 extending from the jack 27 are connected to suitable known control means, not herein disclosed, whereby upon the fall of the liquid to the level of line 12, a pump or valve or the like wil be actuated to raise the level of the liquid to the upper level 13 whereupon the contact of the liquid with the shorter electrode 25 will arrest inward flow of the fluid to the tank. The particular control means referred to is known and forms no part per se of the present improvements.

The electrode assembly above described affords an airtight seal of the opening provided in the tank for the electrodes. The assembly also is sanitary and permits the removal of the electrodes, when desired, by the mere removal of the clamping member 21 which enables the disc and the associated electrodes to be lifted from operative position for cleansing, sterilizing, or the like.

My electrode assembly may be used to especial advantage with a circuit for controlling the level of a liquid having a relatively low electrical conductivity, such as milk. That is, in such a system employing, for example, a double electrode assembly as illustrated in Fig. 1, the tiny current capable of passing through the liquid into the electrodes is directed to the input or controlling portion of the control circuit, the output portion of which, in turn, controls the passage of a much larger current to a pump motor to start the motor when the fluid level drops below the bottom electrode and to stop it when the level rises to the upper electrode.

Liquid food products such as milk are not very conductive and therefore the control circuit must be responsive to current flow in the input thereof (that is, through the milk to the electrodes) in the order of about $^{1}/_{100,000}$ ampere at less than ½ volt.

Many of these food products foam easily and therefore the entire interior of the vessel including the area around the electrodes is normally covered with a film of somewhat conductive liquid or foam layer even when the vessel is nearly empty. Milk is particularly subject to foaming, especially at the warm pasteurizing temperatures encountered in the dairy industry.

A difficulty which I have found, in working with circuits responsive to such small currents, and with foaming liquids, is that the foam itself or the fluid layer around the electrodes resulting from the foam is sufficiently conductive so that, without an insulating sheath such as 30, the foam or layer itself would conduct sufficient current between one or both of the two electrodes and the grounded housing to cause the control circuit to indicate that the vessel is full or nearly full when actually it might be nearly empty. I have discovered, however, that by fitting each electrode with a fluid-tight insulating sheath, I can extend the linear distance between bare portions of the electrodes and the vessel so the increased electrical path along the foam or fluid layer surfaces would have such a high resistance that it would not conduct a current high enough to falsely actuate the pump circuit.

As an illustration of the extreme sensitivity of a control circuit with which my electrode assembly is intended to be used, under some circumstances a person can cause the circuit to indicate "full" and thereby stop the pump merely by placing a hand on one of the electrodes.

By using the insulating sheathing on at least one and preferably on all of the electrodes, I have been able to make the control circuit responsive to very tiny currents, independent of

false actuations caused by response to stray currents conducted by the foam or fluid layer, and therefore have made it possible to control maximum and minimum fluid levels to within 1/100 inch. The expedient of employing the sheathing **30** on the electrodes renders the foam layer on the internal surfaces ineffective to conduct a current sufficient to interfere with proper functioning of the circuit, by causing the bare surfaces of the electrodes to be separated from one another by a longer, and therefore more resistant, path. The only other alternative would be to use an electrode assembly having an impractically large diameter. It will be apparent that the insulating sheaths **30** may be molded as an integral part of the disc **18** where desired.

In Fig. 4, as above stated, a single electrode indicated by numeral **33** is shown supported by the disc **34**. The disc **34** although shown on a smaller scale than the disc **18**, in shape and size may correspond to the disc **18** except that it is provided with a single molded boss **35** through which the electrode extends rather than two molded bosses **36** as shown in Fig. 1. The bosses mentioned afford longer electrode passages within the disc and therefore provide a firmer mounting of the electrodes within the discs.

In Fig. 3, three electrodes are shown supported by a disc **37** which may correspond in shape and size to the disc **18**. Where three electrodes are employed they are spaced preferably at 120° of arc although they may be otherwise arranged if desired. A three electrode assembly is useful in conjunction, for example, with liquids which tend to foam. The two longer electrodes **38** and **39** of Fig. 3 may be used in a control system corresponding to that described above in conjunction with electrodes **25** and **26** in Fig. 1. The shorter electrode **40** may function for initiating the operation of a signal system upon the rise of foam to the level of the lower end of electrode **40** thus warning an attendant of an excess formation of foam in the liquid. Other uses of the assembly are within the ambit of the invention.

In Fig. 3, jack terminals **38***a*, **39***a* and **40***a* are shown as being of different diameters for use with a jack constructed in accordance with the principle of jack **27** for affecting connection of the electrodes in proper circuits.

While certain uses of the assemblies have been mentioned, it will be apparent that other uses may be found for the improvements. Variations in the particular structure described may also be resorted to within the spirit of the present improvements.

I claim:

1. An electrode assembly comprising a base provided with an axial passage and having exterior threads on the upper portion and a lower depending skirt adapted to be secured within an opening in a tank wall, the outer end of said base providing a seating surface of inverted frusto-conical form, an electrode supporting member comprising an electrical insulating disc having a marginal wall on the lower side thereof of frusto-conical form adapted to seat on and provide self-centering sealing contact with said seating surface of said base member and to cooperate with said seating surface to effect disposal of said disc in a plane normal to the axis of said passage, an electrode supported by said disc and extending through the same and through the passage of said base for contact at the inner end with a fluid in the tank and provided with a jack terminal at the outer end, said electrode having an insulating sheath secured to the outside thereof in fluid-tight relationship on the underside of the disc, and a cylindrical clamping member having an axial passage therethrough and having an internally threaded lower portion adapted for coaction with the exterior threads of said base and having a flange at the outer end extending inwardly for engagement with a marginal portion of said disc for clamping the same firmly between said member and base with the conical walls of the base and disc in sealing contact with the electrode terminal projecting outwardly through said clamping member.

2. An electrode assembly comprising a cylindrical base provided with an axial passage therethrough and having exterior threads on the upper portion and a lower depending portion of reduced diameter adapted to be fixed in position within an opening in a tank wall, the outer end of said base having a seating surface of inverted frusto-conical form, an electrode supporting member comprising an electrical insulating disc having a marginal sealing wall on the lower side thereof of frusto-conical form adapted to seat upon said seating surface of said base, a cylindrical clamping member having an axial passage through the same and provided with internal threads in the lower portion for coaction with the external threads of said base and provided with an inwardly directed upper flange adapted to engage an upper marginal portion of said disc for clamping the same in centered relation upon said base with the respective seating walls thereof in sealing contact, and a rod-shaped electrode secured to said disc and extending through the same and through the passages of said base and clamping member and provided at the outer end with a jack terminal for enabling the electrode to be connected into an electrical circuit, said electrode having a fluid-tight insulating sheath extending therealong on the underside of said disc for a distance from the latter.

3. An assembly for supporting a rod-shaped electrode comprising an insulating disc provided with a boss formed on the upper surface thereof and an electrode receiving passage extending through said disc and boss, the portion of the passage in the disc being of greater diameter than the portion extending through said boss, a rod-like electrode extending through said passage and provided with an insulating sheath adhered to the outside thereof and secured at the upper end in said enlarged portion of said passage for retaining the electrode in fixed position with respect to said disc and for preventing the leakage of fluid upward along said electrode, the upper end of the electrode above said disc constituting a jack terminal whereby the electrode is readily connectable in an electrical circuit, a tubular base member adapted to be secured in an opening in a tank wall and having an outer edge upon which a lower peripheral portion of said disc is adapted to seat, and a clamping member arranged for coaction with said base for engaging an upper peripheral portion of said disc for clamping the disc against said outer edge of said tubular base to seal the passage thereof and to support the electrode in fixed position.

4. An electrode assembly comprising a tubular base having exterior threads on the upper portion thereof and adapted for insertion at the lower end in an opening of a receptacle for securement therein, the outer edge of said base being of inverted frusto-conical form, an electrical insulat-

ing disc provided with a lower peripheral surface mating said outer edge of said base and providing self-centering sealing contact with said edge, a plurality of rod shaped electrodes extending in axial directions through said disc and being spaced radially inwardly of said mating surface and spaced also from contact with the interior wall of said tubular base, each of said electrodes having an individual insulating sheath extending therealong in fluid-tight relationship for a distance from the underside of said disc, said disc being rabbeted at the outer edge to provide a clamp engaging ledge, and a tubular clamp member having internal threads in the lower portion for coaction with the external threads of said base and an inwardly extending annular shoulder at the outer end of an internal diameter for engagement with said ledge of said disc for pressing said mating surfaces of said disc and base into cooperative sealing contact and maintaining said electrodes in fixed relation within the assembly.

GEORGE V. CALABRESE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
276,415	Hurlbut	Apr. 24, 1883
1,159,869	Sakai	Nov. 9, 1915
1,393,270	Nickum	Nov. 29, 1921
1,594,814	Brodin et al.	Aug. 3, 1926
1,683,362	Loffler	Sept. 4, 1928
1,807,781	Eddy	June 2, 1931
2,073,268	Ray	Mar. 9, 1937
2,083,916	Mascuch	June 15, 1937
2,264,816	Treanor	Dec. 2, 1941
2,329,961	Walker	Sept. 21, 1943
2,361,215	Lamberger et al.	Oct. 24, 1944
2,400,364	Mittermaier	May 14, 1946

FOREIGN PATENTS

Number	Country	Date
375,377	Germany	May 19, 1923