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GROUNDING MEANS FOR AN ELECTRIC EMULSION TREATER

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Fig. 1.

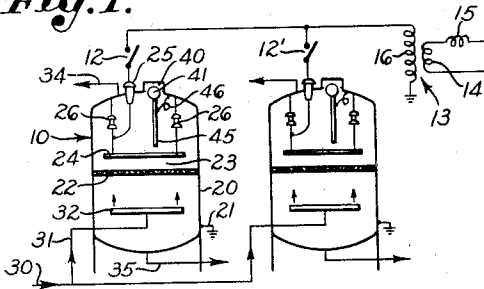


Fig. 2.

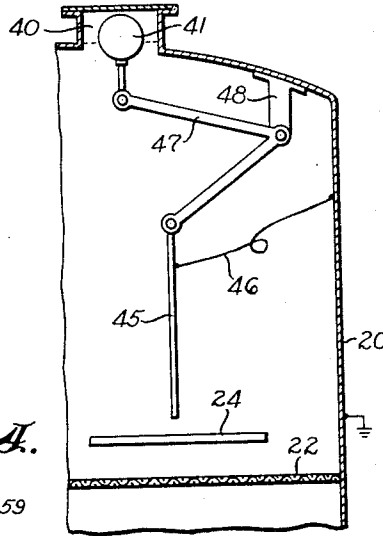


Fig. 3.

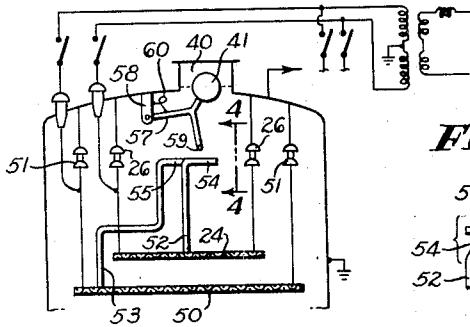


Fig. 4.

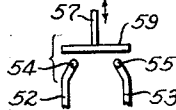


Fig. 5.

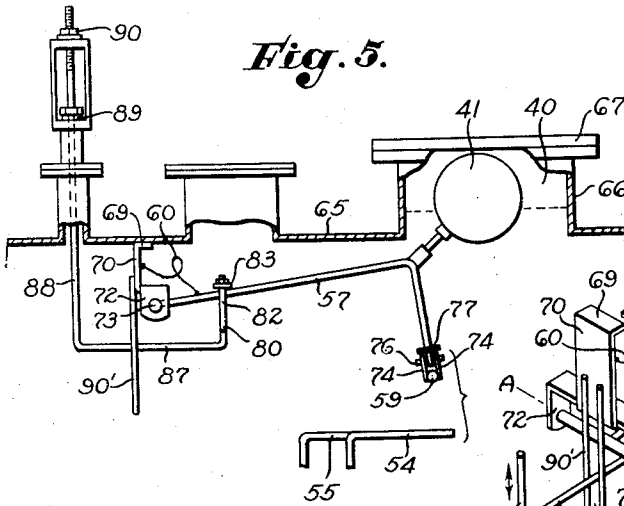
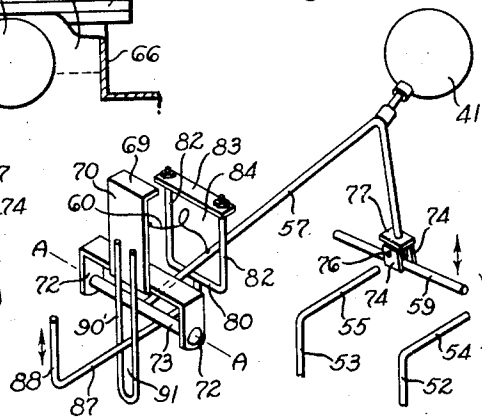


Fig. 6.



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GROUNDING MEANS FOR AN ELECTRIC EMULSION TREATER

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9 Claims. (Cl. 204—306)

My invention relates to apparatus for electrically treating emulsions and more particularly to a low-level safety device therefor.

Conventionally, each electric emulsion treater is energized through a step-up or high-voltage transformer either directly, as a conventional A. C. treater, or indirectly, as in a D. C. power pack in which the high voltage is rectified before being supplied to the treater electrodes. Conventional treater design involves a float switch connected in series with the transformer primary, this switch being outside the treater and being operated by a shaft extending through a stuffing box to a float responsive to the oil level in a pocket at the top of the treater. Should the oil level drop and a body of explosive gas collect in the top of the treater, it is necessary to de-energize the treater to prevent an explosion from a high-voltage spark or arc. The magnetic type switch commonly employed is expensive; also, any breakage or binding of the shaft or any sticking of the contacts destroys the safety function.

It is an object of the invention to protect an electric emulsion treater against low level by a device internal of the treater which functions to de-energize or ground the electrodes without the use of a stuffing box and by equipment that is more reliable and less likely to fail than in prior practice. A related object is to provide a system that will "fail safe" should any malfunctioning occur, as compared with those older systems where the opposite was true.

Another object is to short-circuit or ground the high-voltage circuit of an electric treater upon drop in oil level to a potentially dangerous point or upon other malfunctioning of the treater.

Commonly, large emulsion streams are divided between a plurality of identical electric treaters equipped with individual power supplies, each treater operating individually. It is an object of the present invention to use a single power supply for two or more electric treaters, thus effecting not only an economy in equipment but permitting better treating because of the use of a common power supply of greater rating than would be used on a single treater alone. In such an installation, there would be greater reserve power to draw upon for any of the several treaters should it malfunction by developing a temporary condition of high conductivity from any cause, such as one or more low-resistance paths through the emulsion that might be cleared by a temporary surge of power.

If an attempt were made to use a single power source to energize a plurality of electric treaters with conventional low level equipment and if the float switches were connected serially in the circuit of the primary winding of the transformer, lowering of the level in any treater would open its normally closed float switch but this would de-energize all of the treaters. Before the still-full units could be put back in operation, as would be desired until the malfunctioning unit could be inspected

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and its functioning corrected, it would be necessary to short out or by-pass the switch of the low-level unit. A low-level safety switch with a short-circuiting switch connected to it would be of questionable value as a safety device.

It is an object of the invention to short-circuit the electrodes of a malfunctioning treater of a multi-unit plant energized by a common power supply. The operator can then de-energize the power supply by opening the line switch, whereupon a disconnect switch in the high-voltage circuit of the malfunctioning and now-short-circuited treater can be opened after which the power supply can be immediately re-energized to put the remaining units into renewed operation. It is an object of the invention to provide such disconnect switches in the high-voltage circuits of the respective treaters of a multi-unit plant.

Temporary short-circuiting of the electrodes of an electric emulsion treater will not injure the power supply equipment, which is commonly protected by a choke coil limiting the primary current of the transformer. Such short-circuiting of the high voltage circuit can be effected either externally or internally of the treater, the latter being preferred as it can be made to eliminate stuffing boxes or seals in the operative equipment which would otherwise be necessary and which would normally be required to seal against the higher pressure inside the treater.

It is an object of the invention to provide a structure for internally short-circuiting the high-voltage circuit of an electric emulsion treater. A further object is to connect such a structure to a level-responsive means of the treater. Still a further object is to provide a float-operated short-circuiting device in which malfunctioning of the float or breakage of its supporting structure will cause short-circuiting of the high-voltage circuit, causing the system to "fail safe." A further object is to provide a supplementary means for limiting the float movement or for lifting the float mount from a position outside the treater to aid in inspecting or installing the float.

Further objects will appear hereinafter from the description of an exemplary apparatus illustrated in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view showing how two or more electric treaters can be connected to a common source in accordance with one embodiment of the invention, Fig. 1 showing one way in which the treater electrodes can be short-circuited;

Figs. 2-4 show alternative ways of short-circuiting the electrodes of an electric treater, Fig. 4 being a fragmentary view along the corresponding line of Fig. 3;

Fig. 5 is a fragmentary view of the upper end of an electric treater equipped with the preferred short-circuiting means; and

Fig. 6 is a fragmentary isometric view of the short-circuiting means of Fig. 5.

Referring particularly to Fig. 1, two electric emulsion treaters 10 and 10' are respectively equipped with high-voltage energizing circuits which include disconnect switches 12 and 12'. These circuits are energized from a high-voltage source 13 comprising a step-up transformer having a primary winding 14 energized through a choke coil 15 and having a high-voltage secondary winding 16 with one terminal grounded and the other connected to the high-voltage circuits of the treaters 10 and 10' or to any additional treaters of a group. As the treaters 10 and 10' are of identical construction, only one will be herein described in detail.

As diagrammatically suggested in Fig. 1, the treater 10 includes a tank 20 maintained at ground potential by a connection 21. A foraminous grounded electrode 22 per-

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mits the emulsion to rise into a treating space 23 bounded by a high-voltage electrode 24 connected to the corresponding high-voltage circuit through a bushing 25, the electrode 24 being supported from suspension insulators 26. The large stream of emulsion to be treated advances along a header 30, the proportion to be treated by the treater 10 rising through a branch pipe 31 to a distributor 32, these elements representing any conventional emulsion ingress means. Any conventional egress means may be used for withdrawing the treated emulsion constituents, typically an oil draw-off pipe 34 and a water draw-off pipe 35.

The upper end of the tank 10 provides a float zone 40 in which is disposed a float 41 which rises and falls with the level of the liquid body of emulsion constituents in the tank 20. A dangerous condition would exist if the level dropped to such an extent that a body of explosive gas formed in the upper end of the tank, because any high-voltage spark might then cause a disastrous explosion.

In accordance with the present invention, the high-voltage electrode of the treater is grounded or the high-voltage circuit thereof is short-circuited if the liquid level in the tank drops. This is desirably accomplished by a grounding or short-circuiting means inside the tank. As suggested in Fig. 1, a circuit-closing member or short-circuiting member 45 hangs from the float 41 and lowers into electrical contact with the high-voltage electrode 24 upon drop in liquid level. The short-circuiting member 45 is grounded to the tank by a connection 46 so that lowering of this member will electrically bridge or short-circuit the electrodes of the treater. This short-circuit will not damage the source 13 because of the choke coil 15. Any remaining treaters connected to the source 13 can be continued in operation merely by opening the disconnect switch 12 of the malfunctioning treater.

A slightly modified arrangement is shown in Fig. 2 in which the float 41 is connected to an angled arm 47 pivoted to a bracket 48 secured within the upper end of the tank 20. The lowermost portion of the angled arm 47 is connected to the circuit-grounding or short-circuiting member 45, the treater being otherwise similar to those shown in Fig. 1.

Fig. 3 illustrates the upper end of a modified treater having an upper high-voltage electrode 24 as before but having also a high-voltage lower electrode 50 suspended from insulators 51, both electrodes being foraminous and having respective frameworks, not shown, from which rise rods 52 and 53 terminating in adjacent contact portions or members 54 and 55 (Fig. 4) extending horizontally at a position generally below the float zone 40. The float 41 is connected to the elbow of a bent arm 57 having one end pivoted to a bracket 58 of the tank and having at its other end a circuit-grounding or short-circuiting member 59 which will lower into short-circuiting relationship with the members 54 and 55 upon drop in liquid level in the float zone 40. The short-circuiting member 59 and the arm 57 are preferably maintained at ground potential through a flexible connection 60.

A preferred form of the invention is suggested in Figs. 5 and 6 as applied to a treater of the type suggested in Figs. 3 and 4. The uppermost wall of the treater tank is indicated at 65 and provides a neck or nozzle 66 closed by a plate 67 to form the float zone 40. A flange 69 of a bracket 70 is welded or otherwise secured to the wall 65, this bracket providing spaced legs 72 to which is pivoted a rod 73 secured to one end of the arm 57 so that this end of the arm pivots about an axis A—A.

The other end of the arm 57 is transversely flattened and extends between lips 74 welded to opposite sides of a rod forming the short-circuiting member 59. The lips 74 of the short-circuiting member are laterally pivoted for limited movement relative to the arm 57 by a pin 76 traversing the lips and the flattened portion of the arm. A small stop plate 77 is engaged by the corners of the

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lips 74 to limit the degree of swinging of the short-circuiting member 59. By pivoting the short-circuiting member 59 for limited lateral movement with respect to the arm 57, the short-circuiting means will accommodate contact members 54 and 55 of slightly different elevation, as may be desirable in those treaters wherein it may be desirable to adjust the vertical position of one of the electrodes to change the width of the treating space 23.

It is sometimes desirable to be able to lift the arm 57 from a position outside the tank to facilitate inspecting or attaching the float when the plate 67 is removed. This may be accomplished by use of a lifting member 80 positioned in the zone of movement of the arm 57. As shown, this lifting member includes upwardly extending arms 82 joined by a removable plate 83 to provide a zone 84 in which the arm 57 may normally move. The lifting member also provides a horizontal portion 87 and a vertical portion 88, the latter rising through a stuffing box 89 and being vertically adjustable by turning a nut 90 threaded to the upper end of the vertical portion 88. To guide the lifting member 80 during this adjustment, and to prevent frictional contact between the arms 82 and the arm 57, a U-shaped guide member 90' is welded to the bracket 70 and provides a narrow zone 91 in which the horizontal portion 87 may move freely while being restrained against lateral movement. The nut 90 is initially adjusted to dispose the zone 84 to permit free movement of the short-circuiting member 59 into and from its bridging relationship with the contact members 54 and 55. At the same time, the adjustment is desirably such that the plate 83 engages the arm 57 before the float 41 rises to engage the plate 67.

Various changes can be made without departing from the spirit of the invention as defined in the appended claims.

I claim as my invention:

1. In an electric emulsion treater the combination of: a metal tank having a float zone in the upper interior thereof; a pair of spaced electrodes in said tank defining a treating space therebetween, one of said electrodes being a high-voltage electrode, there being means for electrically insulating said high-voltage electrode from said tank; ingress and egress means for respectively supplying emulsion to and removing emulsion constituents from said tank; a high-voltage circuit having a grounded terminal connected to said metal tank and a high-voltage terminal connected to said high-voltage electrode, said high-voltage circuit providing a contact portion electrically common with said high-voltage electrode; a float in said float zone movable in response to change in liquid level therein; a metal circuit-grounding member within said tank; mounting means for mounting said circuit-grounding member within said tank to move into and from electrical contact with said contact portion in response to a respective lowering and raising of said float; and means for electrically connecting said circuit-grounding member to said tank.

2. An electric treater as defined in claim 1 in which said mounting means includes a connection between said float and said circuit-grounding member, in which said float is buoyant and lowers and raises in said float zone in response to lowering and raising of a liquid level therein, and in which said mounting means opposes the buoyancy of said float against the weight of said circuit-grounding member, the weight of said circuit-grounding member and of said float advancing said circuit-grounding member into said electrical contact with said contact portion in the absence of such float buoyancy.

3. In an electric emulsion treater, the combination of: a tank having a float zone in the upper interior thereof, said tank providing an electrically grounded portion; a high-voltage electrode in said tank; means for electrically insulating said electrode from said tank, said electrode bounding a treating space; ingress and egress means for respectively supplying emulsion to and removing emul-

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5 sion constituents from said tank; a high-voltage circuit connected to said electrode to energize same and establish an emulsion-treating electric field in said treating space, said circuit having a high-voltage contact portion electrically common with said electrode; a metal circuit-grounding member and means for pivoting same within said tank to move from a first position spaced from said high-voltage contact portion to a second position electrically contacting said high-voltage contact portion; means for electrically connecting said circuit-grounding member to said grounded portion of said tank; and a float in said float zone connected operatively to said circuit-grounding member for moving same from said first position to said second position upon drop in liquid level in said float zone.

4. In an electric emulsion treater, the combination of: a tank having a float zone in the upper interior thereof, said tank providing an electrically grounded portion; a high-voltage electrode in said tank; means for electrically insulating said electrode from said tank, said electrode bounding a treating space; ingress and egress means for respectively supplying emulsion to and removing emulsion constituents from said tank; a high-voltage circuit connected to said electrode to energize same and establish an emulsion-treating electric field in said treating space, said circuit having a high-voltage contact portion electrically common with said electrode; an arm pivoted to swing within said tank about a horizontal axis; a metal circuit-grounding member attached to one portion of said arm and movable between first and second positions respectively spaced from and electrically contacting said high-voltage contact portion upon pivoting of said arm about said axis; a float in said float zone responsive to change in liquid level therein; means for attaching said float to another portion of said arm, said pivot for said arm being at such position thereon that the weight of said arm, said circuit-grounding member and said float biases said circuit-grounding member toward engagement with said high-voltage contact portion, the buoyancy of said float being sufficient to overcome such bias upon rise in said liquid level in said float zone; and means for electrically connecting said circuit-grounding member to said grounded tank.

5. In an electric emulsion treater, the combination of: a tank having a float zone in the upper interior thereof, said tank providing an electrically grounded portion; a high-voltage electrode in said tank; means for electrically insulating said electrode from said tank, said electrode bounding a treating space; ingress and egress means for respectively supplying emulsion to and removing emulsion constituents from said tank; a high-voltage circuit connected to said electrode to energize same and establish an emulsion-treating electric field in said treating space, said circuit having a high-voltage contact portion electrically common with said electrode; a bracket connected to said tank and extending into the interior thereof; an angled arm pivoted to said bracket to move about a horizontal pivot axis, said arm having upper and lower portions within said tank; a float in said float zone responsive to change in liquid level therein; means for attaching said float to said upper portion of said arm; a circuit-grounding member attached to the lower portion of said arm and movable between first and second positions respectively spaced from and electrically contacting said high-voltage contact portion upon pivoting of said arm about said axis, the weight of said arm, said contact member and said float biasing said arm in a direction to move said circuit-grounding member toward said second position, the buoyancy of said float being sufficient to overcome such bias upon rise in said liquid level in said float zone; and means for electrically connecting said circuit-grounding member to said electrically grounded portion of said tank to ground said electrode upon lowering of said float in said float zone.

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6. An electric treater as defined in claim 5 in which said means for electrically connecting said circuit-grounding member to said tank is a flexible conductor having one end connected to said tank and another end connected electrically to said circuit-grounding member.

7. In an electric emulsion treater, the combination of: a tank having a float zone in the upper interior thereof, said tank having an electrically grounded portion; two high-voltage electrodes in said tank spaced from each other to define a treating space therebetween; means for electrically insulating each of said electrodes from said tank; ingress and egress means for respectively supplying emulsion to and removing emulsion constituents from said tank; a high-voltage circuit connected to said electrodes to energize same and establish an emulsion-treating electric field in said treating space, each electrode having a high-voltage contact portion electrically connected thereto, said contact portions being spaced from each other within said tank; a metal circuit-grounding member electrically connected to said grounded portion of said tank; means for mounting said circuit-grounding member to move within said tank from a first position spaced from said high-voltage contact portions to a second position electrically bridging said contact portions, said mounting means including an arm within said tank carrying said circuit-grounding member and means for pivotally connecting said arm to said tank to pivot about an axis and move said circuit-grounding member between said positions, said arm having an upper portion adjacent said float zone; a float in said float zone responsive to change in liquid level therein; and means for connecting said float to said upper portion of said arm, the weight of said arm and said circuit-grounding member being opposed and overcome by the buoyancy of said float upon rise in said liquid level to hold said circuit-grounding member in said first position until said liquid level drops whereupon said circuit-grounding member moves to said second position to connect each of said electrodes to said grounded portion of said tank.

8. An electric treater as defined in claim 7 in which said pivot axis is horizontal and at least a terminal portion of said arm moves in a plane at right angles to said axis, said plane passing between said spaced contact portions, and including a hinge joint in said plane attaching an intermediate portion of said circuit-grounding member to said terminal portion of said arm to rock in a plane transverse to said plane of movement of said terminal portion of said arm.

9. In combination in a system for electrically resolving a large stream of emulsion, the combination of: a plurality of electric emulsion treaters each including a tank and a high-voltage electrode therein bounding a treating space, each treater having a local high-voltage circuit connected to its high-voltage electrode, each treater having an electrically grounded portion, each local high-voltage circuit including a high-voltage contact portion electrically connected to the corresponding electrode; a disconnect switch in each of said high-voltage circuit; supply means for delivering a portion of said large stream of emulsion to the treating space of each of said electric treaters; a single high-voltage source of potential connected in energizing relationship with all of said high-voltage circuits respectively through said disconnect switches, said source including a transformer and a current limiting means limiting the total current drawn thereby; a grounding means associated with each of said local high-voltage circuits comprising a circuit-grounding member electrically connected to said electrically grounded portion of the corresponding electric treater; a float in the upper interior of each tank responsive to a drop in liquid level therein; and means for operatively connecting the float in each tank to the corresponding circuit-grounding member to move such circuit-grounding member into engagement with the correspond-

ing high-voltage contact portion upon drop in said liquid level in the upper interior of the corresponding tank.

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