

PATENT SPECIFICATION

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- (21) Application No. 29362/79 (22) Filed 9 May 1977 (19)
 (62) Divided Out of No. 1578607
 (31) Convention Application No. 727894 (32) Filed 29 Sep. 1976 in
 (33) United States of America (US)
 (44) Complete Specification Published 5 Nov. 1980
 (51) INT.CL.³ G01B 3/10
 (52) Index at Acceptance
 G1M 13



(54) TAPE ASSEMBLY FOR ULLAGE MEASURING DEVICE

(71) We, MARINE MOISTURE CONTROL COMPANY, INC., a corporation of the State of New York, United States of America, of 449, Sheridan Boulevard, Inwood, New York 11696, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a tape assembly for an ullage measuring device.

Heretofore, in order to measure ullage (the amount of liquid missing from a cargo tank), a coated tape measure with a bob at the end was used which was lowered to the surface of a liquid in a storage tank. This method had disadvantages, such as inaccuracy, as described in our copending Application No. 19403/77 (Serial No. 1578607), of which this application is a divisional.

The present invention provides a novel tape assembly for use in measuring ullage, e.g. in a device as claimed in our aforesaid application.

According to the present invention we provide a tape assembly for use with an ullage measuring device for measurement of ullage of a liquid in a storage tank, and having one end adapted for connection to a detection device and its other end adapted for connection to a tape assembly payout device, the tape assembly comprising (i) an outer jacket of material which is sufficiently transparent to allow viewing of the indicia on the tape, impervious to the liquid under measurement and electrically non-conductive, (ii) a pair of spaced electrically conductive elements contained within the outer jacket, and (iii) a tape having measuring indicia thereon, contained within the jacket and juxtaposed to the electrically conductive elements but electrically insulated therefrom.

The tape is preferably made of electrically

conductive metal, so that it also serves as an internal ground for the device.

The pair of electrically conductive elements (wires) enclosed within the jacket provide a suitable connection between (a) the electronic detection components in the bob of an ullage measuring device and (b) the energization means and the alarm indication device on the tape reel mechanism. The parts (a) and (b) can be in a device as described and claimed in our aforesaid application.

The outer protective jacket may be knurled or dimpled so as to provide an irregular surface for a metallic tape. This construction with an irregular covering surface is especially useful in those situations where there is a large static charge build-up on the jacket, since it helps to reduce the static charge build-up because the charge leaks through more easily at the areas of reduced cross-section, and is then dissipated by the metallic tape inside the dimpled jacket.

In order that the invention may be more clearly understood it will be described more fully with reference to the accompanying drawings, in which:

Figure 1 is a view of one embodiment of a tape assembly of the invention for use with an ullage measuring device;

Figure 2 is a section taken on line 1-1 of Figure 1;

Figure 3 is a sectional view similar to Figure 2, but showing a modification of the tape assembly of Figure 1;

Figure 4 is a view of another modification of the tape assembly according to the invention;

Figure 5 is a section taken along line 5-5 of Figure 4; and,

Figure 6 is a sectional view of another modification of the tape assembly of Figure 4.

Referring to the drawings, which illus-

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trate the preferred embodiments of a tape assembly 2 according to this invention, the tape assembly 2 includes a plastic jacket 10 which encloses conductors 12 and 14 as well as a metallic tape 16 having measuring indicia thereon, as seen in Figures 1 and 4. The conductors 12 and 14 are shown as positioned on opposite sides of the tape 16 in Figure 2 and next to each other in Figure 3.

The plastic jacket 10 is made to be transparent so that the indicia on the tape can be seen, impervious to the liquid, such as oil, under measurement, and is suitably made of polytetrafluoroethylene. The metallic tape 16 has one end which is adapted for connection with a grounding screw or other conventional ground and the tape 16 then forms the ground connection for the electrical circuit which is adapted for connection with conductors 12 and 14.

In the Figures 1 to 3 embodiments of the tape assembly 2, the outer surfaces 20, 22 of the jacket are shown generally flat and smooth with a uniform cross-section transverse to the longitudinal direction or run of the metallic tape 16. This configuration is generally satisfactory for most contemplated uses of the ullage device.

In some instances, electrical charge may build up along the outer surfaces of the tape assembly 2, and in order to avoid such charge build-up and to remove the same, a modified tape assembly 21 (as shown in Figures 4 to 6) is provided in which the outer surfaces 20' and 22' are dimpled or knurled as at 24 to provide a narrower cross-section of the jacket 10'. The narrowed longitudinal cross-section as shown at 26 permits the charge to leak through the plastic jacket 10' to the metallic tape and is dissipated thereby. When the ullage device with which the tape assembly forms a combined unit is connected to an external ground, such ground assists in the dissipation of the electrical charge.

The embodiments of tape assembly 2' shown in Figures 4 and 5 are generally similar to the Figures 1 and 2 embodiment with conductors 12 and 14 positioned on opposite sides of metallic tape 16, and the Figure 6 embodiment is generally similar to the Figure 3 embodiment, except that the outer jacket 10' is periodically undercut to provide the dimpling or knurling effect. While not specifically shown, it will be evident that it is possible to achieve almost the same results of eliminating electrical charge build-up by dimpling or knurling only one surface 20 or 22 of the outer jacket 10'.

The embodiments of Figures 1, 2 and 4, 5 with conductors 12, 14 positioned on opposite sides of the metallic tape 16 may be more advantageous where capacitative

effect occurs as a result of the placement of the conductors 12, 14 on the same side of the tape 16. In some instances, where conductors 12 and 14 are placed on opposite sides of the tape 16, the center portion of the jacket 10 between the conductors may also be made of reduced cross-section, but uniform throughout. This will also serve to assist in the prevention of charge build-up leaking the charge through the jacket to the tape for dissipation thereby. Moreover, the positioning of the conductors 12, 14 on opposite sides of the tape 16 aids in the maintenance of the tape assembly by imparting some rigidity thereto while maintaining the necessary flexibility to allow the tape assembly to be coiled onto a conventional reel. The conductors 12, 14 and the tape 16 form a composite unit.

It is within the scope of the invention to use a non-electrically conductive tape such as of fibreglass or a fabric (instead of metal). If such a tape is used, then of course, it will be necessary to provide a third or grounding wire within the tape assembly.

The tape may be provided with indicia to measure lengths, e.g. in feet or meters, the appropriate ullage volume may then be obtained by using a calibration table.

Alternatively, the tape may be directly calibrated in accordance with the tank capacity of the vessel so that direct reading of ullage may be obtained, e.g. in litres or barrels, for a specific tank.

WHAT WE CLAIM IS:

1. A tape assembly for use with an ullage measuring device for the measurement of ullage of a liquid in a storage tank, and having one end adapted for connection to a detection device and its other end adapted for connection to a tape assembly payout device, the tape assembly comprising (i) an outer jacket of material which is sufficiently transparent to allow viewing of the indicia on the tape, impervious to the liquid under measurement and electrically non-conductive, (ii) a pair of spaced electrically conductive elements contained within the outer jacket, and (iii) a tape having measuring indicia thereon, contained within the jacket and juxtaposed to the electrically conductive elements but electrically insulated therefrom.

2. A tape assembly according to Claim 1, wherein the indicia tape is of electrically conductive material, the jacket having at least one non-uniform outer surface to provide at least one cross-sectional area having a narrower cross-section than other cross-sectional areas of the jacket, thereby providing a shorter path for electrical charge to leak through the jacket to the indicia tape for dissipation by the tape assembly payout device.

3. A tape assembly according to Claim 1

trate the preferred embodiments of a tape assembly 2 according to this invention, the tape assembly 2 includes a plastic jacket 10 which and encloses conductors 12 and 14 as well as a metallic tape 16 having measuring indicia thereon, as seen in Figures 1 and 4. The conductors 12 and 14 are shown as positioned on opposite sides of the tape 16 in Figure 2 and next to each other in Figure 3.

The plastic jacket 10 is made to be transparent so that the indicia on the tape can be seen, impervious to the liquid, such as oil, under measurement, and is suitably made of polytetrafluoroethylene. The metallic tape 16 has one end which is adapted for connection with a grounding screw or other conventional ground and the tape 16 then forms the ground connection for the electrical circuit which is adapted for connection with conductors 12 and 14.

In the Figures 1 to 3 embodiments of the tape assembly 2, the outer surfaces 20, 22 of the jacket are shown generally flat and smooth with a uniform cross-section transverse to the longitudinal direction or run of the metallic tape 16. This configuration is generally satisfactory for most contemplated uses of the ullage device.

In some instances, electrical charge may build up along the outer surfaces of the tape assembly 2, and in order to avoid such charge build-up and to remove the same, a modified tape assembly 21 (as shown in Figures 4 to 6) is provided in which the outer surfaces 20' and 22' are dimpled or knurled as at 24 to provide a narrower cross-section of the jacket 10'. The narrowed longitudinal cross-section as shown at 26 permits the charge to leak through the plastic jacket 10' to the metallic tape and is dissipated thereby. When the ullage device with which the tape assembly forms a combined unit is connected to an external ground, such ground assists in the dissipation of the electrical charge.

The embodiments of tape assembly 2' shown in Figures 4 and 5 are generally similar to the Figures 1 and 2 embodiment with conductors 12 and 14 positioned on opposite sides of metallic tape 16, and the Figure 6 embodiment is generally similar to the Figure 3 embodiment, except that the outer jacket 10' is periodically undercut to provide the dimpling or knurling effect. While not specifically shown, it will be evident that it is possible to achieve almost the same results of eliminating electrical charge build-up by dimpling or knurling only one surface 20 or 22 of the outer jacket 10'.

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The tape may be provided with indicia to measure lengths, e.g. in feet or meters, the appropriate ullage volume may then be obtained by using a calibration table.

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2. A tape assembly according to Claim 1, wherein the indicia tape is of electrically conductive material, the jacket having at least one non-uniform outer surface to provide at least one cross-sectional area having a narrower cross-section than other cross-sectional areas of the jacket, thereby providing a shorter path for electrical charge to leak through the jacket to the indicia tape for dissipation by the tape assembly payout device.

3. A tape assembly according to Claim 1



or 2, wherein the two electrical conductors are positioned adjacent to each other on the same side of the indicia tape.

4. A tape assembly according to Claim 1 or 2, wherein the electrical conductors are positioned on opposite sides of the indicia tape.

5. A tape assembly for use with an ullage measuring device, the assembly having its parts constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawing.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1980.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.



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