April 27, 1965 L. M. BENNETT 3,180,144

FLOWMETER ELECTRODES

Filed May 15, 1961

FIG. 1.

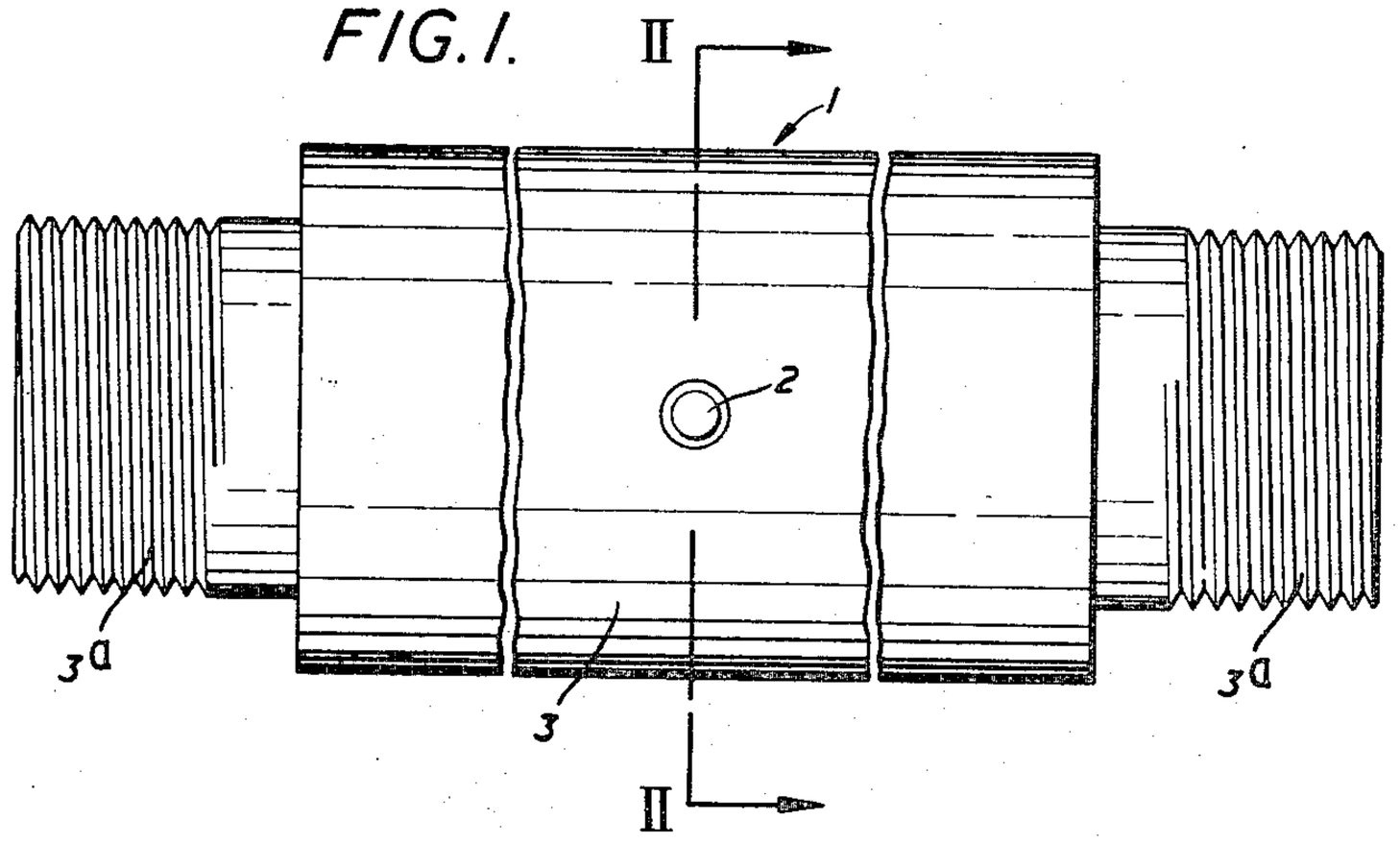
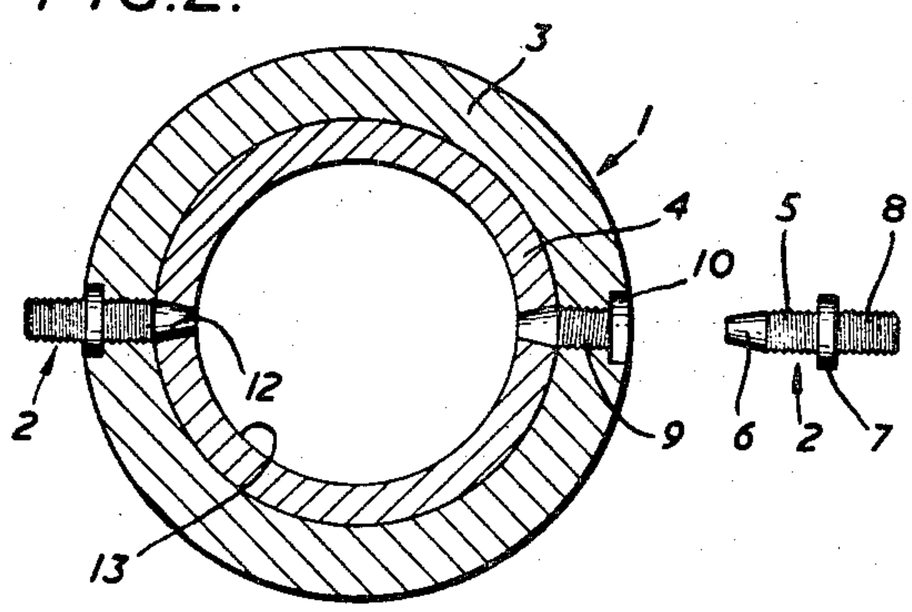


FIG. 2.



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FLOWMETER ELECTRODES

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This invention relates to electrodes for fitting into the walls of tubes to provide an electrical connection to liquids flowing through the tubes, and has for its object to provide a new or improved form of electrode suitable for use with a tube embodied in the detector head of an induction flowmeter, concentration meter or electrical conductivity measuring instrument.

Such a detector head normally comprises a short length of electrically insulating tube through which the liquid flows and into the wall of which suitable measuring electrodes are fitted. The tube commonly comprises a body portion provided with an inner lining the material of which is chosen to suit the chemical nature of the liquid, and the invention is concerned with electrodes for use with tubes having such an inner lining. There is described in our co-pending patent application Serial No. 110,219 filed May 15, 1961 a form of tube having a separate inner lining in the form of a loose sleeve located between the end parts of the tube, and an electrode in accordance with the present invention is particularly well suited for use with a tube of this general construction.

According to the invention an electrode for fitting into the wall of a tube comprising a body portion with an inner lining has a screw-threaded shank for fitting in a threaded bore of the body portion and a tapering nose portion adapted to seat in a bore in the lining. The nose portion is preferably of frusto-conical shape.

The electrode preferably has a shoulder which limits the amount by which the electrode can be screwed into the body portion, and this shoulder is conveniently arranged to produce a small projection of the nose portion into the inner bore of the tube, after which the tube can be reamed to polish and radius the end of the electrode and ensure a flush fitting with the inner bore. An electrical connection is made to the outer end of the electrode in the usual manner.

Seating of the nose portion of the electrode in the inner lining provides a liquid-tight seal which is to some extent pressure assisted as internal pressure tends to press the inner lining more firmly againt the nose portion.

The material of the inner lining is preferably sufficiently deformable for the nose portion to produce its own seating, in which case only a small pilot bore need be drilled in the lining before the electrode is screwed home with the lining suitably supported internally. Normally both the body portion and the lining will be of insulating material, but in some circumstances only the lining may be of insulating material. In this case the shank portion of the electrode may embody an outer insulating sleeve on which the screw threads are formed.

The invention will now be further described with reference to the accompanying drawings which illustrate, by way of example, part of an insulating tube of the detector head of an induction flowmeter embodying two electrodes in accordance with the invention, and in which:

FIGURE 1 is a side view of the insulating tube, and

FIGURE 2 is a partly exploded sectional view on the line II—II in FIGURE 1.

The insulating tube **1** is fitted with diametrically opposed electrodes **2** and comprises an outer cylindrical tube or body portion **3** with an inner lining or insulating sleeve **4**. Threaded end parts **3***a* fitted into the ends of

the body portion **3** serve to connect the complete tube **1** in a pipe line (not shown) with which it is to be used, and both the body portion **3** and the sleeve **4** are of insulating material.

Each electrode **2** has a threaded shank portion **5** adjoining an inner frusto-conical nose portion **6** and limited on its outer side by a peripheral flange **7** providing a locating shoulder. At its outer end the electrode has a further threaded portion **8** for connection to an electrical lead by means of terminal nuts (not shown).

The threaded shank portion **5** is screwed home into a corresponding threaded radial bore **9** in the body portion **3**, this bore being counterbored at **10** to receive the peripheral flange. The nose portion seats into the inner sleeve at **12** and terminates at the inner surface of the latter to provide an electrical connection with liquid flowing through the central bore **13** of the sleeve **4**.

The inner lining is of a slightly deformable nature and prior to fitting the electrodes is formed with corresponding pilot bores respectively aligned with the radial bores **9**. The electrodes **2** during fitting are screwed home into the body portion **3** to provide a slight inward projection of each nose portion **6**, the sleeve **4** being suitably supported internally. After the electrodes are fitted the inner bore **13** of the sleeve is reamed to polish and radius the ends of the electrodes **2** and leave them flush with the inner bore **13** so that they do not disturb flow conditions through the latter.

In the exploded view of FIGURE 2 the right-hand electrode **2** in that figure is shown detached, after the sleeve **4** has been deformed to provide the corresponding seating and the bore **13** reamed through.

It will be appreciated that seating of the electrodes **2** in the sleeve **4** with consequent expansion of the pilot bores in the latter to form the seatings **12** produces an efficient liquid seal around the nose portions **6**. This seal is assisted in use by internal pressure within the bore **13** acting on the inner sleeve **4** and urging it into more intimate contact with the nose portions **6** of the electrodes.

The remainder of the flowmeter head is not illustrated and forms no part of the invention. It includes the usual magnetic coils and pole pieces, and apart from the electrodes of the present invention may be of generally conventional form.

I claim:

1. In combination, a tube having a wall and an inner lining within said wall of electrically insulating material compatible with a liquid the flow of which is to be contained within said tube, and an electrode mounted in said wall with an inner end electrode surface to provide an electrical contact with the liquid flowing along the tube and projecting externally of the tube to provide an electrical connection, said wall having a radial bore with an internal screw thread and the material of the wall in which said bore is formed being electrically insulating material, and said electrode having a screw threaded shank engaging said threaded bore with a tapering inner end nose portion which is of decreasing diameter away from said shank seats in a bore in the lining aligned with said threaded bore, and another electrode exposed to the interior of the tube on the opposite side of the tube from the first-named electrode.

2. The combination according to claim 1, wherein said inner end electrode surface is flush with the interior of said tube lining.

3. An electrode and tube assembly, comprising an electrode threaded in an electrically insulating wall of said tube which has an insulating tube lining of a material compatible with a liquid to be contained within the tube, said wall having a threaded radial bore for the electrode and said lining having a radial bore aligned with said threaded bore, said electrode having a threaded shank

engaging said threaded bore and a tapering nose portion seated in the bore in said lining, said nose portion being of decreasing diameter towards the adjacent end of the electrode which provides an end surface for electrical contact with the liquid, and the nose portion being dimensioned so that the electrode can be fitted and removed from the outside of said tube, and another electrode exposed to the interior of the tube on the opposite side of the tube from the first-named electrode.

4. An assembly according to claim 3, wherein said threaded shank has a peripheral flange spaced from said nose portion and is formed at its outer end for attachment of an external electrical connection to the eleectrode, said flange providing a shoulder limiting insertion of the electrode into the tube so that the inner end of the electrode is substantially flush with the inner surface of said lining.

5. An assembly according to claim 3, wherein the lining is of deformable material deformed by fitting the electrode to form a seating for the nose portion of the latter.

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