H. N. PACKARD.

THERMOMETER UNIT.

APPLICATION FILED NOV. 30, 1914.

1,230,598. Patented June 19, 1917.

Fig. 1

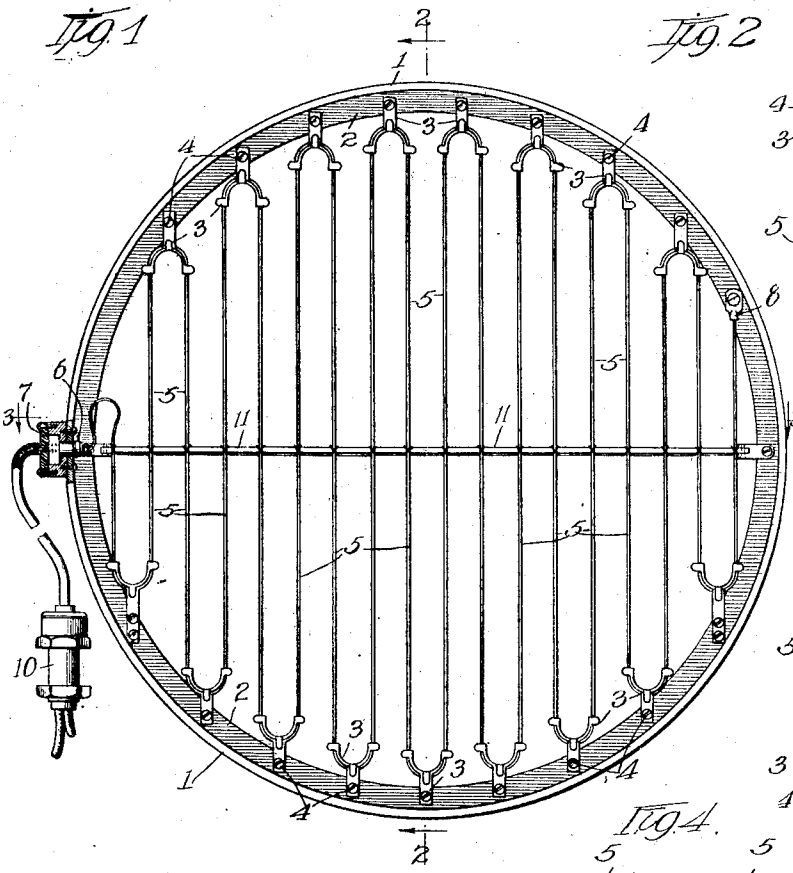


Fig. 2

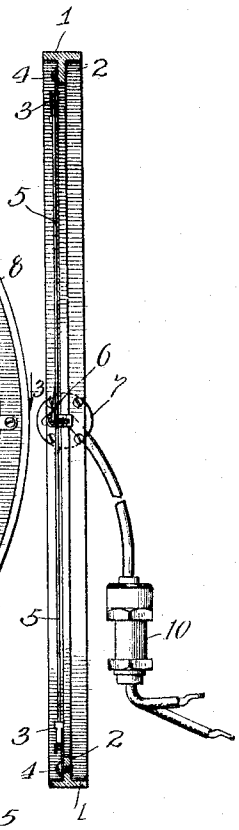


Fig. 4.

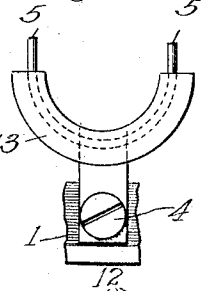
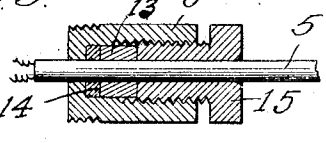


Fig. 3.

Fig. 5.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HORACE N. PACKARD, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

THERMOMETER UNIT.

1,230,598. Specification of Letters Patent. Patented June 19, 1917.

Application filed November 30, 1914. Serial No. 874,733.

To all whom it may concern:

Be it known that I, HORACE N. PACKARD, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Thermometer Units; of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to improvements in thermometer units of the character shown in co-pending application, Serial No. 781,733, filed July 29, 1913. These units are particularly applicable to meters of the type known as Thomas meters. It should be understood however that their application is not limited.

One of the objects of the present invention is to provide an efficient thermometer unit which will not offer appreciable obstruction to the flow of fluid.

Another object is to provide means for incasing the resistance material in a continuous metallic armor free from joints.

Another object is to provide an efficient thermometer unit having a comparatively large tube for incasing the resistance material so that the tube may be effectively covered with a coating of inexpensive non-corrosive material.

Another object is to provide a thermometer unit with improved means for suspending the resistance material in the stream of fluid so that changes in its temperature are not influenced by the supporting means.

Other objects and advantages of my invention will hereinafter appear.

In the accompanying drawings which illustrate an embodiment of the invention—

Figure 1 is an elevation of a thermometer unit.

Fig. 2 is a central section thereof on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is an elevation of an alternate form of clip.

Fig. 5 is a cross-section of a detail of a stuffing box.

The thermometer unit comprises in general a supporting frame 1 having a plurality of clips 3 arranged thereon which support a continuous tubing 5 in which is arranged a suitable resistance wire.

The frame 1 which may be made of any suitable material is shown as T-shaped in cross section so that an inwardly extending flange 2 is provided. The frame is shaped to fit the inside of a conduit in which the thermometer unit is to be mounted. A plurality of clips 3 are arranged at intervals around the frame, being secured thereto by screws 4 or other similar means. The clips are shown as having a supporting shank provided with a semi-circular extension upon which lips are formed for holding the tubing in place. The semi-circular portion of the clip might be otherwise formed as shown, for example, in Fig. 4 so as to provide a suitable groove for receiving the tubing and properly supporting it.

A continuous tubing 5 is strung back and forth across the frame, the spans of which are spaced substantially equal distances apart and parallel to each other. If desired, the frame may be provided with a set of clips on each of its sides and a tubing may be wound on both sides of the frame.

The tubing is made of comparatively small diameter in order that its temperature may change quickly with changes in the temperature of the flowing fluid. In order to give an idea of the relative proportions of the tube and the supporting ring, it may be stated that satisfactory results have been obtained with a tube having an outside diameter of .075″ and an inside diameter of .050″, the diameter of the frame being about 24″. Of course, the dimensions of the frame are not limited to those given. The tubing is preferably made of metal which resists corrosion and which conducts heat rapidly. Tubing made with a brass base covered with a non-corrosive material such as gold, lead, tin, etc., has been found satisfactory.

The tubing is wound back and forth across the frame and around the semi-circular extensions of the clips 3 in the manner shown in the drawings. The clips provide a comparatively large bend and support the spans in such a way that the loops at the ends thereof are subjected directly to the action of the flowing fluid instead of being shielded or protected by the flange 2 of the frame. In other words, the entire length of tubing is in the flowing stream of fluid and is more directly subjected to the temperature thereof.

A resistance wire 9 which is in a plurality

of strands is drawn into the tube before the tube is mounted on the frame. The resistance material may consist of a very fine insulated wire of nickel or the like. An even number of strands may be used so that the terminal ends of the wire are both at the same end of the tube. Six strands connected in series have been used with satisfactory results. After the resistance wire has been drawn into the tube and before the latter is strung on the frame, hot paraffin or other similar material is pumped through the tube in order to insulate the wire more thoroughly and to fill the air spaces in the tube with solid material.

One end of the tubing 5 passes through a stuffing box 6 into a terminal box 7 where the ends of the resistance material are connected to suitable flexible leads which connect with the housing terminal 10. The housing terminal is adapted to pass through an opening in a conduit in which the thermometer is mounted. The flexible leads are incased in a lead covered armor to protect them from moisture and corrosive actions.

The details of the stuffing box which secure a pressure tight connection between the tubing and the terminal box are shown in Fig. 5. The tubing 5 has a brass collar 13 soldered to it which fits within an opening in the stuffing box 6. A lead gasket 14 is placed between the collar 13 and the end of the stuffing box and a gland 15 follows up the collar. By screwing down the gland 15 the collar 13 causes the lead gasket to be forced tightly around the tubing 5 to provide a pressure tight joint. Any other suitable form of pressure tight connection might be used. If desired, the tubing 5 may be soldered or otherwise directly connected to the terminal box.

In order to shorten the length of unsupported strands a bar 11 is provided which is secured to the flange 2 and is provided with a series of notches 12 which receive the individual strands. The strands may be tied to the cross bar in any desired manner. The cross bar, supporting ring, terminal box and housing terminal are tinned or otherwise protected from corrosive actions.

Among the many advantages of the above described structure the following may be mentioned. The multiple strand wire inside the tube enables the total length of tubing to be reduced for a required resistance. Accordingly, the tubing may be given a wider spacing on the supporting frame so that it will afford less obstruction to the flow of fluid. A resistance material can be more effectively protected with an armor without joints and by having the resistance material in multiple strands the length of the tubing is shortened so that it may be made continuous. The tube is of slightly larger diameter than if only a single strand of wire were incased in it but the obstruction afforded to the flow of fluid is decreased rather than increased owing to the decreased length of tubing and consequent greater distance between the spans. For a given size of unit having a given total resistance the space efficiency is much improved. The increased free space through which the fluid may flow without obstruction gives less pressure drop for a given rate of flow and thus a meter of given diameter may be rated higher without exceeding the allowable pressure drop. Inasmuch as the resistance wire is arranged in a plurality of strands which may be connected in series, a total length of wire many times in excess of the total length of tubing may be used thereby giving a sufficient resistance without offering mechanical obstruction to the flow of fluid such as would accompany an increased number of spans if the total length of tubing equaled the total length of resistance wire. Furthermore, the deposit of naphthalene and tar on the units is materially decreased and the liability of these deposits bridging across from one span to another is very materially lessened. The fact that one end of the tubing is closed permits of a very efficient terminal construction. The entire thermometer is very rugged and hence not easily damaged.

While I have shown and described a structure embodying the invention, it should be understood that many other structures might be devised which would embody the same and which are included within the spirit and scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, a flexible tubing, a resistance wire within said tubing and insulated therefrom, and means on said frame for supporting said tubing with the entire length thereof within the inner area bounded by said frame.

2. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, a flexible tubing, a resistance wire within said tubing and insulated therefrom, and a plurality of supporting clips of small mass carried by said frame and projecting inwardly therefrom, said tubing being wound on said clips so that the entire length of tubing is supported within the inner area inclosed by the frame.

3. A resistance thermometer comprising a frame having an inwardly projecting flange, a plurality of Y-shaped clips secured to said flange, a continuous metal tubing strung back and forth across said frame and supported by said clips in

smooth semi-circular bends and a resistance wire within said tubing and insulated therefrom.

4. A resistance thermometer comprising a supporting frame, a heat conducting tube on said frame, and a plurality of strands of resistance wire arranged within said tube.

5. A resistance thermometer comprising a supporting frame, a heat conducting tube on said frame and a plurality of strands of resistance wire arranged within said tube and connected in series.

6. A resistance thermometer comprising a wire composed of a plurality of strands connected in series, a continuous metal tubing incasing said strands whereby a comparatively short length of tubing suffices for a resistance wire having a total length several times the length of said tubing, said tubing being supported with the individual strands spaced a considerable distance apart whereby a sufficient total of electrical resistance is provided without offering appreciable mechanical obstruction to the flowing fluid.

7. A resistance thermometer comprising a supporting ring, a continuous length of metal tubing provided with a non-corrosive covering strung back and forth across said ring, and a plurality of strands of resistance material within said tubing.

8. In a resistance thermometer, a clip having a supporting shank and a semi-circular extension, the latter being provided with lips, and tubing bent around said semi-circular support and held in place by said lips.

9. A resistance thermometer comprising a supporting frame, a terminal box thereon, a metal tube, one end of said tube communicating with said terminal box, the other end being closed, and a plurality of strands of resistance wire arranged within said tube and connected in series, the free ends of two of said strands extending into said terminal box.

10. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, said frame having means thereon for supporting a tubing with substantially the entire length of tubing within the inner area bounded by said frame, and a plurality of strands of resistance wire arranged within said tubing and insulated therefrom whereby a comparatively long resistance wire may be thoroughly protected and at the same time distributed over the area inclosed by the frame in a comparatively small number of spans spaced at a considerable distance apart.

11. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, said frame having means thereon for supporting a tubing with substantially the entire length of tubing within the inner area bounded by said frame, an even number of strands of resistance wire arranged within said tubing and insulated therefrom whereby a long resistance wire may be protected and distributed over the area inclosed by said frame in a relatively small number of spans spaced a considerable distance apart, and a stuffing box supported by said frame for receiving said tubing so that the ends of said resistance wire may be led to the exterior of said frame and the insulating material in said tubing retained therein.

12. A resistance thermometer comprising a supporting frame, a terminal box thereon, a stuffing box communicating with said terminal box, a metal tubing supported by said frame, one end of said tubing communicating with said stuffing box and the other end being closed, and a plurality of strands of resistance wire arranged within said tube and insulated therefrom, the free ends of two of said strands extending through the stuffing box into the terminal box.

13. An electric resistance thermometer comprising a continuous length of metal tubing, a resistance wire within said tubing and insulated therefrom, a supporting frame adapted to be mounted in a meter housing, and means projecting from the inner side of said frame over which the tubing is wound, whereby the entire length of tubing is supported in spaced relation within the inner area bounded by said frame.

14. An electric resistance thermometer comprising a continuous length of metal tubing, a plurality of strands of resistance wire within said tubing and insulated therefrom, a supporting frame adapted to be mounted in a meter housing, and means projecting from the inner side of said frame over which the tubing is wound whereby the entire length of tubing is supported in spaced relation within the inner area bounded by said frame.

15. An electric resistance thermometer comprising a continuous length of metal tubing, an even number of strands of resistance wire within said tubing and insulated therefrom, a supporting frame adapted to be mounted in a meter housing, means projecting from the inner side of said frame over which the tubing is wound whereby the entire length of tubing is supported in spaced relation within the inner area bounded by said frame and a stuffing box communicating with one end of said tubing whereby the terminals of the resistance wire may be led to the exterior of the frame.

16. An electric resistance thermometer adapted for use in meters for measuring gases and comprising a frame capable of being mounted within the meter housing so that the gas to be measured will flow through the frame, a flexible tubing, a resistance

wire within said tubing and insulated therefrom, and means on said frame for supporting said tubing with the entire length thereof within the inner area bounded by said frame.

17. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, a flexible tubing, a plurality of strands of resistance wire within said tubing and insulated therefrom, and means on said frame for supporting said tubing with the entire length thereof within the inner area bounded by said frame.

18. An electric resistance thermometer comprising a frame adapted to be mounted in a meter housing, a flexible tubing, a plurality of strands of resistance wire within said tubing and insulated therefrom, and a plurality of supporting clips of small mass carried by said frame and projecting inwardly therefrom, said tubing being wound on said clips so that the entire length of tubing is supported within the inner area inclosed by the frame.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

HORACE N. PACKARD.

Witnesses:
J. C. WILSON,
L. A. WATSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."