M. E. MOELLER.

METHOD OF MAKING THERMOMETERS.

APPLICATION FILED MAY 11, 1918.

1,274,576.

Patented Aug. 6, 1918

Fig. 1.

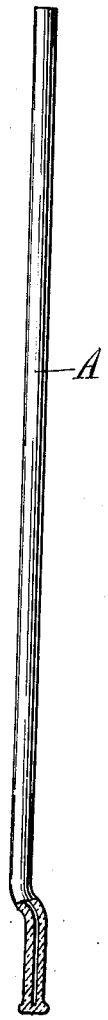


Fig. 2.

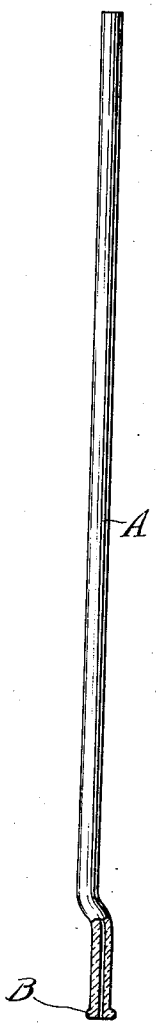


Fig. 3.

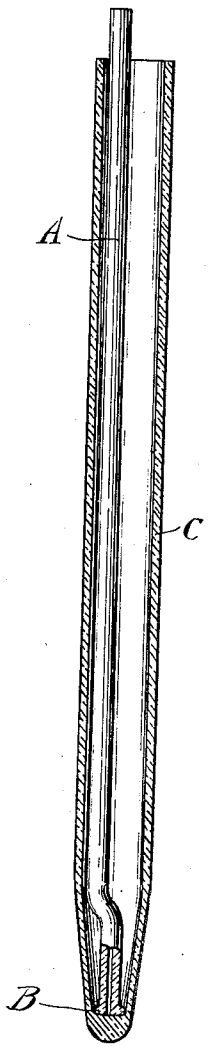
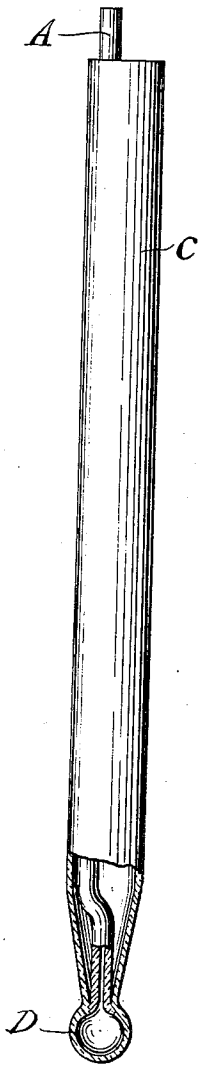


Fig. 4.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING THERMOMETERS.

1,274,576. Specification of Letters Patent. Patented Aug. 6, 1918.

Application filed May 11, 1918. Serial No. 233,984.

To all whom it may concern:

Be it known that I, MAX E. MOELLER, a citizen of the United States, and a resident of the borough of Brooklyn, in the county of Kings, city and State of New York, have invented certain new and useful Improvements in Methods of Making Thermometers, of which the following is a specification.

The improvements relate to the manufacture of thermometers, and more particularly to instruments of this kind which comprise an inner tube containing mercury and an outer tube in which a scale may be secured to give a reading of the mercury in the inner tube, both tubes being made of transparent material, such as glass, and united at the bulb end. They may be employed, however, in the making of any instrument of similar construction and for any purpose for which such an instrument can be employed. In these thermometers the outer tube is usually of much greater diameter than the inner tube, so that a space is left between them, the inner tube being out of contact with the outer tube and joined thereto at the lower or bulb end. It is therefore necessary that this connection between the two tubes shall be strong, and capable of resisting all strains due to the movement of the inner tube in the outer, as well as that the mercury containing channel shall be accurate and so formed that the mercury can be placed therein and the air expelled with certainty and without great difficulty. The term mercury as used herein includes mercury or any other fluid used for the same purpose in instruments of this character.

Heretofore it has been common practice to form and elongate a bulb on the lower end of the inner tube, then break off the end of this elongated bulb and spread the remaining part into the form of an inverted funnel, then place this inner tube in the outer tube and unite their lower ends. This operation gives satisfactory results, but requires great skill and care, and even when highly skilled labor—which is not always obtainable—is employed, imperfect instruments and breakage result. Attempts have been made to overcome the difficulties of the process and produce desirable results by the employment of labor of ordinary or little skill, but so far as is known these attempts have not been successful.

The steps in the process are illustrated in the drawings, in which Figure 1 is an elevation partly in vertical medial section of the inner tube after the first step in the process has been performed; Fig. 2 is a similar view of the same part after the second step; Fig. 3 is a similar view of the two tubes after the third step; Fig. 4 is a similar view of the parts shown in Fig. 3 after the last step in the tube forming process has been formed and the instrument is ready to receive the mercury.

The process has been divided into the four steps referred to above arbitrarily and merely for the purpose of description and illustration. Each step involves one or more operations, and the process therefore might be divided into a greater number of steps or reduced to fewer.

In carrying out the present process, according to the best method at present employed, a tube A of the proper size and with the desired bore is taken and one end flattened as shown at B, to form an annular flange or spatula. This may be done by subjecting the end to be flattened to the heat of a blow-pipe and at the same time pressing it against a flat hard surface having a temperature below the fusing point of the glass. This flattening operation causes the bore at the lower end of the tube to become closed.

The spatulate end of the tube is now heated—or the original heat maintained—while air is forced through the bore from the opposite end and the material immediately below the end of the bore blown out so as to open the tube again at that end. This surrounds the lower end of the tube with a relatively thick flange and prevents the metal from being unduly stretched and weakened or forced out of shape. The inner tube is then placed in the end of the outer tube C with the enlarged part in the contracted neck at the bottom of said outer tube, and, after centering the inner tube—which may be done by packing the opposite end in wax or the like—the operation of uniting the lower ends of the two tubes and forming the bulb is performed. This is done by heating the glass at the lower end of the outer tube at and below the enlarged end of the inner tube until it fuses, and a seal and joint is formed, and then blowing through the inner tube while the material is in a fusing state, from the opposite end, to form a bulb D of the required size.

The instrument may then be completed by filling the inner tube and bulb with mercury and expelling the air in the manner common in the art. The structure formed as herein described is however advantageous in this last process, since it is customary to first heat the tubes to rarify the air, then immerse the upper end of the inner tube in a body of mercury and permit the mercury to rise therein to the desired point as the tubes cool, then invert the tubes and cause the mercury to flow into the bulb and the air to be expelled by displacement of the heavier fluid. If the upper part of the bulb or the lower end of the inner tube, which closes the said bulb against communication with the outer tube, is irregular air pockets may be formed, and the flow of the fluid interfered with, thus impairing the accuracy of the instrument. With the process herein described the air forced in when the bulb is blown does not expand or distort the upper part of the bulb, but merely forms a downwardly flaring channel in the lower end of the inner tube and a bulb in the bottom of the outer tube below this channel. The joint of the two tubes thus being formed of the thickened end of the inner tube and the unexpanded neck of the outer tube will be a strong one capable of resisting all ordinary strains.

Variations in the method above described may be employed within certain limits without departing from the scope of the present improvement. Thus if desired the end of the inner tube may be placed in the end of the outer tube without first blowing out the metal closing the end of the bore of said inner tube, and the said metal may then be blown out and the bulb formed in one blowing operation.

I claim:

1. The method of making thermometers and the like substantially as herein described, which consists in forming an enlargement at one end of a hollow tube, heating the enlarged portion to the fusing point and opening the end of the bore of the tube by forcing fluid through the material immediately opposite the end of said bore, placing the said enlarged end in an outer tube of greater internal diameter than the external diameter of the first tube, but having a portion approximately equal in diameter to said enlarged portion, fusing the said outer tube and enlarged portion and forming a bulb below said enlarged portion by forcing fluid into the portion of the outer tube below the enlargement while the said portion is heated to a fusing temperature.

2. The herein described method of making thermometers consisting of a plurality of concentric tubes of different diameter and joined together, which consists in first taking a hollow tube, fusing one end and spreading it to form an enlargement, then blowing through the interior of the tube from the opposite end and opening the end which has been closed by the fusing and spreading operation, placing the said tube within another tube and with its enlarged end in a contracted end of the said second tube and holding the remainder of the tubes out of contact, then fusing the ends of the two tubes which are in contact and uniting them, and blowing through the inner tube to form a bulb below the point of junction of the two tubes in the outer tube.

3. The herein described method of making thermometers consisting of a plurality of concentric tubes of different diameter and joined together, which consists in first taking a hollow tube, fusing one end and spreading it to form an enlargement, then blowing through the interior of the tube from the opposite end and opening the end which has been closed by the fusing and spreading operation, forming a second or outer tube of greater internal diameter than the external diameter of the first tube and with a closed contracted end, placing the first tube inside the second with the enlargement in the said contracted end, heating the said ends and uniting them and blowing through the inner tube to form a bulb below the junction of the two tubes in the end of the outer tube.

4. The herein described method of making thermometers consisting of a plurality of concentric tubes of different diameter and joined together, which consists in first taking a hollow tube, fusing one end and spreading it to form an enlargement, then blowing through the interior of the tube from the opposite end and opening the end which has been closed by the fusing and spreading operation, forming a second or outer tube of greater internal diameter than the external diameter of the first tube and with a closed contracted end thicker than its sides, placing the first tube inside the second with the enlargement in the said contracted end, heating the said ends and uniting them and blowing through the inner tube to form a bulb below the junction of the two tubes in the end of the outer tube.

5. The herein described process of making thermometers which consists in first forming a long mercury tube, with a relatively small bore and an enlargement at one end having an opening communicating with the bore, forming an outer tube of greater diameter than the inner tube and with a closed contracted end, placing the first tube within the second and with the enlarged end in the contracted end, then fusing the two ends and thus uniting them and blowing through the first tube to expand the lower end of the second tube and form

a bulb therein and a flaring channel connecting the bore of the first tube with said bulb.

6. The herein described process of making thermometers and the like, which consists in taking a tube of glass, expanding one end thereof, then placing the expanded end in the bottom of a tube with a closed end, then fusing the two ends and forming a bulb in the bottom of the second tube by blowing through the first tube.

Witness my hand this 9th day of May, 1918, at the city of New York, in the county and State of New York.

MAX E. MOELLER.