March 19, 1963 F. V. BOYLAN 3,082,024

PLASTIC DIP TUBE LOCKING OR SECURING MEANS

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FIG.2

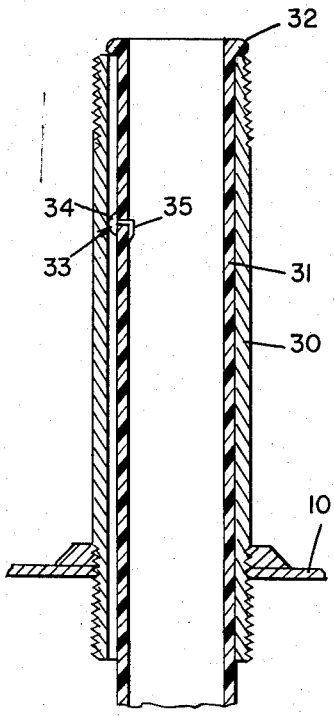


FIG.1

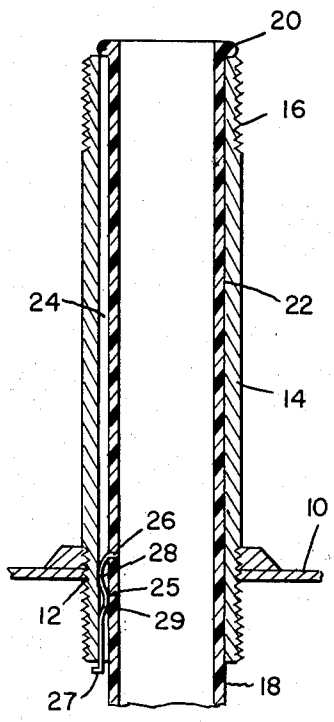


FIG.3

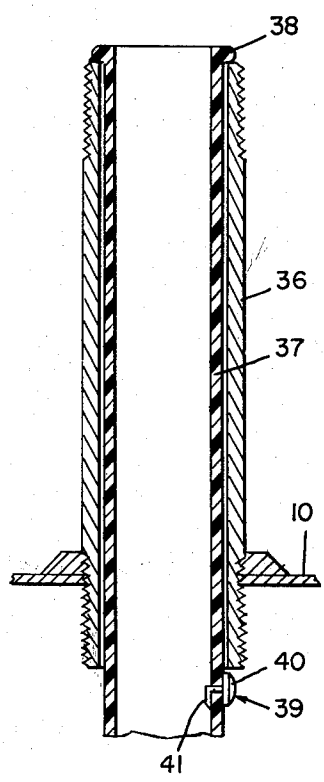


FIG.4

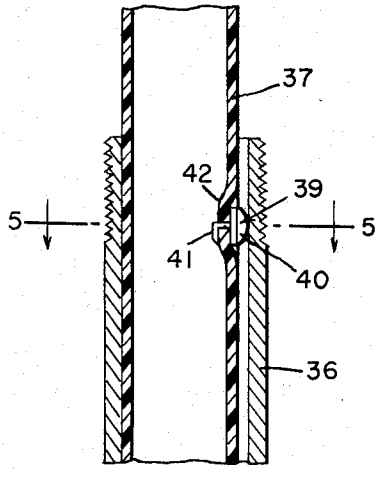
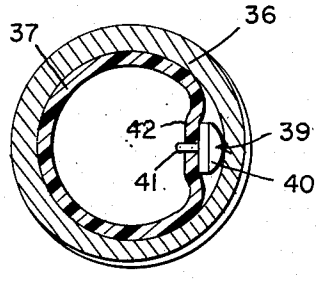


FIG.5



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FIG.6

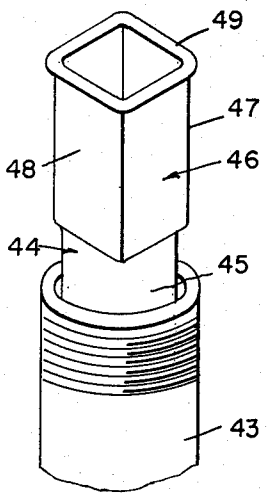


FIG.9

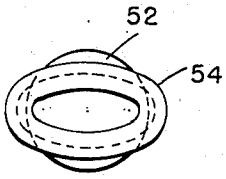


FIG.12

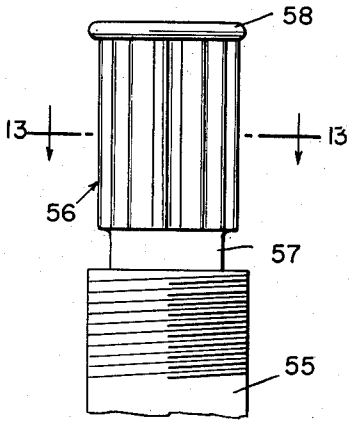


FIG.10

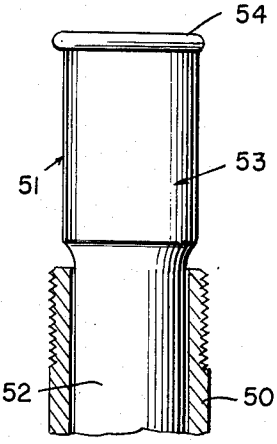


FIG.7

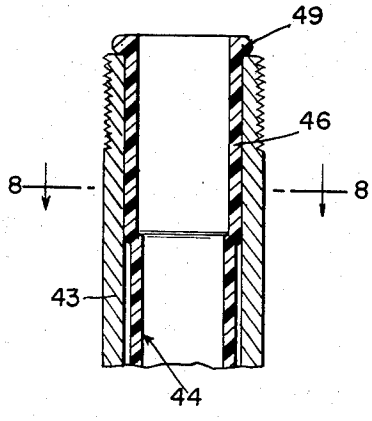


FIG.13

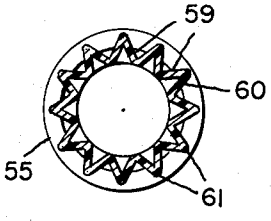


FIG.11

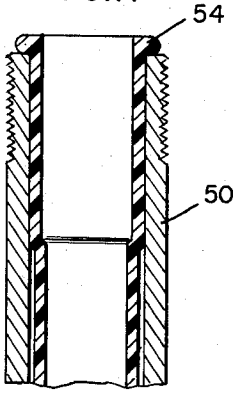


FIG.14

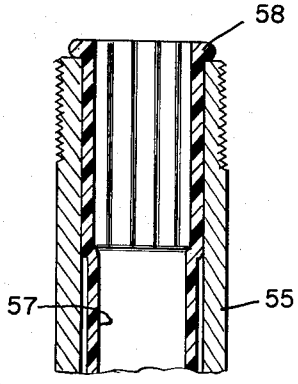
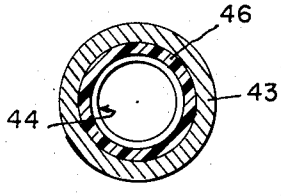


FIG.8



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United States Patent Office 3,082,024
Patented Mar. 19, 1963

3,082,024

PLASTIC DIP TUBE LOCKING OR SECURING MEANS

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Filed Mar. 26, 1959, Ser. No. 802,066
5 Claims. (Cl. 285—140)

This invention relates generally to the class of water heating devices and is concerned more particularly with the mounting in a domestic water heater of a dip tube.

As is well known, water heaters such as the usual domestic storage heaters, have top water inlet and outlet connections and the cold water inlet embodies a coupling nipple in which is suspended a long tube which extends to near the bottom of the heater tank so that as hot water is drawn from the top of the tank through the outlet, the inflowing cold water will not decrease the temperature of the outflowing water by reason of the fact that it is introduced at the bottom of the tank.

Various arrangements have been devised for maintaining the water inlet tube or dip tube in position, these dip tubes in the past having been formed of metal and they usually are so suspended in the inlet nipple that some movement is possible which when the same occurs creates an undesirable noise.

Use has been made of plastic dip tubes of a hard or relatively hard synthetic resin plastic, but these tubes also are found to move or shift their position due to the forces created by the jet action of the water passing into the tube, thereby causing water hammer and accordingly it becomes desirable to provide some means for fastening or locking the tube in the coupling nipple or otherwise restricting the movement thereof due to the action of the entering water stream.

It is an object of the present invention, in the light of the foregoing, to provide new and novel means whereby a plastic dip tube can be effectively held in position in a supporting nipple through which it passes into the water tank in such a manner that it cannot move axially in the nipple.

It is another object of the invention to provide a plastic dip tube having in association with a flanged top end adapted to rest upon the top edge of the coupling nipple through which it extends, and which flange prevents movement of the tube downwardly through the nipple, an additional holding means which will effectively prevent reverse or upward movement of the dip tube in the nipple.

A still further object of the invention is to provide an improved dip tube construction wherein means is provided which will maintain a locking connection between the dip tube and either an opposing wall surface of the nipple in which it is suspended or an inner end of the nipple whereby to maintain the dip tube against the stated reverse movement in the nipple.

The invention broadly contemplates the provision in one aspect thereof, of an element carried by the dip tube which when the dip tube is inserted through the supporting nipple will, in one embodiment of the invention, establish a sufficiently strong frictional engagement with the inner wall of the nipple to prevent the movement of the dip tube therein, or prevent reverse movement of the dip tube in the nipple by engagement with the bottom or inner end of the supporting nipple.

In another aspect of the invention the frictional holding means for the dip tube is embodied in the formation of the dip tube itself in a portion of the upper end thereof whereby the said formed upper end portion of the tube must be forcibly inserted into the supporting nipple and the dip tube will thereby be caused by reason of its inherent resiliency and flexibility to shape itself to the interior contour of the supporting nipple and establish the desired tight frictional engagement therewith such as will result in holding the tube against axial movement.

More specifically with regard to the stated second aspect of the invention, the dip tube through a portion of its upper end may be made of polygonal cross section or elliptical cross section or longitudinally fluted so that in certain transverse directions it will have a width greater than the inside diameter of the supporting nipple and when forced into the supporting nipple the parts having the greater width will be pressed in and adjacent parts will be pressed out and as a result the dip tube will substantially shape itself to the round or circular contour of the supporting nipple.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming part of the specification, with the understanding, however, that the invention is not confined to a strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modificaions mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

FIG. 1 illustrates in longitudinal section a coupling nipple such as forms a conventional part of a domestic water heater and showing therein and also in longitudinal section the upper end portion of a plastic dip tube constructed in accordance with a first embodiment of the present invention, wherein both friction and locking means are employed for holding the dip tube in position;

FIG. 2 is a view corresponding to FIG. 1, but illustrating a second embodiment of the invention wherein a friction button is carried by the dip tube and is pressed in firm contact against the inner wall surface of the coupling nipple;

FIG. 3 is a sectional view corresponding to the preceding views but showing a locking means embodying a button carried by the dip tube for engagement with the lower or inner end of the coupling nipple;

FIG. 4 is a detail sectional view illustrating the manner in which the wall of the plastic dip tube is pressed inwardly during the process of inserting the dip tube into the coupling nipple shown in FIG. 3, so that when the latching button reaches the lower end of the nipple the flexibility of the tube will force it outwardly to its operative position;

FIG. 5 is a sectional view taken substantially on the line 5—5 of FIG. 4;

FIG. 6 is a view in perspective of the top end of the coupling nipple and of a portion of the top end of the dip tube wherein such portion is molded or otherwise formed of polygonal cross section to establish the desired frictional engagement with the inside of the nipple when the dip tube is fully inserted;

FIG. 7 is a sectional view through the upper end of the nipple and the dip tube of FIG. 6 showing the close frictional contact between the two members;

FIG. 8 is a transverse section taken on the line 8—8 of FIG. 7;

FIG. 9 is a top end view of another form of the dip tube wherein a portion of the upper end is made of elliptical cross sectional form with the long axis of the ellipse having a length greater than the inside diameter of the coupling nipple;

FIG. 10 is a view in side elevation of the tube shown in FIG. 9 and illustrating a portion of the coupling nipple into which it is inserted;

FIG. 11 is a longitudinal section through the nipple and tube shown in FIG. 10 with the tube fully inserted in the nipple;

FIG. 12 is a view in side elevation of another embodiment of the dip tube structure showing the same in position ready for insertion into the supporting nipple, the upper end portion of which is shown in elevation;

FIG. 13 is a sectional view taken substantially on the line 13—13 of FIG. 12, showing the fluted formation of the upper end portion of the dip tube forming a part of that figure;

FIG. 14 is a longitudinal sectional view through the upper portion of the supoprting nipple and the dip tube shown in FIG. 12 with the dip tube fully inserted into the nipple.

Referring now more particularly to the drawings, the numeral **10** in FIG. 1 designates a portion of the top of the tank or boiler of a water heater having threaded into the reinforced opening **12** thereof one end of a conventional coupling nipple **14**, the upper end of which is threaded as indicated at **16** for connecting a water pipe thereto.

The numeral **18** generally designates a dip tube formed of a suitable semi-rigid elastic synthetic resin plastic and having the top end thereof molded or otherwise formed with an encircling rib, flange or collar **20** of an overall diameter greater than the inside diameter of the nipple **14** whereby when the dip tube is introduced into the nipple it cannot slip down therethrough but will be suspended in the manner illustrated.

The outside diameter of the dip tube is somewhat less than the inside diameter of the nipple **14** so that when the dip tube is in working position in the nipple it will be held by the securing means in an eccentric position where it will engage at one side against the inner wall surface of the nipple as indicated at **22** while at the diametrically opposite side a slight space **24** will remain.

In the first embodiment of the securing means for preventing the dip tube from moving axially in the nipple, there is provided a combined friction and latching element which is generally designated **25**. This element **25** may be in the form of a relatively thin resilient metal ribbon or spring wire, as preferred, shaped intermediate its ends to an ogee longitudinal contour and having one end right angularly turned as indicated at **26** and with the opposite end turned in the opposite direction, substantially at right angles to the length of the strip as indicated at **27**. Between these turned ends the bowed contour provides the oppositely curved spring portions **28** and **29**. The angularly turned end **26** of the element **25** is secured in the wall of the dip tube as shown, in such a manner as to position the element **25** longitudinally of the tube and the holding element has this end **26** secured at such a distance from the flange or collar **20** that the distance between the underside of this flange or collar and the top of the outwardly turned end portion **27** will be approximately the same or slightly greater than the length of the coupling nipple. Thus when the dip tube is introduced into the coupling nipple and pushed through until the flange **20** rests upon the top end of the coupling nipple, the free inner end of the holding or securing device **25** will project sufficiently beyond the inner end of the nipple **14** to permit the angled end portion to snap out across the inner end of the nipple **14** and at the same time the resiliently bowed portion of the element **25** will be slightly compressed between the dip tube and the coupling nipple so as to have frictional engagement with the wall of the latter. It will, of course, be understood that the springy character of the holding device **25** will permit the outer turned portion **27** to be pushed toward the dip tube so that no difficulty will be encountered in sliding the holding device **25** through the nipple to the locking position.

FIG. 2 illustrates another embodiment of the invention employing a frictional engagement between an element carried by the dip tube and the inner wall surface of the coupling nipple. Here the coupling nipple is designated **30** while the dip tube is generally designated **31** and has the top end formed as a flange or collar to rest upon the top end of the coupling nipple.

In this second embodiment of the invention a button or tack **33** is secured against the outer side of the dip tube at a position where it will be located between the ends of the coupling nipple when the dip tube is fully inserted therein. This button or tack may be formed of metal or other suitable material and comprises the head portion **34** and a pin **35** which is here shown as passing through the wall of the dip tube and turned down at its inner end so as to lock the button head firmly in position. While this is a preferred construction it will be appreciated that other means might be employed for holding the button in position. The button head is of sufficient height so that when the dip tube is forced into the coupling nipple it will be made to bear against the inner surface of the coupling nipple with sufficient frictional force to effectively hold the dip tube against movement in the nipple.

FIGS. 3 to 5 illustrate a third embodiment of the invention and in these figures the coupling nipple is generally designated **36** while the dip tube is designated **37** and the flanged upper end thereof is designated **38**. This third embodiment also makes use of a button or tack fixed to the wall of the dip tube and here the tube retaining button or tack is generally designated **39**. As in the case of the embodiment shown in FIG. 2, this tack may be formed of any suitable material such as metal or the like and embodies the head portion **40** and a means for securing it to the wall of the dip tube here shown as a pin **41**, which is extended through the dip tube and bent over to hold the button firmly in place. In this embodiment of the invention the button does not function by friction to hold the dip tube in place, but it is located so as to be spaced from the flange or collar **38** a distance approximating the length of the coupling nipple so that when the dip tube is fully inserted in the nipple the button or tack will be located outside of the nipple close to the inner end thereof and will extend across the inner end of the nipple to prevent outward movement of the dip tube. In this case the button may be somewhat larger or higher than the button **33** so that it will extend across the inner end of the nipple and consequently when the dip tube is being inserted the wall thereof will have to yield or flex inwardly as indicated at **42** to permit the button to pass through and when the button reaches the inner end of the nipple or passes beyond the inner end this flexed portion of the wall of the resilient dip tube will thrust the button outwardly to tube-securing or locking position.

FIGS. 6 to 14 illustrate embodiments of the invention which involve a particular or special formation or configuration of a portion of the dip tube itself for effecting the frictional holding of the dip tube in position in the nipple. Referring first to FIGS. 6 to 8 illustrating these modified forms of the dip tube, the numeral **43** generally designates the upper end portion of the coupling nipple while the numeral **44** generally designates the modified dip tube structure. The major portion of the body of the dip tube is of circular configuration and somewhat less in overall diameter than the inside diameter of the nipple **43** and this portion of the dip tube body is designated **45**. The outer end of the dip tube is of polygonal cross sectional form through a short extent of its length as indicated generally by the numeral **46**, such cross sectional form here being shown as square, thus embodying the longitudinal corners **47** and the intermediate flat faces or flat portions **48** and the top end of this polygonal portion is defined by the surrounding flange or collar **49**.

The dimensions of the polygonal portion **46** are calculated with respect to the interior diameter of the nipple **43** so that the distance transversely of the portion **46** between one edge **47** and the opposite edge is slightly greater than the inside diameter of the nipple and thus when this polygonal portion is forced into the nipple, inward pressure will be applied to the four corners **47** and

this will cause an out-bowing of the flat portions 48 between the corners to bring the outer surfaces of these portions 48 into firm contact with the inner surface of the nipple. In other words, the dimensioning of the polygonal portion will be such with respect to the interior diameter of the nipple that when this compression of the corners is brought about, this portion 46 will change from polygonal form to a circular form and fit tightly in the nipple.

FIGS. 9 to 11 illustrate another formation of the upper end portion of the dip tube which will conform itself to the inside dimensions of the nipple when the tube is placed therein. In these figures, the nipple is generally designated 50 and the dip tube is generally designated 51 with the major extent of the body designated 52 and the specially formed or contoured upper end portion is designated 53. This special configuration of the portion 53 is elliptical in cross section as shown in FIG. 9 and the upper end of this elliptical portion is bordered or terminated by the surrounding outstanding rib or flange 54 to rest upon the top end of the nipple.

In this elliptical form the long axis of the ellipse is greater than the inside diameter of the nipple 50 while the short axis is less than the inside diameter of the nipple so that when the elliptical portion 53 is forced into the nipple the ends of the ellipse will be forced toward one another and the sides of the ellipse will be forced outwardly and this portion will then conform to and tightly frictionally engage the inner surface of the nipple as illustrated in FIG. 11.

FIGS. 12 to 14 illustrates still another form of the upper end portion of the dip tube whereby the desired frictional coupling or locking of the tube in the nipple is effected. In these figures the nipple is generally designated 55 and the deformed upper end portion of the dip tube is generally designated 56. The main body portion of the dip tube is designated 57.

The top end of the portion 56 of the dip tube has, as in all of the other cases, the integral outstanding flange or collar 58 for engagement with the top end of the nipple and below this flange the portion 56 is shaped to have the longitudinal flutes 59 with the intermediate portions or ribs 60 more or less pointed or of triangular cross section and the distance between the point or edge 61 of one of the ribs and the point or edge of a diametrically opposite rib is slightly greater than the inside diameter of the coupling nipple 55. With this construction it will be seen that when the fluted or ribbed portion 56 is forced into the coupling nipple, the top end portion of the dip tube will conform itself to the circular contour of the nipple.

I claim:

1. A dip tube for installation in an upright water inlet nipple of a water heater, said tube comprising a plastic tubular body of a length to extend entirely through a water heater inlet nipple, the tube having a top end with means thereat for engagement upon the top end of the inlet nipple to suspend the tube in the inlet nipple, and holding means positioned upon the outer side of the dip tube at a location materially closer to the top end of the tube than to the bottom end thereof for engagement with the nipple below the top end of the latter, the said means comprising a one piece body having a part having an end formed to pierce the plastic tube material and passing through the tube material and anchoring the body thereon and the body having a part projecting outwardly from the outer side of the tube and having an outwardly rounded surface and said outwardly rounded surface facilitating introduction of said body into an inlet nipple and the movement of the body along the inner surface of the nipple and said part functioning upon disposition of the dip tube in working position in the nipple to oppose outward movement of the dip tube.

2. The invention as defined by claim 1, wherein the said part of the body projecting outwardly from the outer side of the tube is in the form of a button.

3. The invention as defined by claim 1, wherein the said body part having an end formed to pierce the plastic tube material is in the form of a pointed pin and the said part projecting outwardly from the outer side of the tube is in the form of a button head on the pin.

4. As a new article of manufacture, a plastic dip tube having a circumferentially directed top end portion of a diameter greater than the outside diameter of the remaining portion of the tube, and a holding element secured upon the outside of the tube below said top end portion, said holding element comprising a strip of resilient material disposed longitudinally of the tube and having a top end portion fixed to the tube and a lower end portion free of connection with the tube and adapted to be flexed outwardly, said strip having a portion adjacent to the top end thereof outwardly bowed, and the strip having a lower terminal portion projecting substantially at right angles thereto and outwardly with respect to the tube.

5. The combination of an upright water inlet nipple of a water heater and a dip tube comprising a plastic tubular body of materially greater length than the inlet nipple and of a diameter through a major portion of the length thereof to extend through the nipple, the dip tube having a top end with means thereat for seating on the top end of the upright inlet nipple, and a means carried by the wall of the plastic tubular body and projecting laterally from the outer side of such wall for engagement with the water inlet nipple when the plastic tubular body is in position with the said top end means seated on the top of the inlet nipple, for engaging the water inlet nipple and holding the plastic tubular body against longitudinal movement in the inlet nipple, the last-stated means comprising an elongate body of resilient material having a portion thereof longitudinally and outwardly bowed and located at a position with respect to the top end of the tubular body whereby to frictionally engage the inner surface of the inlet nipple and said elongate resilient body further terminating at its lower end in a lateral extension and located in a position with respect to the lower end of the inlet nipple to engage at least part way across such lower end of the inlet nipple.

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