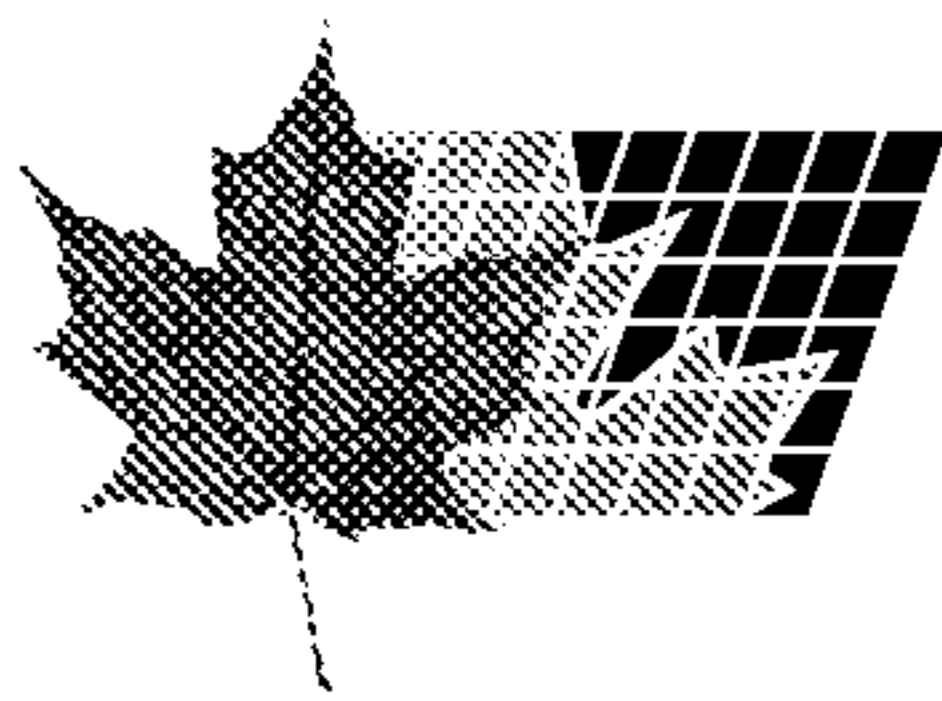
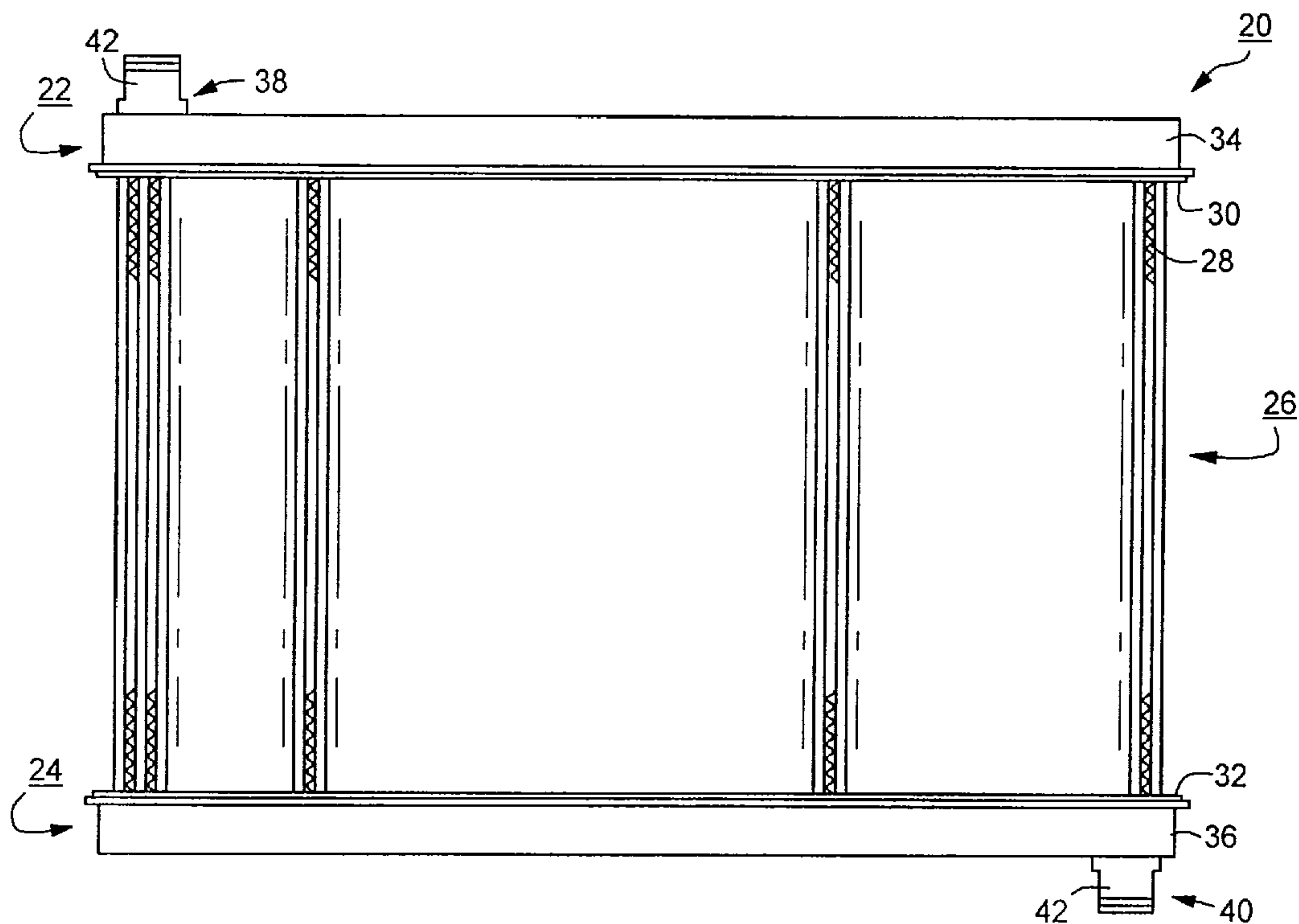




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(54) **ENSEMBLE DE RESERVOIR-RACCORD DE TUYAU ET
METHODE D'ASSEMBLAGE**
(54) **HOSE CONNECTOR-TANK ASSEMBLY AND ASSEMBLY
METHOD**



(57) A tank assembly (22, 24) includes a tank (34, 36) having a wall (62) with an opening (64) therethrough and adapted to be fitted to the header (30, 32) of a heat exchanger (20), and a hose connector (42) having a first end (46) and a stop (60, 76, 78) disposed a predetermined distance from the first end (46). The stop (60, 76, 78) abuts the tank wall (62) with the first end (46) of the hose connector (42) disposed in the opening (64) in the tank wall (62) to prevent the hose connector (42) from being disposed further into the opening (64). The first end (46) of the hose connector (42) is deformed against the wall (62) of the tank (34, 36) oppositely of the stop (60, 76, 78) to prevent withdrawal of the hose connector (42) from the tank (34, 36). A method of assembling the tank assembly (22, 24) is also provided.

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ABSTRACT

A tank assembly (22, 24) includes a tank (34, 36) having a wall (62) with an opening (64) therethrough and adapted to be fitted to the header (30, 32) of a heat exchanger (20), and a hose connector (42) having a first end (46) and a stop (60, 76, 78) disposed a predetermined distance from the first end (46). The stop (60, 76, 78) abuts the tank wall (62) with the first end (46) of the hose connector (42) disposed in the opening (64) in the tank wall (62) to prevent the hose connector (42) from being disposed further into the opening (64). The first end (46) of the hose connector (42) is deformed against the wall (62) of the tank (34, 36) oppositely of the stop (60, 76, 78) to prevent withdrawal of the hose connector (42) from the tank (34, 36). A method of assembling the tank assembly (22, 24) is also provided.

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HOSE CONNECTOR-TANK ASSEMBLY AND ASSEMBLY METHOD

FIELD OF THE INVENTION

5 The present invention relates to a hose connector and tank assembly and a method for assembling such an assembly, in particular, a hose connector and tank assembly and assembly method which limits improper insertion of the hose connector into the tank.

BACKGROUND OF THE INVENTION

10 It is known in the heat exchanger art to use a pipe fitting attached to a tank forming part of the heat exchanger to define either an inlet or an outlet for the tank. These pipe fittings may be referred to as hose connectors, for they serve as the attachment site between a hose and the tank.

15 Typically, a first end of the hose connector is disposed into an opening in the tank. To prevent relative movement between the hose connector and the tank, the hose connector is secured to the tank with a tack weld, for example. The hose connector-tank assembly, which is conventionally made of aluminum, then undergoes a brazing process to form a sealed joint between the hose connector and the tank.

20 This process has its disadvantages. The hose connector may be inserted too far or not far enough into the opening in the tank during the assembly process. If the hose connector is inserted too far into the opening, the hose connector may obstruct the flow of the coolant within the tank and/or between the tank and the open ends of the tubes in a header to which the tank is fitted. If the hose connector is not inserted far enough into the tank, the joint between the hose connector and the
25 tank may be weakened and/or not fluid tight.

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SUMMARY OF THE INVENTION

According to an aspect of the present invention, a tank assembly for a heat exchanger includes a tank having a wall with an opening therethrough and adapted to be fitted to the header of a heat exchanger, and a hose connector having a first end and a stop disposed a predetermined distance from the first end greater than the thickness of the wall. The stop abuts the wall with the first end of the hose connector disposed in the opening in the tank wall to prevent the hose connector from being disposed further into the opening. The first end of the hose connector is deformed against the wall of the tank oppositely of the stop to prevent withdrawal of the hose connector from the tank. Preferably, the hose connector body includes a wall, and the wall may have a plurality of slits therethrough starting at the first end of the hose connector and extending no further than the stop.

Most preferably, the slits may extend no further than a distance equal to the predetermined distance from the first end of the hose connector less the thickness of the tank wall.

The hose connector may include a stepped wall defining a shoulder at the predetermined distance from the first end, the shoulder defining the stop. Also, the hose connector may include a wall deformed to define a rib at the predetermined distance from the first end, the rib defining the stop.

The stop and the first end may be brazed to the tank to form leak-tight joints therebetween.

According to another aspect of the present invention, a tank assembly for a heat exchanger includes a tank having a wall with an interior surface, an exterior surface, and an opening therethrough and adapted to be fitted to the header of a heat exchanger, and a hose connector having a first end and a stop disposed a predetermined distance from the first end greater than the thickness of the wall. The stop abuts the exterior surface of the wall of the tank to prevent the hose connector

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from being disposed further into the opening. The first end is disposed through the opening and is deformed against the interior surface of the wall of the tank to prevent the hose connector from being disposed further into the opening.

5 Braze alloy may be applied to the exterior and/or the interior surface of the tank. Braze alloy may be applied to the hose connector. The stop may be brazed to the exterior surface of the wall of the tank, and the first end may be brazed to the interior surface of the wall of the tank.

10 According to a further aspect of the invention, a method of positioning a hose connector relative to a tank for a heat exchanger includes providing a tank with a wall having an opening therethrough, and providing a hose connector with a first end and a stop disposed a predetermined distance greater than the thickness of the wall from the first end. The first end of the hose connector is disposed into the opening in the tank wall, and the stop is abutted against the wall to position the first end relative to the tank. The first end of the hose connector is
15 deformed against the wall of the tank.

The method may include applying braze alloy to the tank and/or the hose connector. The method may also include brazing the hose connector to the tank.

20 The step of deforming may include the step of flaring out the first end of the hose connector against the wall of the tank.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of a heat exchanger with a connector/tank assembly made according to the present invention attached thereto;

25 Fig. 2 is an end view of an embodiment of a hose connector made according to the present invention;

Fig. 3 is a side view of the hose connector of Fig. 2;

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Fig. 4 is a partial cross-sectional view of the hose connector of Fig. 2 and a wall of a tank in a pre-insertion state;

Fig. 5 is a partial cross-sectional view of the connector-tank assembly of Fig. 4 with a first end of the connector inserted into an opening in the wall of the tank;

Fig. 6 is a partial cross-sectional view of the connector-tank assembly of Fig. 4 with the first end of the connector deformed against the wall of the tank;

Fig. 7 is an end view of another embodiment of a hose connector made according to the present invention;

Fig. 8 is a side view of the hose connector of Fig. 7;

Fig. 9 is an end view of still another embodiment of a hose connector made according to the present invention;

Fig. 10 is a side view of the hose connector of Fig. 9; and

Fig. 11 is a bottom view of the hose connector of Fig. 9.

BRIEF DESCRIPTION OF THE DETAILED EMBODIMENTS

An embodiment of the present invention is explained first with reference to Fig. 1. A heat exchanger 20 is shown, with first and second tank assemblies 22, 24 and a plurality of tubes 26 extending therebetween and in fluid communication therewith. Fins 28 are disposed between the tubes 26. Each of the first and second tank assemblies 22, 24 includes a header 30, 32 to which the tubes 26 are attached, and a tank 34, 36. An first port 38 is provided to the tank 34, while a second port 40 is provided to the tank 36 to allow coolant to enter and exit the heat exchanger 20. Although the ports 38, 40 are shown in Fig. 1 in separate tanks 34, 36, such that the coolant flows in an odd number of passes through the tubes 26, the ports 38, 40 may be in the same tank 34 or 36 so that the coolant flows through tubes

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26 in an even number of passes. The presence or absence of conventional baffles within the tank 34 and/or tank 36 will define the number of passes.

Each of the ports 38, 40 is defined by a hose connector 42, which is attached to the tanks 34, 36. Figs. 2-3 show a first embodiment of the hose connector 42 according to the present invention. The hose connector 42 has a tubular body 44 with a first end 46 and a second end 48. The body 44 of the hose connector 42 is flattened in a section 50 adjacent to the first end 46 so that the latter is in the form of an oval. The second end 48 is circular to receive a hose, and includes a peripheral radially outwardly directed hose retaining rib 52. In use, a hose (not shown) is fitted about the second end 48, and over the rib 52. A hose clamp (not shown) is disposed about the hose between the end 46 and the rib 52 and tightened to secure the hose in fluid tight relation to the hose connector 42.

The body 44 also has a wall 54 which defines a passage 56 therethrough. The body 44 also has a stepped region 58 adjacent to the first end 46, which may be formed by milling down the wall 54 adjacent to the first end 46. The stepped region 58 defines a shoulder or stop 60 which is disposed a distance "d" from the first end 46.

Figs. 4-6 show an assembly of the hose connector 42 with the tank 34, for example. In Fig. 4, the hose connector 42 is shown in a pre-insertion state relative to a wall 62 of the tank 34. It will be recognized that an opening 64 is provided in the wall 62 and is sized to receive the first end 46 of the hose connector 42.

Because the tank 34 and hose connector 42 are preferably made of aluminum, the tank 34 and hose connector 42, as assembled, will preferably be brazed together to provide a leak-tight joint, although alternative means of attachment, for example soldering, can be used when the tank 34 and/or hose connector 42 are made of other materials. Assuming a brazed joint is to be formed,

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5 braze alloy will be applied before assembly to the wall 62 of the tank and/or the body 44 of the hose connector 42. As shown in Fig. 4, because the wall 54 of the hose connector 42 is milled down to define the shoulder 60, it is more advantageous to apply the braze clad to the wall 62 of the tank 34. This is the case because the milling process used to form the stepped region 58 will remove the braze alloy from the exterior surface of the wall 54 of the hose connector 42.

10 The cladding may be applied to both sides 66, 68 of the wall 62, or alternatively only to one side 66 or 68. It is preferable, however, to use cladding on both sides 66, 68 of the wall 62, so that any gap between the wall 62 and the body 44 of the hose connector 42 is filled and so that a brazed joint may be formed both on the internal and external sides 66, 68 of the wall 62. Overall, the clad wall 62 has a thickness "t" (inclusive of the thickness of the cladding material) which is less than the distance "d". Alternatively, braze alloy in the form of a powder may be applied to the joint to be formed.

15 As shown in Fig. 5, the hose connector 42 is moved in the direction of an arrow 70, such that the first end 46 of the hose connector 42 enters the opening 64 in the wall 62. With continued movement of the hose connector 42 in the direction of the arrow 70, the shoulder 60 of the hose connector 42 abuts the external surface 66 of the wall 62. Abutment of the shoulder 60 with the external surface 66 of the wall 62 prevents further movement of the hose connector 42 into the opening 64. It will be recognized that the first end 46 of the hose connector 42 extends into the tank 34 a distance equal to "d" (the predetermined distance from the first end 46 to the shoulder 60) less "t" (the thickness of the wall 62 of the tank 34).

20 Fig. 6 shows the completed assembly 72 of the hose connector 42 and the tank 34, wherein the first end 46 of the hose connector 42 has been deformed to form a flared out region 74 which abuts against the interior surface 68 of the tank wall 62. The abutment of the flared out region 74 and the interior surface 68 of the

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tank wall 62 prevents separation of the hose connector 42 from the tank wall 62, and, in particular, the first end 46 from being withdrawn from the opening 64 in the tank wall 62. Moreover, the flaring out of the first end 46 urges to the shoulder 60 into closer abutment with the external surface 68 of the wall 62.

5 It will be recognized that this method ensures that the first end 46 of the connector 42 is disposed only to a predetermined depth through the opening 64 in the tank wall 62. In particular, the method achieves this result without the necessity of tack welding the hose connector 42 to the tank wall 62. The post
10 connector-tank assembly 72 can now be brazed, thereby providing a secure and leak tight joint between the hose connector 42 and the tank 34, in particular between the shoulder 60 of the hose connector 42 and the external surface 68 of the wall 62 and the flared out region 74 of the hose connector 42 and the internal surface 66 of the wall 62.

 A modified embodiment of the invention is shown in Figs. 7-8. In the
15 interest of brevity, like components are given the same reference numerals as in the previous description of the embodiment of Figs. 1-6, and will not be redescribed. The embodiment of Figs. 7-8 omits the stepped region 58 adjacent the first end 46 in favor of oppositely directed ribs or beads 76, 78 which define a stop. The ribs 76, 78 are located on opposite flat sides 80, 82 of the flattened section 50, and have stop
20 surfaces 84, 86 most nearly adjacent the first end 46 spaced therefrom by the distance "d".

 The ribs 76, 78 may be formed, for example, by applying a force to the interior surface of the wall 54 to deform the wall 54 radially outward such that a raised area is formed on the sides 80, 82 of the body 44 of the hose connector 42.
25 Because, unlike the first embodiment, it is not necessary to remove material from the sides 80, 82 to form the ribs 76, 78, braze alloy may be applied to the sides 80, 82 instead of or in addition to the braze alloy applied to the wall 62 of the tank 34, for

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example. By applying the braze alloy to the hose connector 42 instead of the tank 34, less braze alloy may be used, resulting in a less expensive hose connector-tank assembly 72. However, by applying braze alloy to the tank 34 is believed that there is less of a chance that a leak-tight braze joint will not form between the hose connector 42 and the tank 34.

The stop surfaces 84, 86 of the ribs 76, 78 serve the same purpose as the shoulder 60, i.e., to abut against the external surface 68 of the wall 62 of the tank 34, for example. With the stop surfaces 84, 86 abutting the external surface 68, the first end 46 of the hose connector 42 extends into the tank 34 a predetermined distance, depending on the values of the distance from the stop surfaces 84, 86 to the first end 46, the thickness of the wall 62 of the tank 34, and the placement of the cladding material. If the cladding material is applied to the surfaces 84, 86 and the exterior surface 68 of the wall, then the distance which the first end 46 of the hose connector 42 extends into the tank 34 will be reduced in accordance with the thickness of the cladding material applied.

A still further embodiment of the hose connector according to the present invention is shown in Figs. 9-11, again with like components numbered similarly. In addition to the ribs 76, 78, the hose connector 42 has four slits 88, 90, 92, 94. As best seen in Fig. 9, the wall is nominally rectangular with rounded corners; and the slots 88, 90, 92, 94 are located in such corners. The slits 88, 90, 92, 94 are provided to minimize the chance of metal tearing during the deformation process of the first end 46 of the hose connector 42. The slits 88, 90, 92, 94 also decrease the force required during the deformation process to deform the end 46 of the hose connector 42, and may increase the extent to which the end 46 may be flared out to maintain the hose connector 42 fixed to the wall 62 of the tank 34, for example. Preferably, the depth of the slit (shown as "s" in Fig. 11) is less than the distance "d" - "t" (the distance from the surfaces 84, 86 to the first end 46 less the

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thickness of the wall 62 of the tank 34), taking into account the placement and thickness of the cladding material.

It will be recognized that any of the embodiments of the hose connector 42 according to the present invention described above may be used to assure proper insertion of the hose connector 42 into the opening 64 in the tank wall 62. By preventing the hose connector 42 from being inserted too far into the tank 34, for example, the risk of flow obstruction due to the extension of the hose connector 42 into the tank 34 is limited. This is especially true as the end 46 of the hose connector 42 disposed in the tank 34 is flared out against the interior surface 74 of the tank 34 to secure the hose connector 42 and tank 34 together, thereby limiting the extent to which the hose connector 42 extends into the tank 34. Further, the risk of weak or leaky joints formed by not inserting the hose connector 42 far enough into the tank 34 may be avoided through the abutment of the body 44 of the hose connector 42 and the exterior surface 68 of the tank 34. The flaring out of the end 46 of the hose connector 42 against the interior surface 74 of the wall 62 also assists in encouraging a snug abutment of the body 44 of the hose connector 42 with the exterior surface 68 of the tank 34.

Still other aspects, objects, and advantages of the present invention can be obtained from a study of the specification, the drawings, and the appended claims.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A tank assembly for a heat exchanger comprising:

2 a tank having a wall with an opening therethrough and adapted to be fitted to the header of a heat exchanger; and

4 a hose connector having a first end and a stop disposed a predetermined distance from the first end greater than the thickness of the wall,

6 the stop abutting the wall with the first end of the hose connector disposed in the opening in the tank wall to prevent the hose connector from being disposed further into the opening,

8 the first end of the hose connector deformed against the wall of the tank oppositely of the stop to prevent withdrawal of the hose connector from the tank.

2. The tank assembly according to claim 1, wherein:

2 the hose connector body comprises a wall, and

4 the wall has a plurality of slits therethrough starting at the first end of the hose connector and extending no further than the stop.

3. The tank assembly according to claim 2, wherein:

2 the tank wall has a thickness, and

4 the slits extend no further than a distance equal to the predetermined distance from the first end of the hose connector less the thickness of the tank wall.

4. The tank assembly according to claim 1, wherein the hose

2 connector comprises a stepped wall defining a shoulder at the predetermined distance from the first end, the shoulder defining the stop.

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5. The tank assembly according to claim 1, wherein the hose
connector comprises a wall deformed to define a rib at the predetermined distance
from the first end, the rib defining the stop.

6. The tank assembly according to claim 1, wherein the stop and
the first end are brazed to the tank to form leak-tight joints therebetween.

7. A tank assembly for a heat exchanger comprising:
a tank having a wall with an interior surface, an exterior surface, and
an opening therethrough and adapted to be fitted to the header of a heat exchanger;
and

a hose connector having a first end and a stop disposed a
predetermined distance from the first end greater than the thickness of the wall,
the stop abutting the exterior surface of the wall of the tank to prevent
the hose connector from being disposed further into the opening,
the first end disposed through the opening and deformed against the
interior surface of the wall of the tank to prevent the hose connector from being
disposed further into the opening.

8. The tank assembly according to claim 7, further comprising
braze alloy applied to the exterior surface of the tank.

9. The tank assembly according to claim 8, further comprising
braze alloy applied to the interior surface of the tank.

10. The tank assembly according to claim 9, further comprising
braze alloy applied to the hose connector.

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11. The tank assembly according to claim 7, wherein the stop is
2 brazed to the exterior surface of the wall of the tank.

12. The tank assembly according to claim 11, wherein the first end
2 is brazed to the interior surface of the wall of the tank.

13. A method of positioning a hose connector relative to a tank
2 for a heat exchanger comprising the steps of:

providing a tank with a wall having an opening therethrough;

4 providing a hose connector with a first end and a stop disposed a
predetermined distance greater than the thickness of the wall from the first end;

6 disposing the first end of the hose connector into the opening in the
tank wall;

8 abutting the stop against the wall to position the first end relative to
the tank; and

10 deforming the first end of the hose connector against the wall of the
tank.

14. The method according to claim 13, further comprising the step
2 of brazing the hose connector to the tank.

15. The method according to claim 13, wherein the step of
2 deforming comprises the step of flaring out the first end of the hose connector
against the wall of the tank.

16. The method according to claim 15, further comprising the step
2 of brazing the hose connector to the tank with the stop abutting the tank wall.

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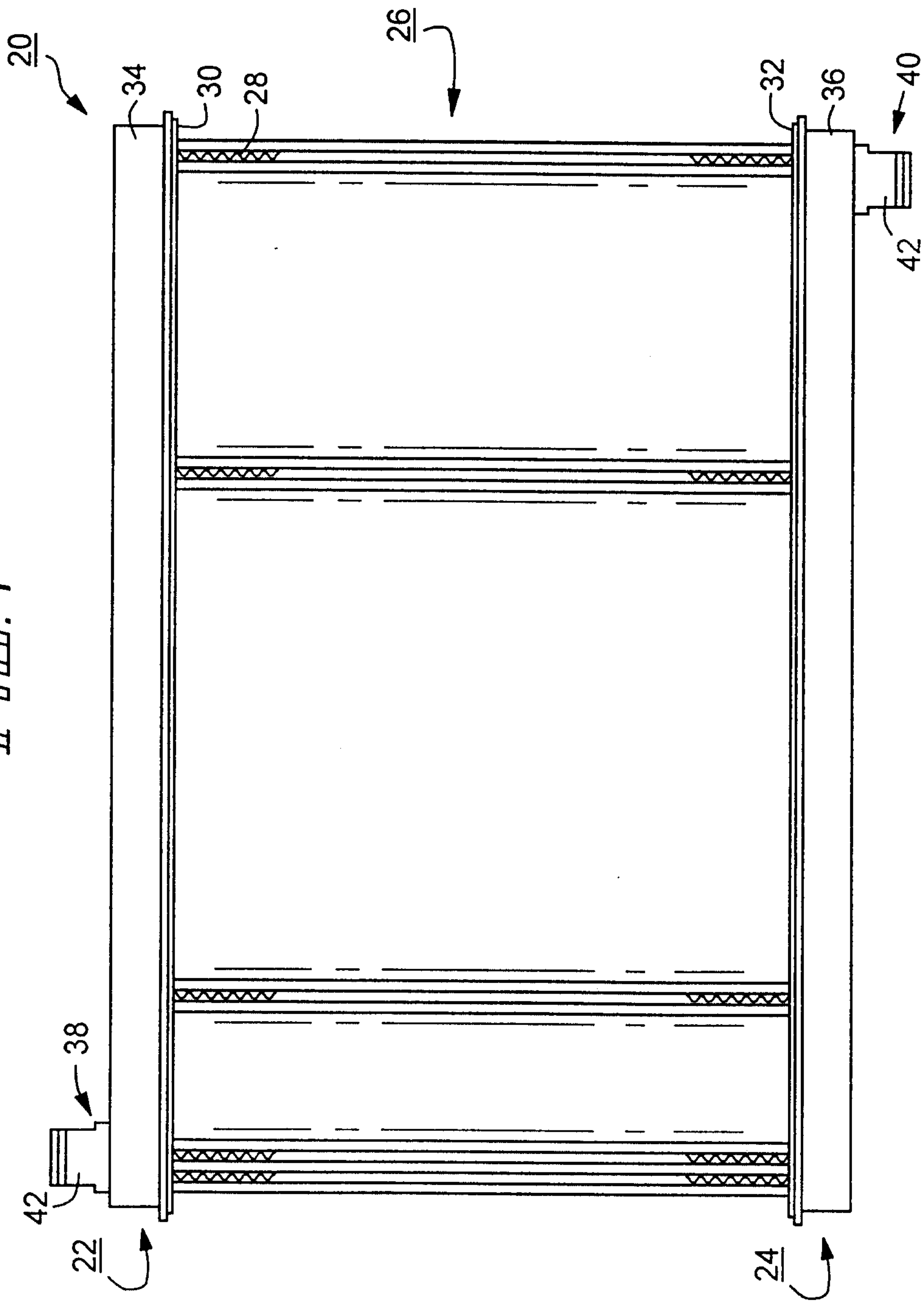
2 17. The method according to claim 13, further comprising the step
of applying braze alloy to the tank.

2 18. The method according to claim 17, further comprising the step
of brazing the tank to the hose connector.

2 19. The method according to claim 17, further comprising
applying braze alloy to the hose connector.

2 20. The method according to claim 19, further comprising brazing
the hose connector to the tank.

FIG. 1



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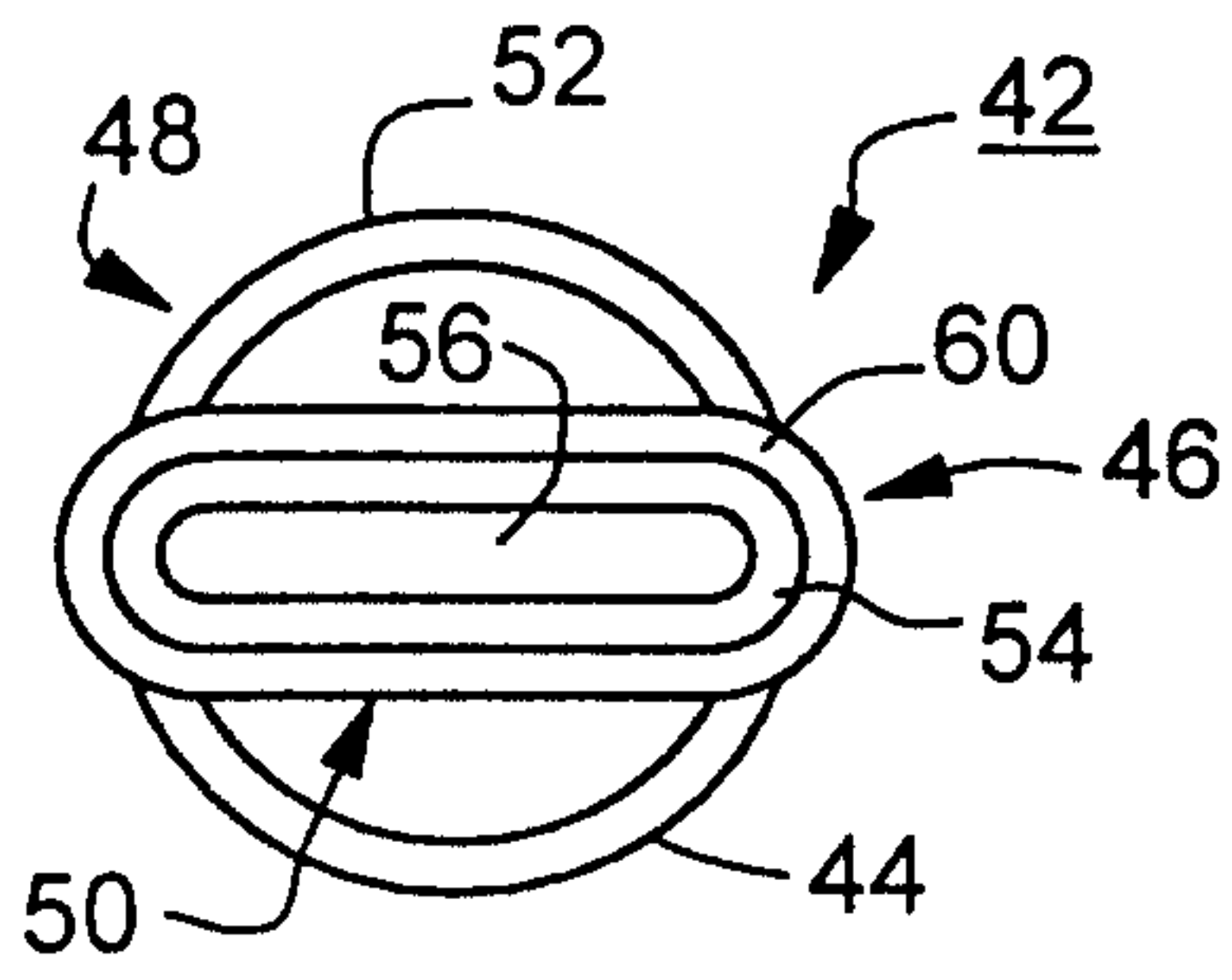


FIG. 2

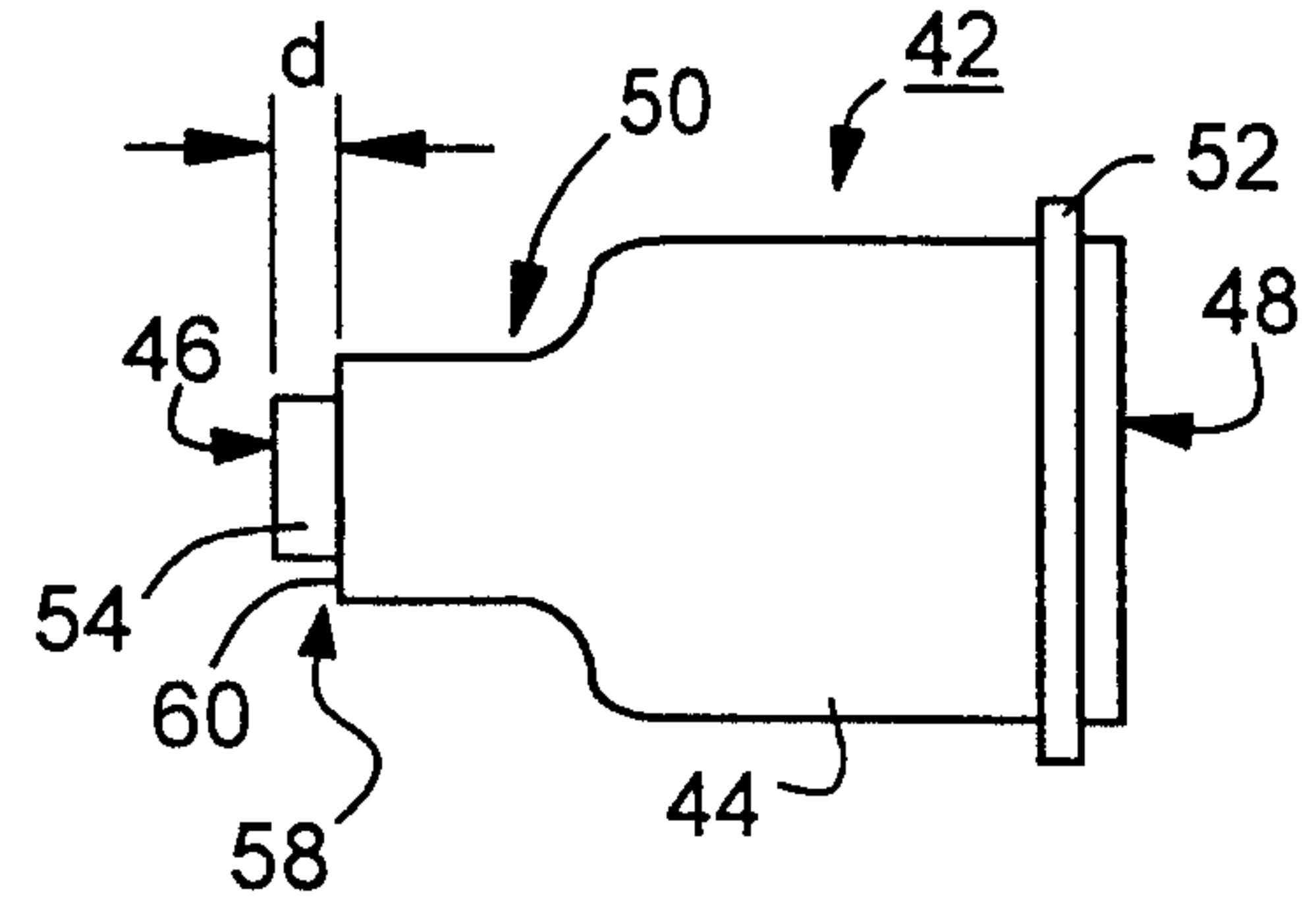


FIG. 3

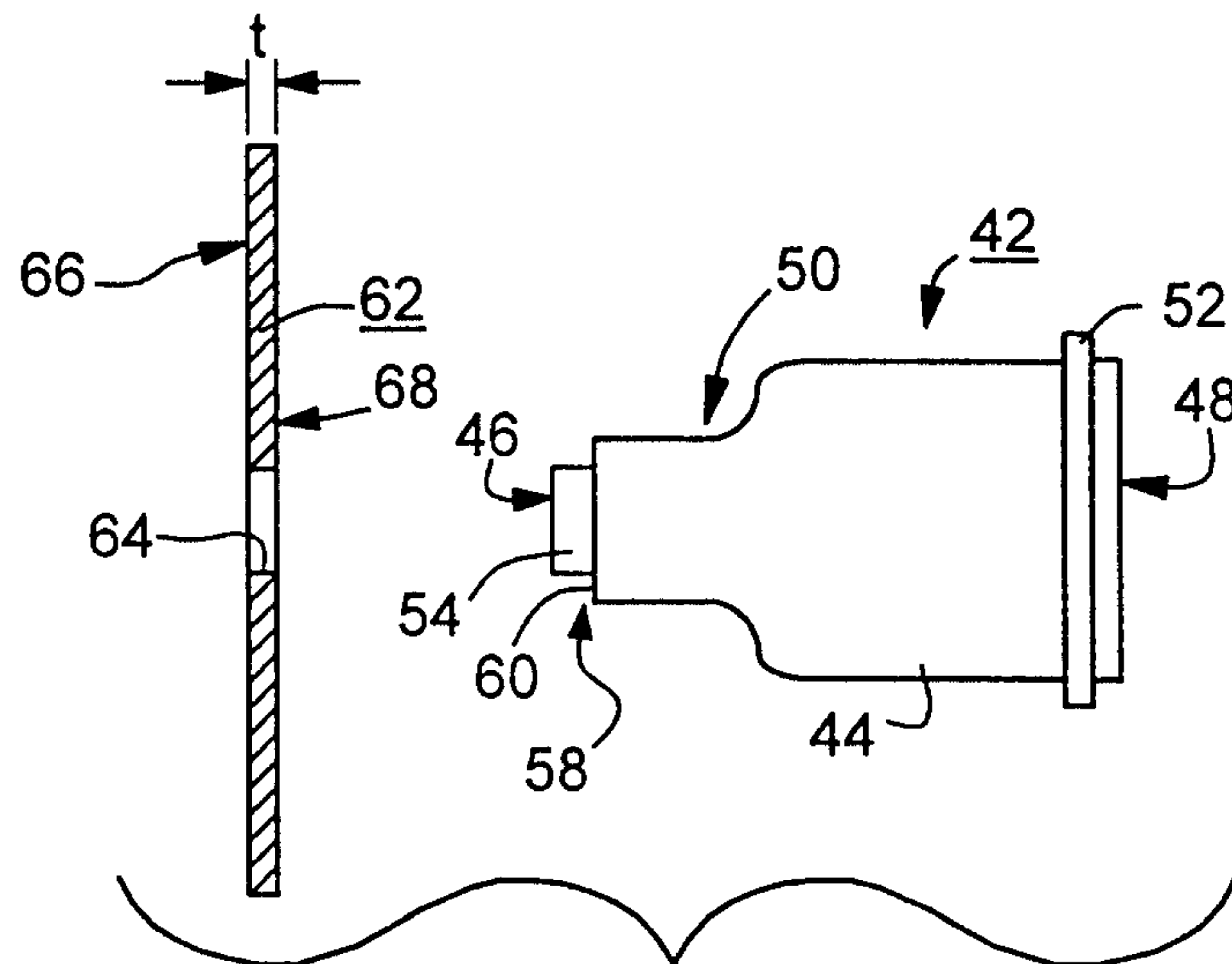


FIG. 4

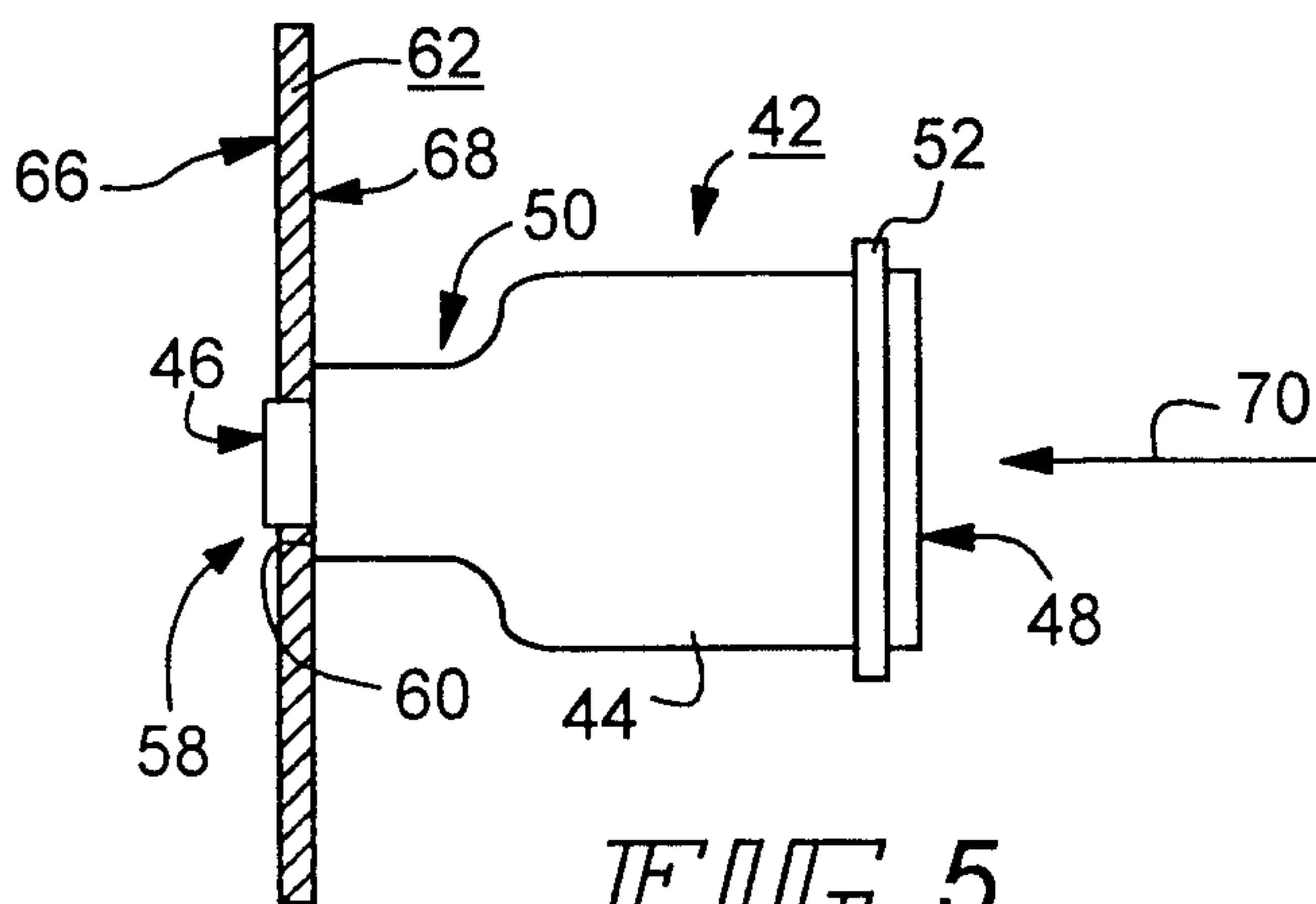


FIG. 5

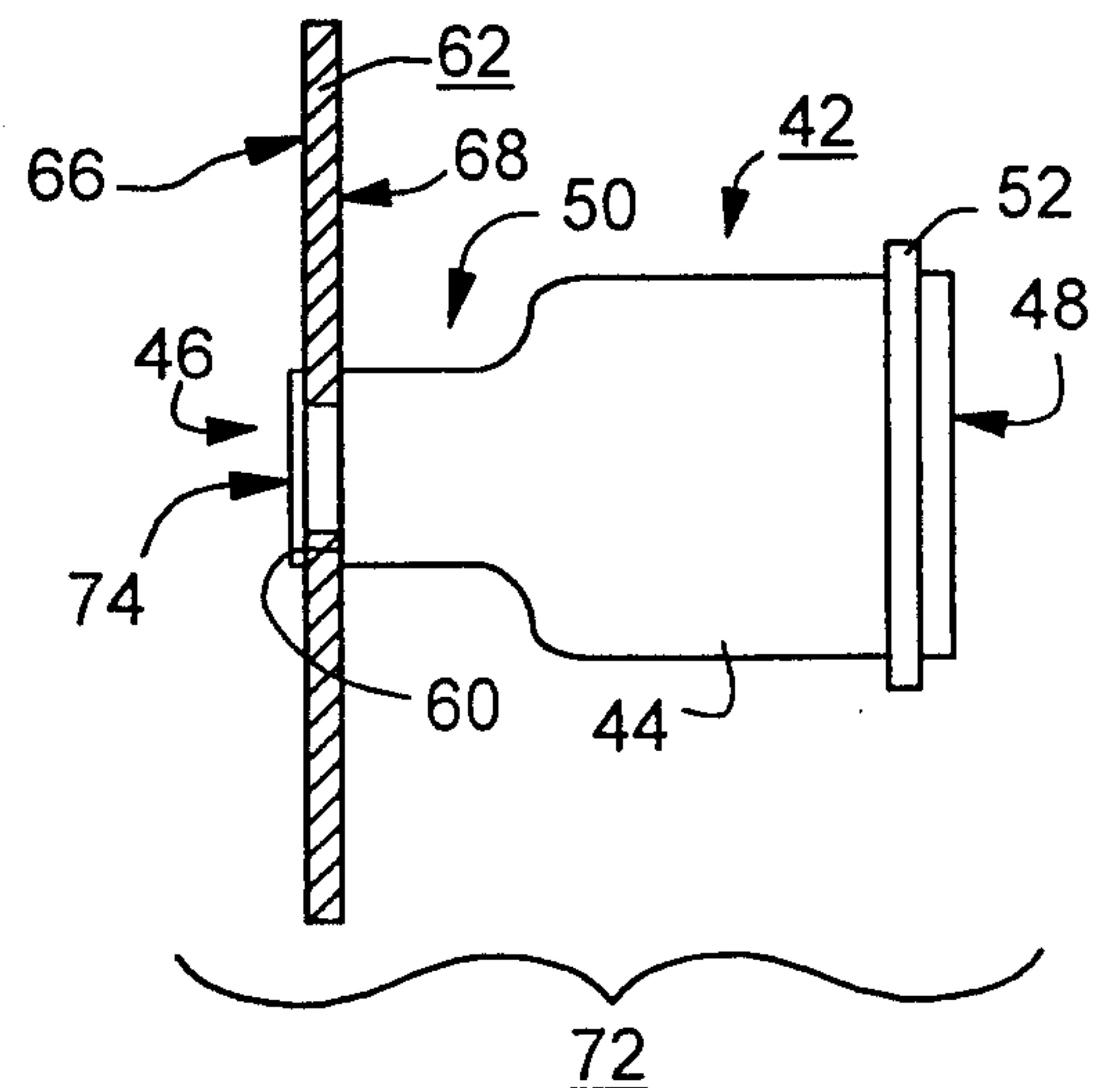


FIG. 6

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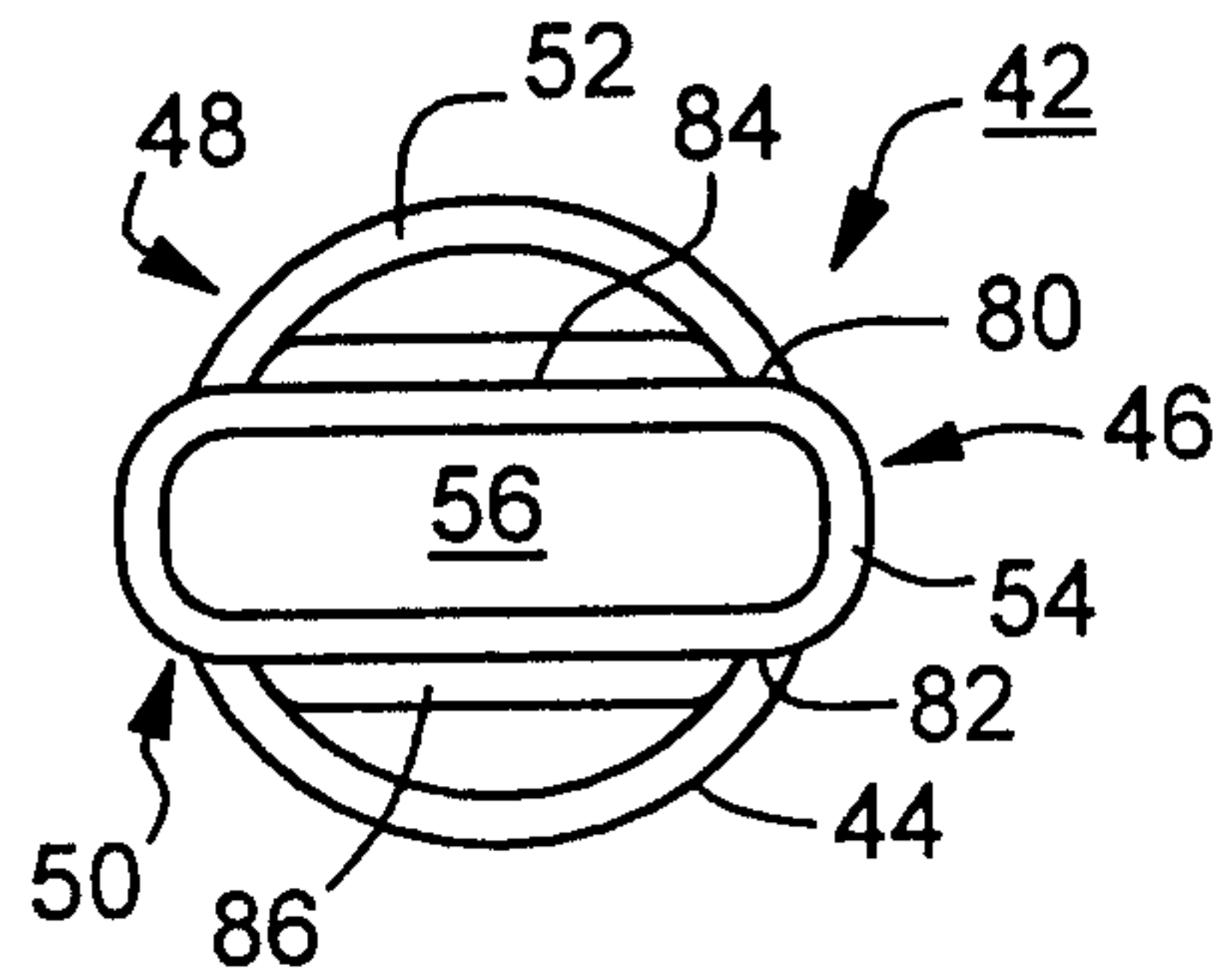


FIG. 7

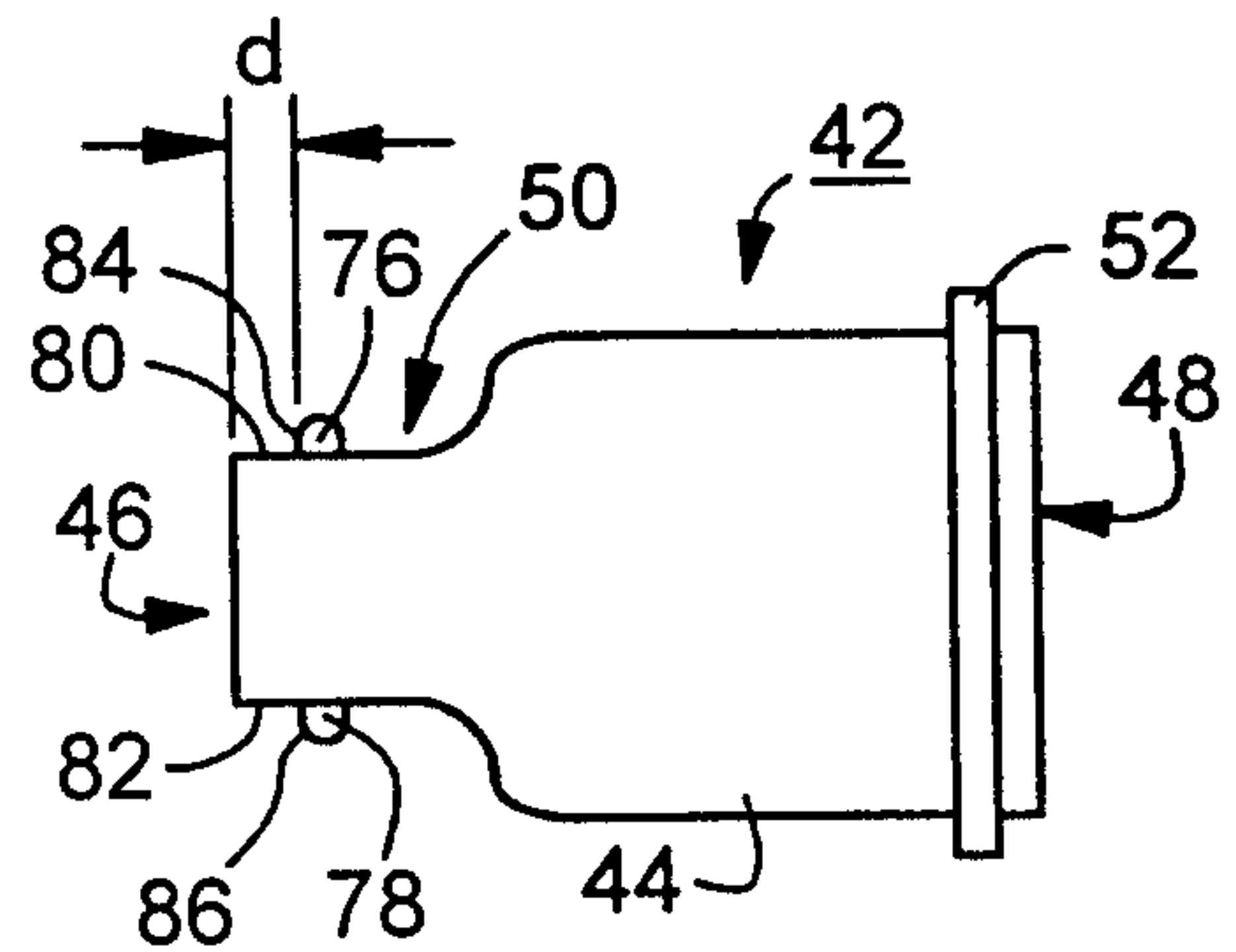


FIG. 8

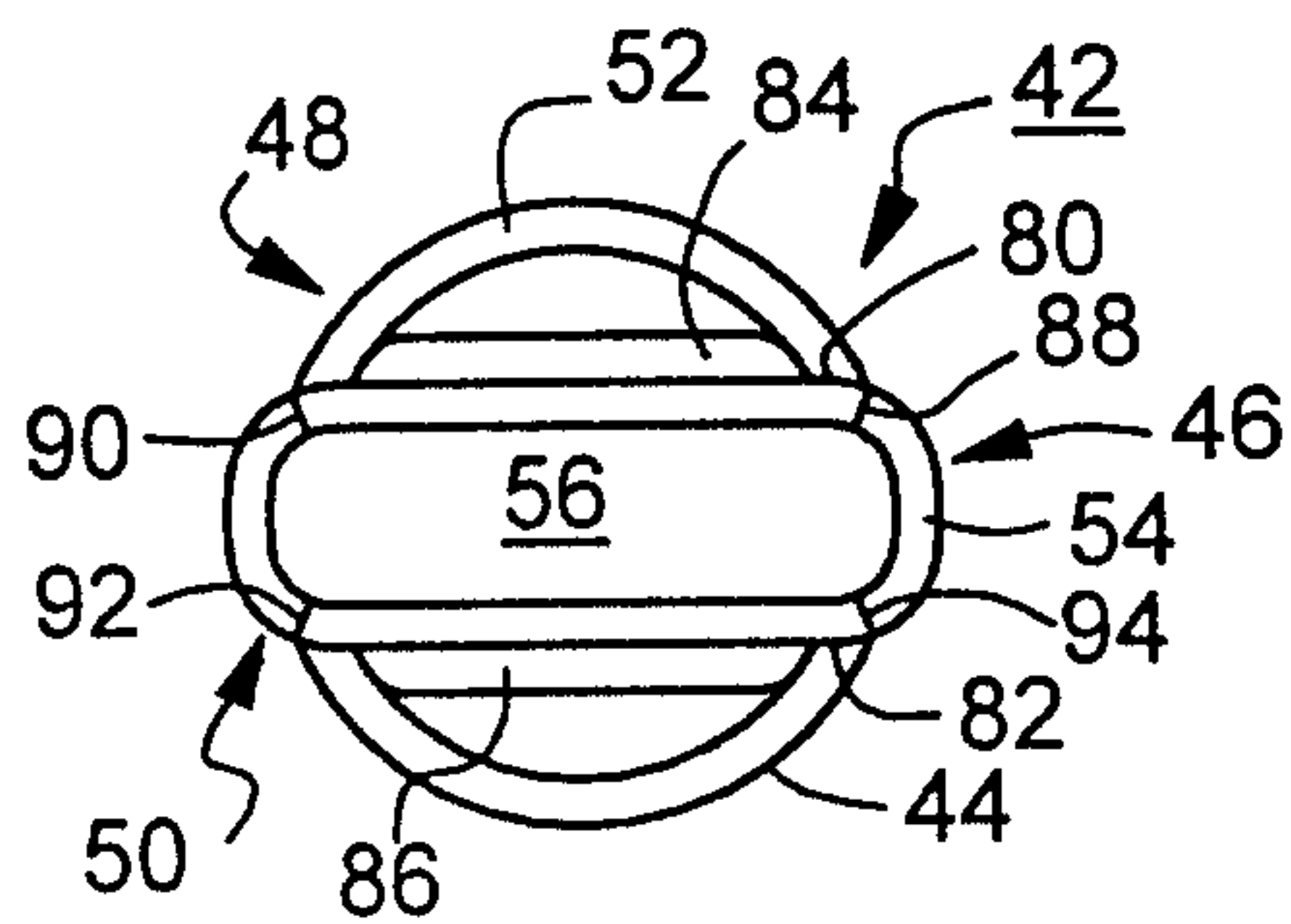


FIG. 9

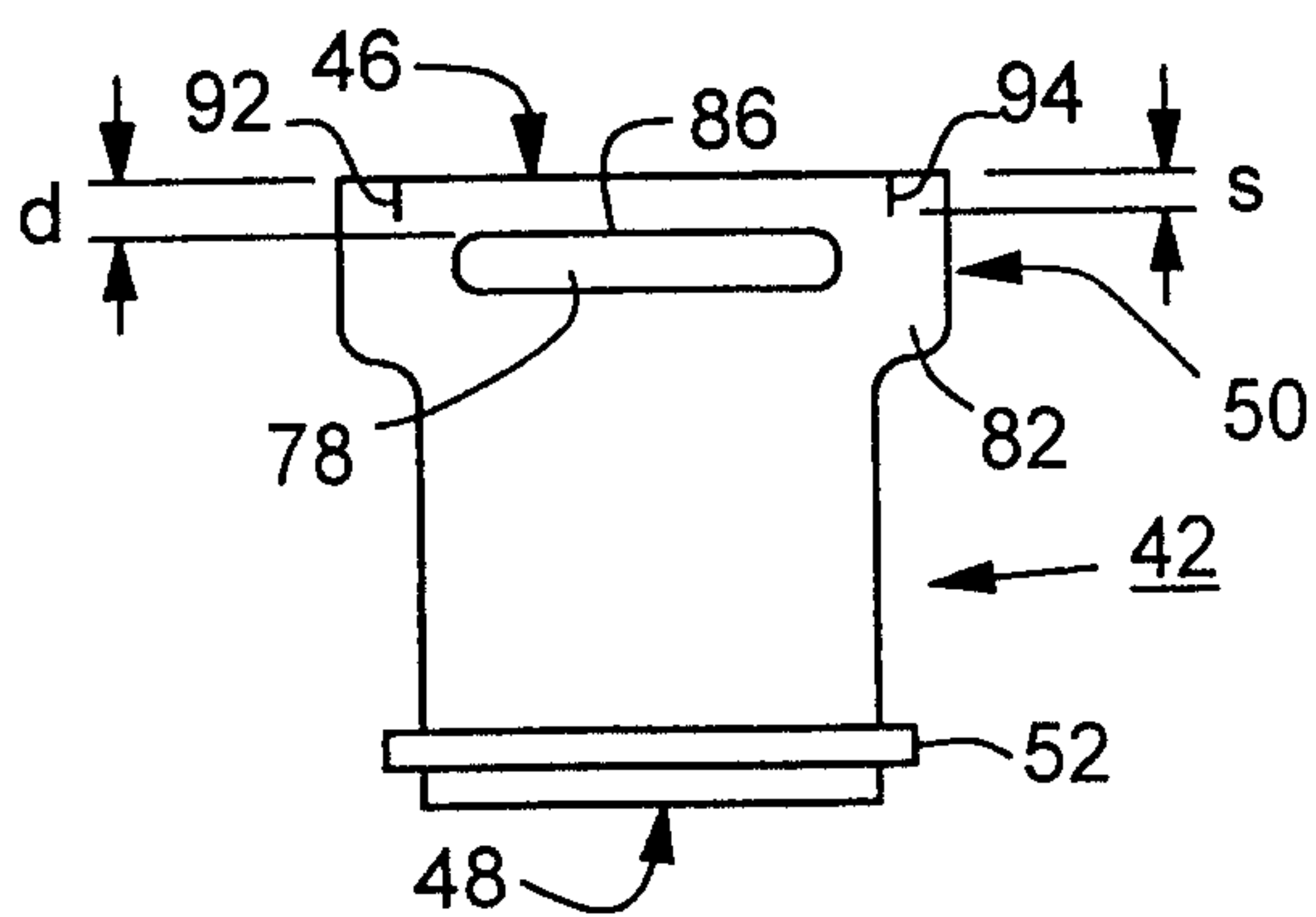


FIG. 11

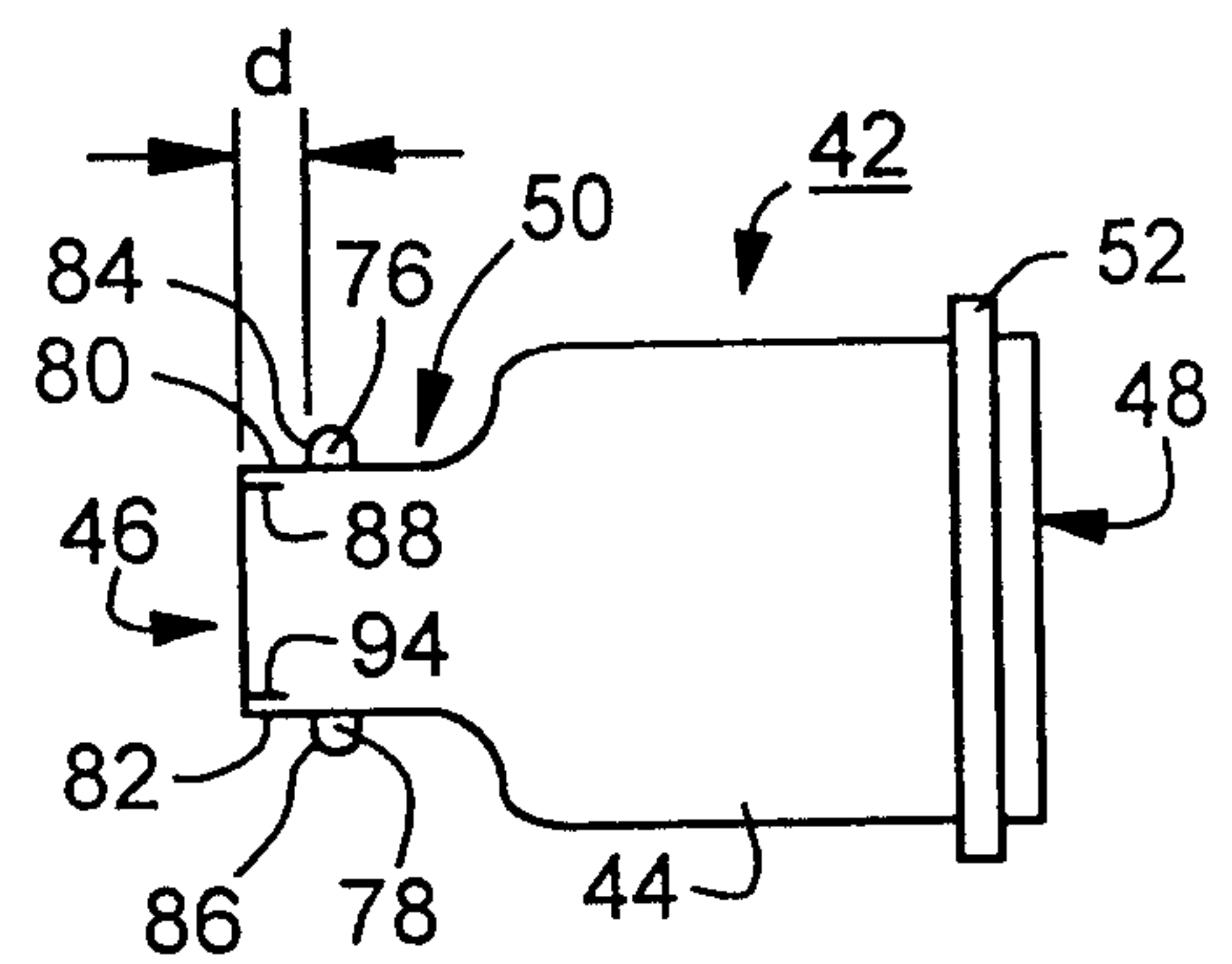


FIG. 10

