



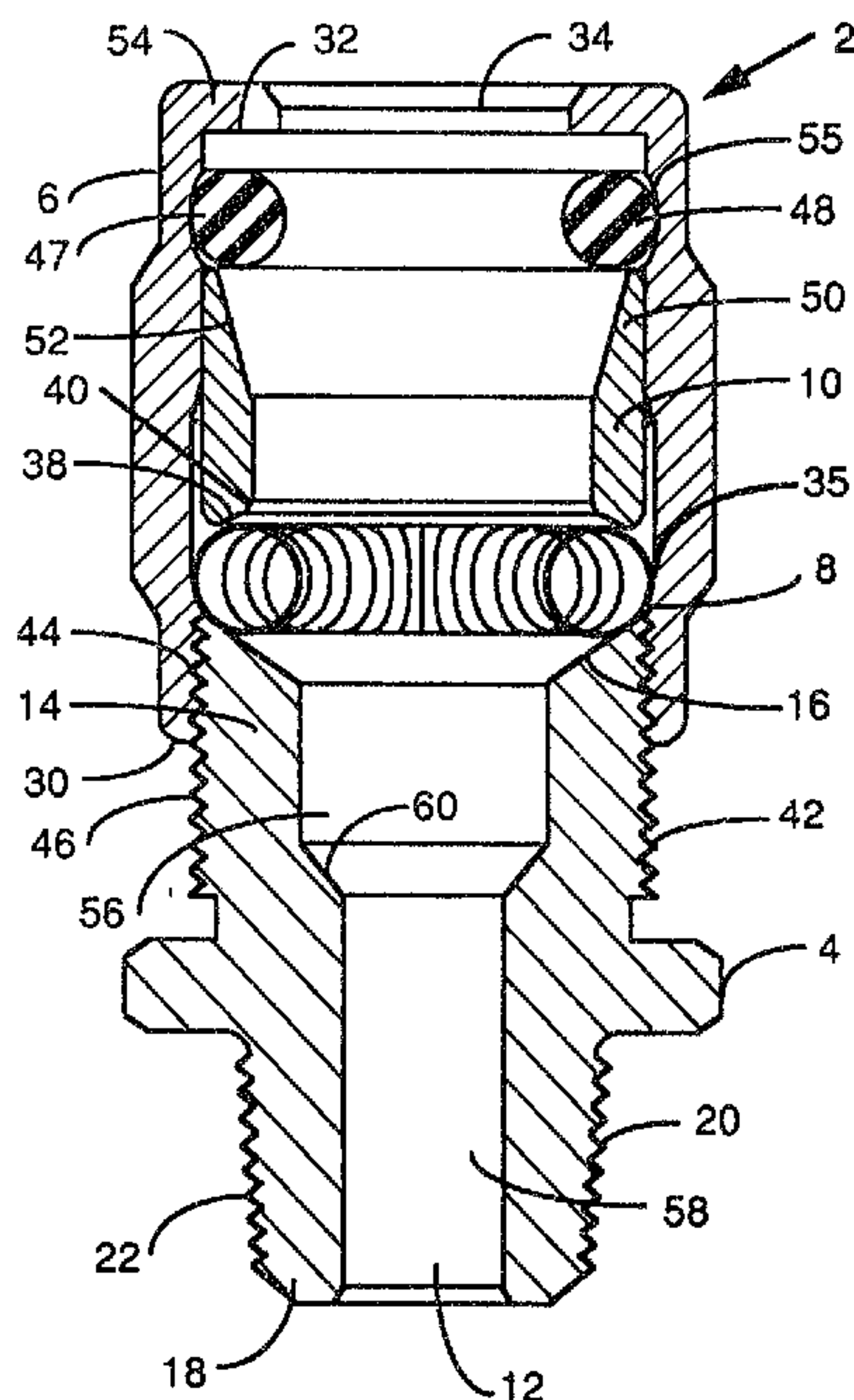
(11) (21) (C) **2,096,710**
(22) 1993/05/20
(43) 1994/11/21
(45) 2000/08/08

(72) Nattel, William, CA
(72) Michaud, Alain, CA
(73) Commander Electrical Materials Inc., CA

(51) Int.Cl.⁵ H01R 13/648

(54) **CONNECTEUR POUR CABLE ELECTRIQUE ARME**

(54) **CONNECTOR FOR ARMORED ELECTRICAL CABLE**



(57) A connector for an armored cable includes a connector body and a cap. A generally longitudinal opening extends through the connector. An electrically conductive spring, a ring washer and an O-ring may be positioned inside the cap. When the container body and cap are compressively engaged, beveled surfaces on the connector body and ring washer compress the spring against the cable that has been inserted into the connector, thereby mechanically and electrically connecting the cable and the connector body. Another beveled surface on the ring washer simultaneously compresses the O-ring against the cable and against the cap to provide a dust-tight and watertight seal between the cable and the connector.



2096710

57,693

ABSTRACT

5 A connector for an armored cable includes a
connector body and a cap. A generally longitudinal opening
extends through the connector. An electrically conductive
spring, a ring washer and an O-ring may be positioned
inside the cap. When the container body and cap are
compressively engaged, beveled surfaces on the connector
body and ring washer compress the spring against the cable
that has been inserted into the connector, thereby
10 mechanically and electrically connecting the cable and the
connector body. Another beveled surface on the ring washer
simultaneously compresses the O-ring against the cable and
against the cap to provide a dust-tight and watertight seal
between the cable and the connector.

CONNECTOR FOR ARMORED ELECTRICAL CABLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to connectors for electrical cables, and, more particularly, to connectors for attaching armored electrical cables to metal enclosures.

2. Brief Discussion of Related Art

Armored electrical cable is used for a wide variety of applications. The electrically conductive armor enables the cable to be grounded over its entire length. The armor also protects the conductors of the cable from damage resulting from abrasion and the like. An outer plastic or rubber sheath may be provided over the armor to waterproof and further protect the cable. When permitted by applicable electrical code, armored cable may be used in place of rigid conduit. Rigid conduit is typically more difficult to install than the more flexible armored cable. In addition, rigid conduit is often more expensive than comparably sized armored cable.

When armored cables are connected to, or terminated in, metal enclosures, special connectors are typically used. Often, such connectors are required by the applicable electrical code. The connectors provide electrical grounding continuity between the cable armor and the enclosure, resistance to undesirable withdrawal of the cable from the enclosure, and moisture and dust resistance in the area where the cable is connected to the enclosure.

Existing armored cable connectors are bulky in size. Those connectors may require tightening of three or more threaded parts for complete installation of the connector, which increases installation time and complexity. Such connectors are complex and relatively expensive to manufacture because of the number of components. The prior art armored cable connectors are also quite limited as to the range of cable sizes that can be accommodated using a given size connector.

There is a need for a connector for an armored cable which permits simpler and less expensive construction, accommodates a greater range of cable sizes for a given size of connector, and is simpler and quicker to install.

SUMMARY OF THE INVENTION

This invention has met the above described needs. The armored cable connector of this invention includes a body of unitary construction, and a cap. The body has a generally longitudinal opening extending therethrough. The cap includes a first open end to receive at least a portion of the body therein and a second end being open to receive the cable therein. A first end of the body has an inwardly beveled surface thereon. The second end of the body has connecting means thereon to attach the connector to another structure, such as a metal enclosure. An electrically conductive circular spring is positioned inside the cap to be in electrical contact with the armored cable and the body. A ring washer is positioned inside the cap between the spring and the second end of the cap. A first end of the ring washer is beveled generally inwardly to engage and wedge the spring into mechanical contact with the armored cable to secure the armored cable to the connector and to provide an electrical connection between the cable armor and the connector body. Engaging means, such as for example screw threads, compressively engage the cap and the connector body to effect this wedging action.

Sealing means may be positioned inside the cap between the ring washer and the second end of the cap. The

ring washer may also be provided with an inwardly beveled second end to wedge the sealing means into sealing engagement with the armored cable as the cap is applied to the connector body.

5 It is an object of this invention to provide an armored cable connector for securing armored cable to a metal enclosure.

 It is another object of this invention to provide a connector for an armored cable which provides improved
10 electrical grounding continuity, moisture resistance, and cable pullout resistance.

 It is yet another object of this invention to provide an armored cable connector which is relatively simple to use and install.

15 It is still another object of this invention to provide an armored cable connector that is relatively simple and relatively inexpensive to manufacture.

 It is another object of this invention to provide an armored cable connector that will accommodate a large
20 range of cable sizes for a given connector size.

 These and other objects will be more fully understood from the following description of the preferred embodiment, the drawings and claims.

25 BRIEF DESCRIPTION OF THE DRAWINGS

 Figure 1 is a longitudinal sectional view of a preferred embodiment of the armored cable connector of this invention taken through the center of the connector and showing the connector prior to installation of a cable.

30 Figure 2 is a longitudinal sectional view of a preferred embodiment of the armored cable connector of this invention taken through the center of the connector and showing a cable installed therein.

35 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

 In Figures 1 and 2, there is shown the armored cable connector 2 of this invention. Connector 2 includes connector body 4, cap 6, electrically conductive spring 8 and ring washer 10. An armored cable 3 with which

connector 2 is used is shown in Figure 2. Cable 3 includes conductors 5 encased in electrically conductive armor 7. Armor 7 may be covered by a plastic or rubber sheath 9.

5 With reference to Figures 1 and 2, body 4 is of generally unitary construction and is made of electrically conductive material, such as aluminum or zinc-plated steel. A generally longitudinal opening 12 extends through the center of body 4. A first end 14 of body 4 has surface 16 thereon. Surface 16 is beveled generally inwardly toward opening 12. A second end 18 of body 4 has connecting means 20 thereon to attach
10 body 4 to another structure (not shown). In a preferred embodiment, connector means 20 includes external threads 22 to engage cooperating threads on the structure to which body 4 is to be attached. Examples of types of structures to which connector 2 may be attached include junction boxes, panel boards, motor control enclosures, electrical distribution
15 equipment, and the like.

Cap 6 is positioned over first end 14 of body 4. First end 30 of cap 6 is open and at least a portion of body 4 is received therein. Preferably, the portion of body 4 received into cap is a portion extending axially from first end 14. A second end 32 of cap 6 has an opening 34 to receive
20 armored cable 3 (Figure 2). Cap 6 is preferably made from an electrically conductive material, such as the same type of material from which body 4 is made.

A central axis (not shown) extends through the second end 18 of body 4 and second end 32 of cap 6.

25 A generally circular, electrically conductive spring 8 is positioned inside cap 6. Spring 8 is positioned to be in mechanical and electrical contact with connector body 4 and armored cable 3. Preferably, spring 8 will be in electrical contact with armor 7 of cable 3. If necessary to expose armor 7, a portion of sheath 9 may be removed to provide electrical
30 continuity for grounding the armor 7 through the connector. In a preferred embodiment, spring 8 is retained in recess 35 in cap 6 during assembly of connector 2. Spring 8 is preferably a coil spring made out of non-magnetic stainless steel. It will be

appreciated, however, that spring 8 may be made out of any suitable conductive material.

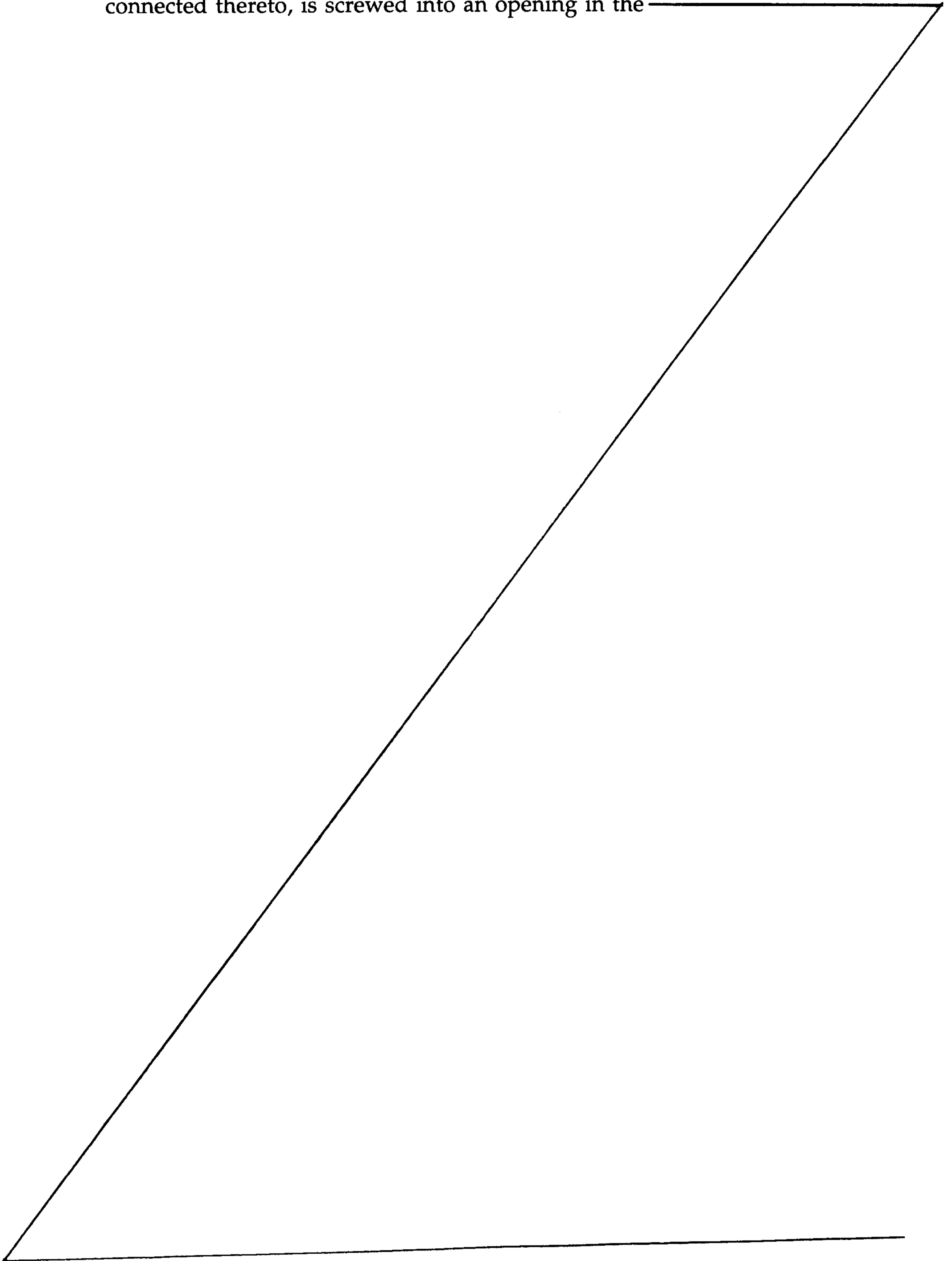
5 Ring washer 10 is positioned inside cap 6 between spring 8 and second end 32 of cap 6. Ring washer 10 has a first end 38 which has a generally inwardly beveled surface 40 thereon. Beveled surface 40 is inclined at a relatively large angle to the central axis. Beveled surface 40 is positioned to engage spring 8 into mechanical and electrical contact with cable 3 and connector body 4. The retention of spring 8 in recess 35 will hold ring washer 10 inside cap 6 during assembly of connector 2.

10 Engaging means 42 are provided for compressively connecting cap 6 and body 4. In a preferred embodiment, engaging means 42 includes threads 44 on an inner surface of cap 6 positioned to engage cooperating threads 46 on an outer surface of body 4.

15 In a preferred embodiment, seal 47 is positioned inside cap 6 between second end 32 of cap 6 and ring washer 10. Seal 47 sealingly engages cap 6 and armored cable 3. Such engagement provides a watertight and dust-tight seal where cable 3 enters connector 2. Preferably, seal 47 includes flexible O-ring 48. O-ring 48 is preferably made of neoprene or another suitable material. A second end 50 of ring washer 10 has a generally inwardly beveled surface 52 thereon. Beveled surface 52 is inclined at a relatively small angle to the central axis. Beveled surface 52 engages and wedges O-ring 48 into sealing engagement with armored cable 3 and cap 6. In preferred embodiment, cap 6 includes a generally inwardly projecting shoulder 54 positioned to engage O-ring 48. O-ring 48 is preferably positioned to engage the plastic or rubber sheath 9 of cable 3. In a preferred embodiment, O-ring 48 is retained in recess 55 during assembly of connector 2. While it is preferred to use a flexible O-ring as seal 47, it will be appreciated that any suitable seal may be used, such as a cylindrical sealing washer, for example.

30 Referring more particularly to Figure 2, to attach an armored cable 3 to an enclosure or other structure (not shown), connector body 4, with

cap 6, spring 8, ring washer 10 and O-ring 48 all relatively loosely connected thereto, is screwed into an opening in the



enclosure using threads 22. Armored cable 3 is inserted through opening 34 in cap 6 and into opening 12 in connector body 2. In a preferred embodiment, opening 12 through body 4 includes a large diameter portion 56 and a small diameter portion 58 connected by a beveled cable stop 60. Large diameter portion 56 extends from first end 14 to cable stop 60 and small diameter portion 58 extends from cable stop 60 to second end 18. The free end of cable 3 inserted into connector 2 abuts cable stop 60. Preferably, the end of armor 7 will abut cable stop 60. It will be appreciated that the outer diameter of armor 7 of cable 3 will preferably, but not necessarily, be larger than the diameter of small diameter portion 58 of opening 12. The conductors 5 of cable 3 extend past cable stop 60, through small diameter portion 58 and exit connector 2 through second end 18. Once cable 3 is fully inserted, cap 6 is tightened, thereby compressing spring 8, ring washer 10 and O-ring 48 to ensure the desired electrical connection and seal discussed above. In addition, the compression of spring 8 between beveled surface 16 of body 4 and beveled surface 40 of ring washer 10 pushes spring 8 against cable 3, which holds cable 3 tightly within connector 2 thereby increasing cable pullout resistance.

It will be appreciated that once connector 2 is in place in the enclosure, only cap 6 needs to be tightened to provide the necessary compression to achieve the desired electrical connection, dust and water seal and cable pullout resistance. In addition, the beveled surfaces of connector body 4 and ring washer 10 permit generally inward movement of spring 8 and O-ring 48, thereby allowing a range of cable sizes to be accommodated in a connector of a given size.

In a preferred embodiment, body 4 and cap 6 are formed from generally hexagonal or octagonal stock. Parts are preferably machined in a manner well known to those skilled in the art. Forming of threads 22 and 44, 46, and the desired openings can be done while leaving portions of the hexagonal or octagonal stock intact as locations where

the connector may be engaged for tightening the connector into the enclosure and/or tightening cap 6 onto body 4.

5 It will be appreciated that the connector for an armored cable of this invention provides electrical grounding continuity, water and dust resistance, and cable pullout resistance while being relatively simple to manufacture and install.

10 Whereas, particular embodiments of this invention have been described for purposes of illustration, it will be evident to those skilled in the art that numerous variations may be made without departing from the invention as described in the claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

- 5 1. A connector for an armored cable, comprising:
- (a) an electrically conductive connector body (4) having a longitudinal opening (12) therethrough, a first end (14) of said connector body having a surface (16) thereon beveled inwardly toward said opening, a second end (18) of said connector body having connecting
- 10 means (20) thereon to attach said connector body to another structure;
- (b) a cap (6) telescoping around said first end of said connector body, a first end (30) of said cap being open to receive therein at least a portion of said connector body extending axially from said first end of said connector body, and a second end (32) of said cap having an opening
- 15 (34) therein to receive the armored cable, the cap and connector body including a central axis extending through the second end (18) of said connector body and the second end (32) of said cap;
- (c) a generally circular, electrically conductive spring (8) positioned inside said cap in electrical contact with said connector body
- 20 and said armored cable;
- (d) a ring washer (10) positioned inside said cap between said spring and said second end of said cap, a first end (38) of said ring washer having a first inwardly beveled surface (40) thereon positioned to engage said spring into mechanical and electrical contact with said armored cable
- 25 and said connector body;
- (e) sealing means positioned inside cap between said second end of said cap and said ring washer to sealing engage said cap and said armoured cable;
- (f) said cap having a first recess into which said spring is
- 30 received during assembly of the connector;
- (g) said cap having a second recess into which said sealing means is received during assembly of the connector; and
- (h) engaging means (42) for compressively connecting said cap and said connector body.

2. The connector of claim 1, wherein said sealing means comprises a flexible O-ring.

5 3. The connector of claim 2, wherein said ring washer includes a second end (50) having a second inwardly beveled surface (52) thereon to engage and wedge said O-ring in sealing engagement with said armored cable and said cap, the angle of said second inwardly beveled surface to the central axis being different to the angle of said first inwardly beveled surface (40) to the central axis.

10 4. The connector of claim 3, wherein said cap includes a generally inwardly projecting shoulder positioned to engage said O-ring.

15 5. The connector of claim 4, wherein said opening in said connector body includes a large diameter portion, a small diameter portion, and a beveled cable stop connecting said large diameter portion and said small diameter portion, said large diameter portion extending from said first end to said beveled cable stop and said small diameter portion extending from said beveled cable stop to said second end.

20 6. The connector of claim 5, wherein said engaging means includes threads on an inner surface of said cap and threads on an outer surface of said connector body, said threads on said cap positioned to engage and cooperate with said threads on said connector body.

25 7. The connector of claim 6, wherein said connecting means includes threads on an outer surface of said second end of said connector body.

8. The connector of claim 7 wherein said connector body and said cap are constructed of aluminum.

9. The connector of claim 7 wherein said connector body and said cap are constructed of zinc plated steel.

30 10. The connector of claim 7 wherein said spring is constructed of stainless steel.

11. The connector as claimed in one of claims 3 to 10, wherein the first inwardly beveled surface (40) is inclined at a relatively large angle to the central axis and the second inwardly beveled surface (52) is inclined at a relatively small angle to the central axis.

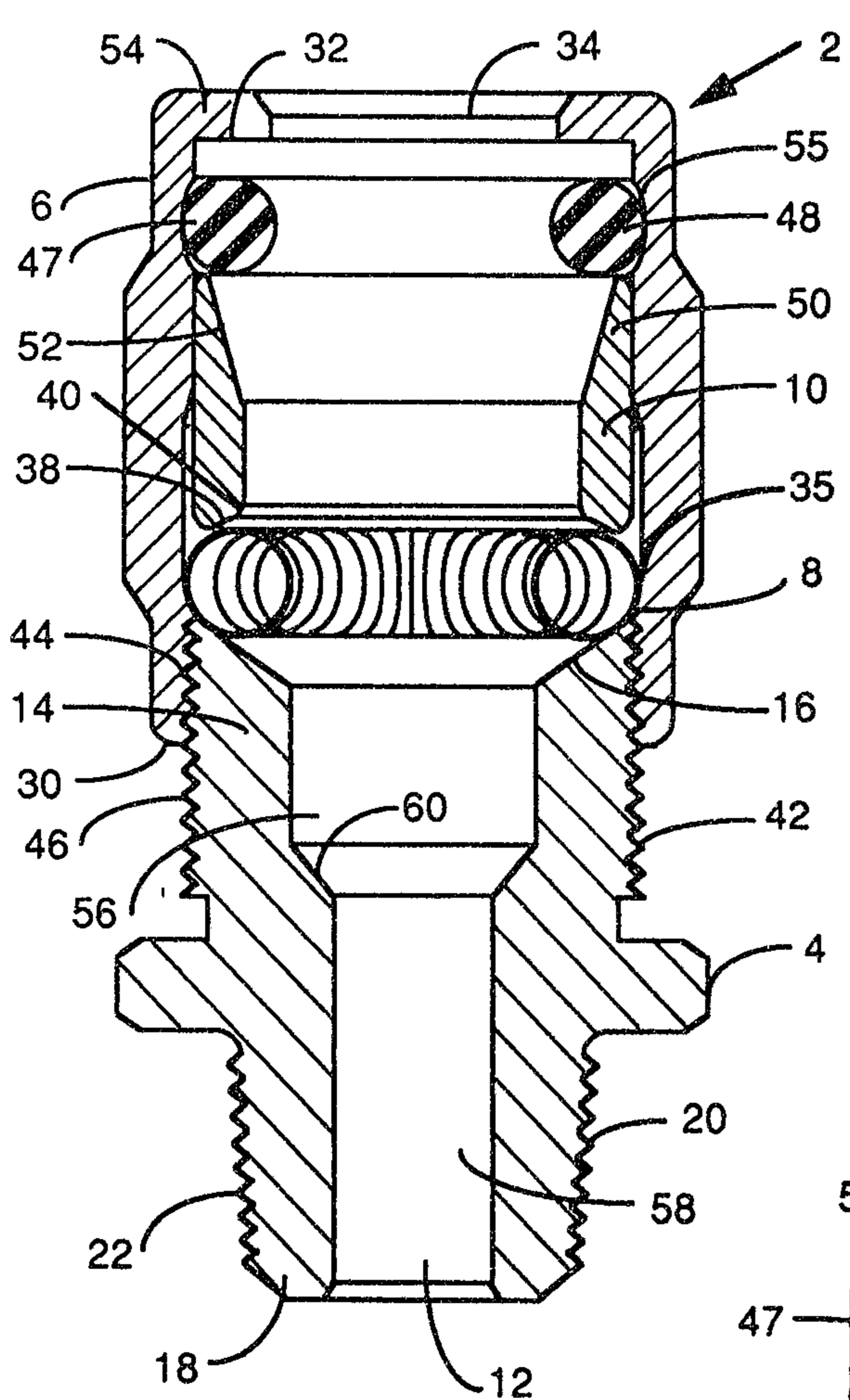


FIG. 1

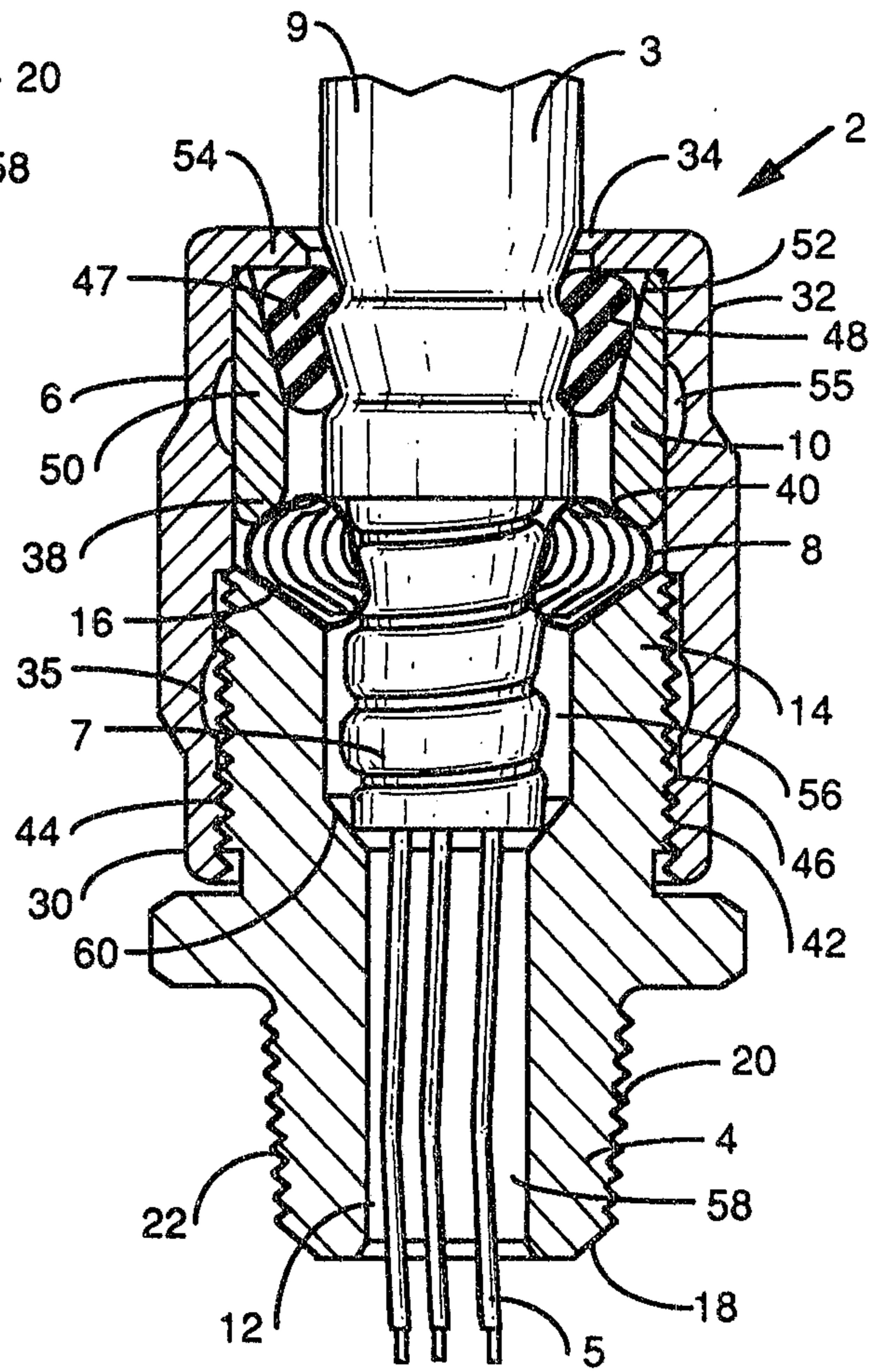


FIG. 2