July 8, 1969 N. GOLDSOBEL ETAL 3,454,291

RAINTIGHT ELECTRICAL CONNECTOR

Filed Feb. 15, 1967

Fig. 1.

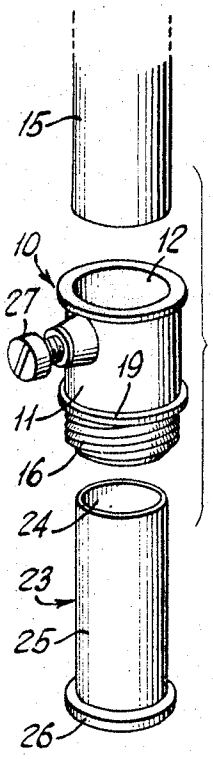


Fig. 2.

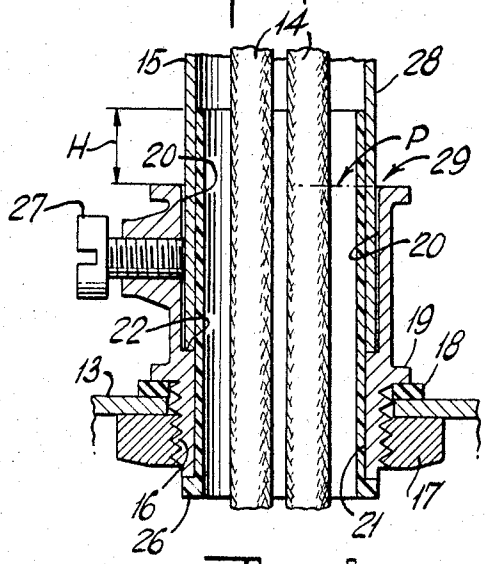


Fig. 3.

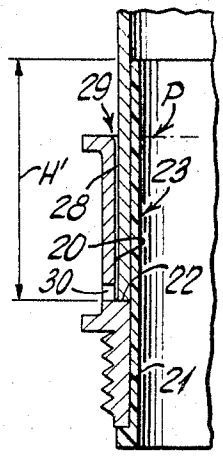


Fig. 4.

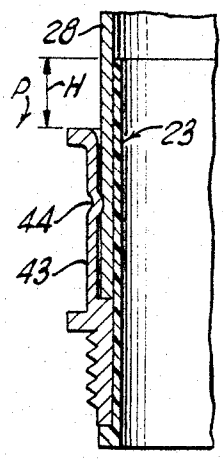


Fig. 6.

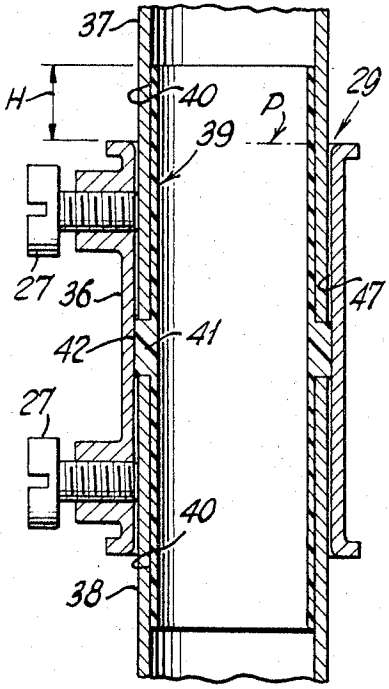
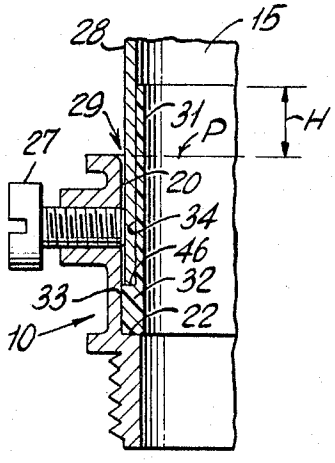


Fig. 5.



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RAINTIGHT ELECTRICAL CONNECTOR

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ABSTRACT OF THE DISCLOSURE

An electrical connector for attachment to a conduit wherein the connector body incorporates a sleeve member which is inserted preferably by a force fit into the connector body. One section of the sleeve, the section in force fit relationship with the connector body, forms a liquidtight seal with the internal bore of the connector. An end of the inserted sleeve protrudes beyond an end of the connector body to form a liquid pressure head differential which cooperates with the seal to prevent liquid flow into the interior of the conduit attached to the connector.

This invention relates to an electrical connector for attachment to electrical cable conduit, and in particular, wherein connectors of the type contemplated herein are designed to prevent seepage of rain water into the conduit interior.

Heretofore electrical connectors for attachment to electrical cable conduit of the set screw and crimp type as contemplated herein have not been raintight and thus could not be employed for installation requiring raintight attachments to such conduit. The present invention provides a connector with an interior sleeve fitted within the connector body to form a water-tight seal adjacent the bottom of a conduit receiving chamber. The sleeve extends beyond the end of the body a predetermined length to form a "differential" or "head." Hence, water, such as rain or spray, entering the connector between the connector body and conduit, will propagate between the outside wall of the conduit and the inside wall of the body until it reaches the seal. The water then will propagate upwardly between the inside wall of the conduit and the outside wall of the sleeve to about the same height as the connector body, but in no case higher than the sleeve portion extending beyond the body length. The differential in length of the body and the portion of the sleeve extending beyond the body end prevents water entering the conduit. Therefore, it is the principal object of the invention to make conventional connectors raintight.

It is another principal object of the invention to provide an electrical connector for attachment to electrical conduit wherein the connector incorporates an inner sleeve member. The foregoing is designed to provide a liquid pressure head differential at one end of the connector, and a liquidtight seal within the connector so as to prevent moisture and seepage of rain water into the interior of the attached conduit.

It is a further object of the invention to provide a raintight electrical connector as described hereinbefore wherein the connector body may be the conventional set screw connector.

Further objects and advantages will become apparent from the following description of the invention taken in conjunction with the figures, in which:

FIG. 1 is an exploded view of a connector in accordance with the claimed invention;

FIG. 2 is a vertical elevational view in section of the connector illustrating same attached to an electrical junction box;

FIG. 3 is a fragmentary section in vertical elevational view illustrating a modified embodiment of the connector to include a rainwater drain hole;

FIG. 4 is a fragmentary section in vertical elevation illustrating a further modified embodiment of a connector in accordance with the invention;

FIG. 5 is a fragmentary section in vertical elevation of another modified embodiment of a connector employing the invention; and

FIG. 6 is a sectional view in elevation showing still a further modification of a connector in accordance with the invention.

Reference is made to FIGURES 1 and 2 for an electrical connector **10** incorporating the invention claimed herein. Connector **10** is essentially a tubular body **11** with opposite open ends and a through bore **12** therebetween. In FIG. 2, connector **10** is shown mounted vertically to an electrical junction box **13** (shown fragmentary in FIG. 2) or other electrical unit. Electrical cable **14** from a conduit **15** feeds into box **13**. Connector **10** has a lower threaded end **16** attached at a box knockout by a locknut **17**. A watertight sealing ring **18** is clamped between a connector flange **19** and the box wall.

Connector bore **12** has an enlarged inner diameter section **20** and a reduced inner diameter section **21**. A bore shoulder **22** appears at the junction of said sections **20, 21**.

A concept of the invention involves supporting a hollow tubular insert **23** in body bore **12**. Insert **23** is made of pliable material such as plastic and has uniform inner and outer diameter surfaces **24, 25**. As used hereinafter, OD means an outer diameter surface, and ID means an inner diameter surface. The dimension of insert OD **25** is selected to require a force press fit with respect to lower bore section **21** upon assembling insert **23** into connector **10**. The foregoing force fit relationship creates a liquidtight seal along the section of insert OD **25** in contact with bore section **21**. The upper section of insert OD **25** is spaced peripherally from the upper bore section **20** and thus provides a clearance for receiving the end of conduit **15** therebetween.

Shoulder **22** serves as a limit stop when the lead end of conduit **15** abuts against same. The upper end of insert **23** protrudes a distance H above the horizontal plane P of the upper body end. The insert lower flanged end **26** abuts against the lower end of connector body **11**. A set screw **27** clamps conduit **15** to connector **10**.

As seen in the figures, connector bore surface **20** is in contact with a contiguous section of the conduit OD **28**. These contacting surfaces are not watertight. The figures show an exaggerate space between the bore ID **20** and the conduit OD **28** to emphasize that the space therebetween is not normally watertight. For an outdoor installation, rain or other spray of liquid, as depicted by arrow **29**, will enter connector **20** at its top end and result in propagation of water downwardly between surfaces **20, 28**. Such water seepage is stopped at the liquidtight seal formed between surface **21** and the section of insert OD **25** in contact with same. The top of this seal is approximately at the level of shoulder **22**; essentially water does not seep below the upper level of such seal.

There is a line-to-line contact fit between the conduit ID and the contiguous section of insert OD **25**, however such contact is not liquidtight. Water seeks its own pressure level. Hence water tending to accumulate at the top of the liquidtight seal will reverse its flow direction and then propogate upwardly between the aforesaid line-to-line contacting surfaces, the conduit ID and insert OD, until it reaches level P. The head differential H prevents the propagation of water in an upwardly direction above the level P and into the conduit interior. Head differential H also prevents rise of water above level P by means of

a capillary or wetting action. The aforesaid liquid tight seal prevents flow of water in a downwardly direction into the conduit interior.

Insert **23** also serves to guard against stripping of insulation from cable **14** when snaking same through connector **10**. Conduit **15** deforms slightly when set screw **27** is tightened. Normally this causes a slight contraction of the conduit end for example at shoulder **22** thereby introducing a constricted sharp edge into the path of cable **14** as it is being pulled into box **13**. The presence of insert **23** precludes stripping of the cable insulation at such time.

The invention also admits a liquid weep hole **30**, see FIG. 3, in connector body **11**. Water seeping downwardly between surfaces **20** and **28** from the top end of connector **10** will drain out of hole **30**. The head differential for this embodiment is H'.

Connector **10** is the conventional set screw fitting. It does not require any reconstruction or alteration to incorporate the invention thereto. This invention may be incorporated in similar fashion to a crimp-type connector **43**, see FIG. 4, wherein the outer shell of the connector is crimped at **44** by a tool in lieu of clamping the conduit by a set screw. The liquid tight connector may be used with the many known types of standard conduit as, for example, thin wall conduit and heavy wall conduit.

FIG. 5 shows an embodiment employing connector **10** with a hollow tubular insert **31** terminating within connector bore section **20**. In this device, insert **31** has a flanged end **32** the bottom of which abuts against shoulder **22**. The size of the flange OD **33** requires a force press fit with respect to bore section **20** upon assembling insert **31** into connector **10** to create a liquidtight seal along contacting surfaces **20** and **33**. The upper section of the insert OD **34** has a uniform diameter. Rain entering from the top end of connector **10** will propagate downwardly between conduit OD **28** and bore section **20** to the top of the liquid-tight seal at **46** and then reverse flow direction and propagate upwardly between the adjacent surfaces of the conduit ID and insert OD **34** to level P. In this embodiment, the lead end of conduit **15** abuts against the upper edge of the insert flange **32**. In all other respects, the operation of the raintight connector of FIG. 5 is similar to the embodiment of FIGS. 1 and 2.

The embodiment of FIG. 6 shows a hollow tubular fitting **36** for connecting a pair of conduits **37, 38**. In this device, a hollow tubular insert **39** of flexible material, as described hereinbefore, has a pair of uniform outer diameter sections **40** and a central enlarged uniform diameter section **41**. Central section **41** has an OD **42** which is in force press fit with the fitting ID **47** to form a liquidtight seal along the line of contact therebetween. The lead ends of the clamped conduits **37, 38** abut against the respective opposite edges of central section **41**. The illustrated embodiment depicts conduit **37** at the top. Consequently, the formed head differential H is that shown in FIGURE 6. In this illustration rain water will not enter at the bottom end of fitting **36**. Set screws **27** clamp the conduits **37, 38**. In operation this embodiment is substantially similar to that of the prior described figures. The liquidtight seal along OD **42** prevents seepage of moisture and water from entering directly into the interior of conduit **38**. Whereas by reason of the head differential H, water propagation between the ID of conduit **37** and the OD of the contiguous section **40** does not rise above level P.

In electrical installations, positive bite electrical ground continuity is made by a set screw clamping against the conduit. The foregoing embodiments do not preclude this feature. When the conduits are clamped as, for example, by a set screw, such action causes the insert to squeeze against the conduit which assist the action of the raintight seal.

The problem of rainwater or other liquid spray entering into a connector as described hereinbefore is most pronounced when the connector is oriented in a position most favorable to catch rainwater. For a normal outdoor installation, this obtains for the vertically mounted connector, that is to say, when the connector lengthwise axis extends along a vertical line.

The preferred embodiments FIGURES 1 to 6 contemplate inserts **23, 31** and **39** made of plastic-like material. It is within the scope of the invention to use metallic inserts otherwise identical to the illustarted plastic inserts. The liquidtight seal attachments are formed by force fitting the metallic insert into the connector body as shown hereinbefore.

In the above described embodiments, the liquidtight seals are made by force-press fit attachments. It is within the scope of the invention to obain liquid-tight attach- serts otherwise identical to the illustrated plastic inserts. surface hereinabove described in a force-press fit relationship to a section of conductor bore. For example, in FIGURES 2 and 3 the force fit attachment is replaced by an adhesive attachment between bore surface **21** and the section of insert surface **25** in contact with same. The adhesive glue may be applied to the lower section of insert OD **25** designed to come in contact with bore ID **21**, after which the units are assembled by inserting insert **23** up into the connector bore. In FIG. 5, insert surface **33** is glued to the section of the connector body bore in contact with same; whereas, in FIG. 6 insert surface **42** is glued to the section of the connector body bore contacting same. In these embodiments, the adhesive glue is applied to the sections of the bore surfaces designed to contact respective surfaces **33, 42** after which the inserts are assembled into the connector bodies. When the adhesive cures, the contacting surfaces are attached by a liquidtight seal.

For the purpose of claim definition, the expression "conduit chamber" means the cylindrical clearance spaced formed between an insert OD and the adjacent body bore surface into which clearance the conduit is inserted for attachment to the connector. For example, in FIG. 2 the conduit chamber is the clearance space between bore surface **20** and the juxtaposed insert OD **25**. The inner end of this chamber is shoulder **22**. As another example, in FIG. 5, the conduit chamber is the space between bore surface **20** and insert surface **34**. Surface **46** is the inner end of the conduit chamber.

While the sleeve disposed within the bore of the connector body was illustrated as being a separate insert member, which is integral with the body when assembled to form the seal, the sleeve and connector body could be made in one piece, if desired.

What is claimed is:

1. A liquidtight connector for attachment to cable conduit, comprising a connector body having an end and an open-ended bore extending from said end into the interior of said body, said bore being defined by a wall of said connector body, a tubular sleeve in said bore and having an end extending exteriorwise beyond said body end, said sleeve having an outer diameter spaced radially inwardly from said body bore wall for defining a conduit chamber, said conduit being telescopically seated within said chamber for attachment to said connector with the radial outer wall of said conduit being radially inwardly spaced from said bore wall, said body and sleeve forming a liquidtight seal at the interior end of said chember, water can propagate between the conduit outer wall and said bore wall by reason of entering said connector at its open end, the axial distance between the end of said sleeve extending beyond said body and a plane at least through said body end provides a minimum liquid differential head, said head being sufficient to prevent propagation of water between said conduit and said sleeve beyond the extending end of said sleeve, so that water propagation in opposite directions along the conduit interior is prevented, respectively, by said seal and said differential head.

2. A liquidtight connector for attachment to cable conduit, comprising a connector body having an end and an open-ended bore extending from said end into the interior of said body, said bore being defined by a wall of said connector body and a tubular member in said bore and having an end extending exteriorwise beyond said body end, said member having a first section of outer diameter spaced radially inwardly from said body bore wall for forming a conduit chamber, said conduit being telescopically seated within said chamber with the radial outer wall of the conduit being radially inwardly spaced from said bore wall, said member having a second section of outer diameter in liquidtight attachment with a section of said body bore wall, water can propagate between the conduit outer wall and said bore wall by reason of entering said connector at its open end, the axial distance between the end of said member extending beyond said body end and a plane at least through said body end provides a minimum liquid differential head, said head being sufficient to prevent propagation of water between said conduit and said member beyond the extending end of said member, so that water propagation in opposite directions along the conduit interior is prevented, respectively, by said seal and said differential head.

3. A connector as defined in claim 2, wherein said wall defining said bore has sections of enlarged and reduced inner diameters, respectively, axially adjacent and axially spaced from said body end, a shoulder in said bore at the junction of said body sections, said shoulder forming the interior end of said conduit chamber, the second section of said member outer diameter being in a forced press-fit attachment with said reduced inner diameter bore wall section to form there along the aforesaid liquidtight attachment.

4. A liquidtight connector for attachment to cable conduit, comprising a tubular connector body having an end and an open-ended bore extending from said end into the interior of said body, said bore being defined by a wall of said connector body, a tubular insert supported in said bore and having an end extending exterior-wise beyond said body end, said insert having an outer diameter section in a liquidtight, press-fit attachment with a section of said body bore wall, the press-fit sections of said bore wall and insert section forming a liquidtight seal, said insert having another outer diameter section spaced radially inwardly from said body bore wall for forming a conduit chamber, said conduit being inserted within said chamber with the radial outer wall of the conduit being radially inwardly spaced from said bore wall, water can propagate between the conduit outer wall and said bore wall by reason of entering said connector at its bore open end, the axial distance between said insert end extending beyond said body and a plane at least through said body end provides a minimum liquid differential head, said head being sufficient to prevent propagation of water between said conduit and said member beyond the extending end of said member, so that water propagation in opposite directions along the conduit interior is prevented, respectively, by said seal and said differential head.

5. A connector as defined in claim 4, wherein said wall defining said bore has sections of enlarged and reduced inner diameters, respectively, axially adjacent and spaced from said body end, a stepped shoulder in said bore at the junction of said bore section, said stepped shoulder defining the interior end of said conduit chamber, the reduced inner diameter section of said bore wall providing the aforesaid sealtight fit with said insert outer diameter.

6. A connector as defined in claim 4, wherein said insert has a flange spaced from its outer end, the outer diameter of said flange is the section of said insert making a sealtight fit with said body bore wall.

7. A connector as defined in claim 4, wherein said insert has an enlarged diameter portion defining the interior end of said conduit chamber, the outer diameter of said enlarged diameter portion is the section of said insert making a sealtight fit with said body bore wall.

8. A connector as defined in claim 7, said bore wall having sections of enlarged and reduced inner diameters, respectively, axially adjacent and spaced from said body end, a stepped shoulder in said bore at the junction of said bore wall sections, said insert enlarged diameter portion being in abutment against said bore shoulder.

9. A connector as defined in claim 8, further including means for clamping said conduit within said conduit chamber.

10. A conduit as defined in claim 9, wherein said means is a set screw threadedly mounted on said connector body substantially transverse to the longitudinal axis of said body and communicating with said conduit chamber.

References Cited

UNITED STATES PATENTS

1,244,722	10/1917	Finne	277—135
1,762,766	6/1930	De Garay	285—398 X
1,800,348	4/1931	Hunter	285—161
2,184,116	12/1939	Eastman	285—256
2,218,835	10/1940	Ulrich	285—109
2,338,316	1/1944	Buzzell	285—161
2,449,616	9/1948	Pennella	285—423 X
2,698,191	12/1954	Samiran	285—86

FOREIGN PATENTS

40,656	4/1932	France.

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U.S. Cl. X.R.

285—161, 404