May 9, 1950 J. MERCIER 2,507,261

COUPLING

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Fig.1.

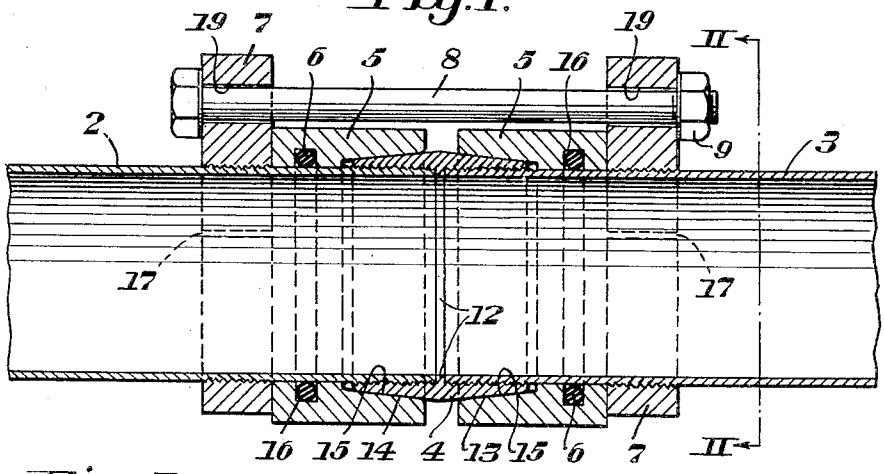


Fig.3.

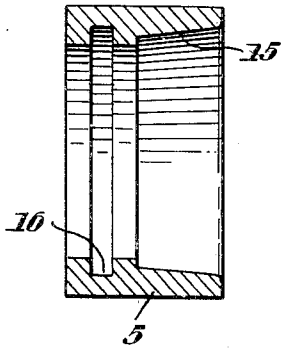


Fig.4.

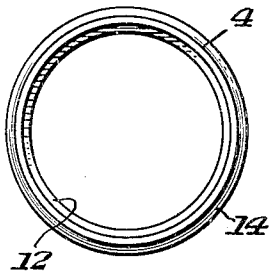


Fig.5.

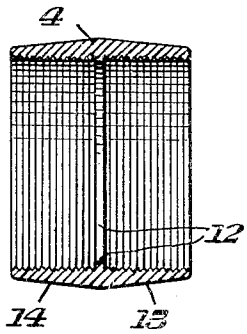
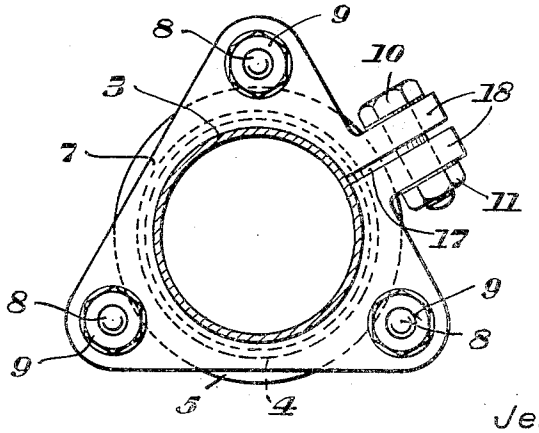


Fig.2.



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Fig. 6.

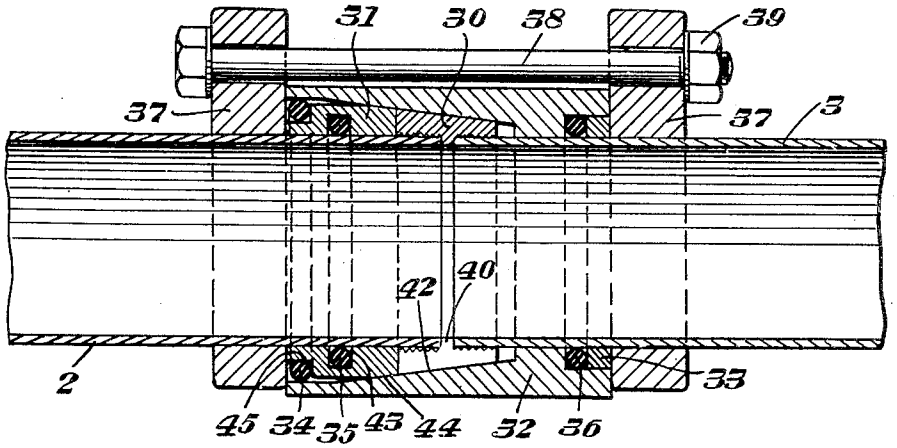


Fig. 7.

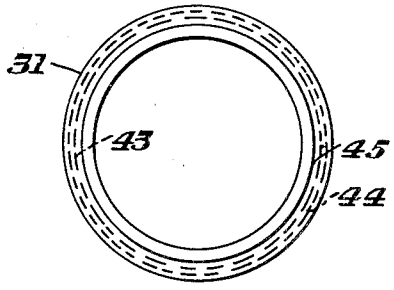


Fig. 9.

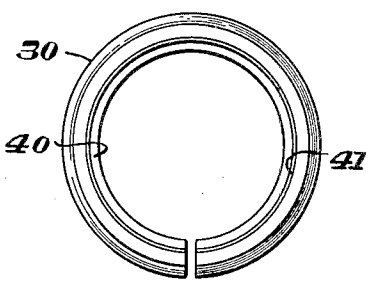


Fig. 8.

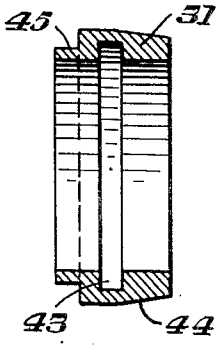
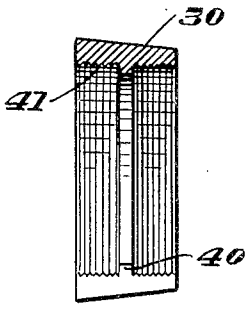


Fig. 10.



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Fig. 11

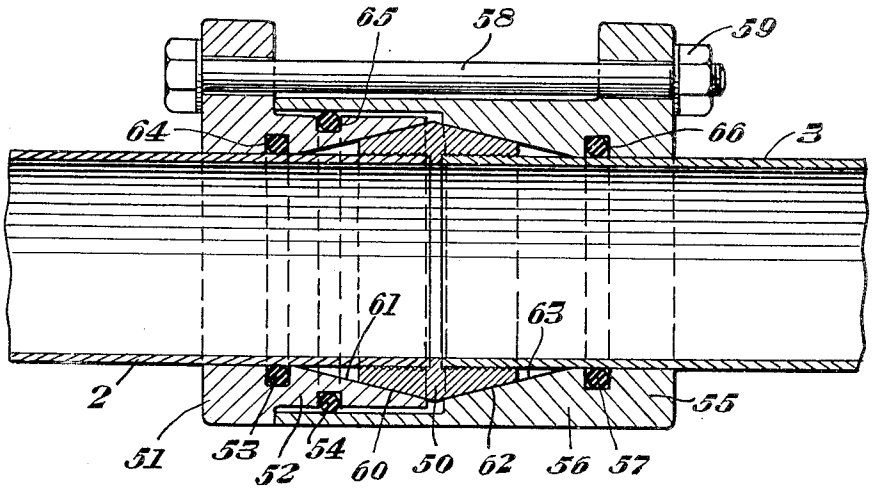
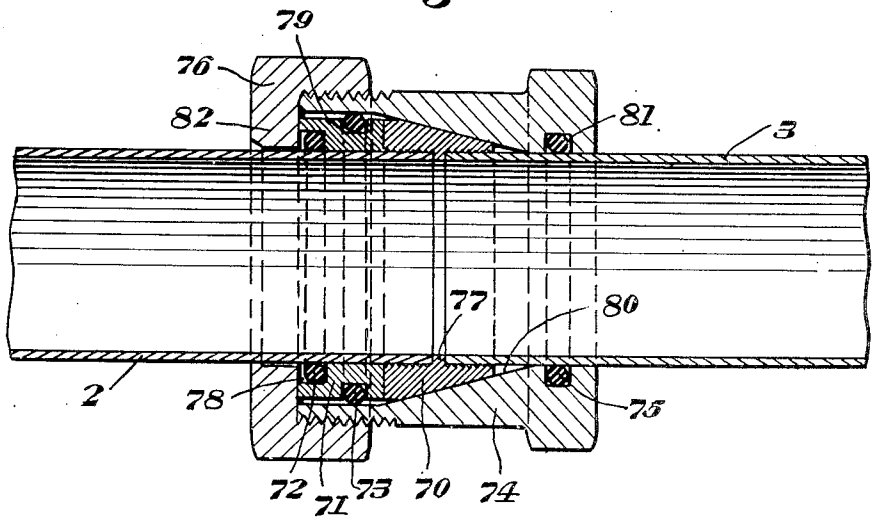


Fig. 12.



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UNITED STATES PATENT OFFICE

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COUPLING

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Application March 6, 1946, Serial No. 652,305

5 Claims. (Cl. 285—132)

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The present invention relates to couplings for joining together thin-walled tubes in end-to-end relationship without the threading of the tubes. My invention is particularly applicable to the joining of tubular conductors in high frequency electric circuits where it is desirable to provide an electrical connection between the tubes, which will not interfere with the transmission of the current.

In certain electrical transmission systems, such as radio transmission lines, high frequency currents are normally carried by coaxial lines in which the outer and inner conductors are in the form of tubes, the tubes forming each conductor being placed in end-to-end relationship. The inner conductor is normally spaced from the outer conductor by a series of rings of a non-conducting material, such as a plastic, and also by a suitable gas. Both the inner and outer tubular conductors carry high frequency currents along the surfaces thereof and, consequently, it is necessary to avoid any substantial interruptions in the flow of the current along these surfaces. These and other requisites of couplings for such lines render the usual types of couplings unsatisfactory.

The joint between adjacent tubes must be of such character as to provide a good electrical connection so that there will be no substantial interruption in the flow of the current along the surfaces of the conductors. Moreover, since the high frequency flow is along the surfaces of the tubes, it is necessary to avoid any substantial deformation of the tube where the joint is effected or resonance in the circuit will result. Gas under pressure is maintained between the inner and outer tubes and, consequently, the coupling must have the further requisite of efficiently sealing the gas within the tube. There must also be sufficient gripping action between the parts of the coupling and the tubes to withstand the substantial axial pressures which are exerted from time to time tending to separate the tubes.

The coupling which I provide by this invention possesses all of the requisites just mentioned and is also of such character as to permit the preassembly of the parts of the coupling before they are applied to the tubular conductors.

In the accompanying drawings, I have shown, for purposes of illustration only, a preferred embodiment and one modified form of my invention. In the drawings,

Figure 1 is a longitudinal sectional view through a joint formed between two tubes by my improved coupling;

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Figure 2 is a view taken along the line II—II of Figure 1;

Figure 3 is a diametral section through one of the collars utilized in the embodiment shown in Figure 1;

Figure 4 is an end view of the sleeve of the embodiment shown in Figure 1;

Figure 5 is a diametral section through the sleeve shown in Figure 4;

Figure 6 is a longitudinal section through a modified form of my invention;

Figure 7 is an end elevational view of the inner ring of the structure shown in Figure 6;

Figure 8 is a diametral section through the inner ring shown in Figure 7;

Figure 9 is an end elevation of the inner sleeve of the embodiment shown in Figure 6;

Figure 10 is a diametral section through the inner sleeve shown in Figure 9;

Figure 11 is a longitudinal sectional view through a modified form of my invention; and

Figure 12 is a longitudinal sectional view through a further modified form of my invention;

Referring first to the embodiment shown in Figures 1 to 5, inclusive, the tubes 2 and 3 are joined together in end-to-end relationship by a coupling comprising a sleeve 4, collars 5, sealing rings 6, end plates 7, longitudinally extending bolts 8, having nuts 9 thereon, and a bolt 10 and a nut 11 for causing the plates 7 to tightly grip the tubes.

The sleeve 4 in which the ends of the tubes are positioned is in the form of a ring having an inner diameter substantially the same as the outer diameter of the tubes. The inner face of the sleeve is serrated so that when the joint is formed the serrations will bite into the tubes and grip them tightly. In order to assure the proper positioning of the tubes in the sleeve, a radially extending projection 12 is provided adjacent the middle of the sleeve, this projection extending inwardly a distance approximately the same as the thickness of the tubes being joined together. Although the inner diameter of the sleeve is the same from one end to the other end, except for the projection just mentioned, the outer diameter increases from each end toward the center so as to provide tapered or sloping faces 13 and 14 for cooperating with the tapered inner faces 15 of the collars 5. The sleeve 4 is continuous and not split longitudinally, although it will be readily apparent that

an additional gripping action will be obtained if this ring is split or slotted longitudinally. However, where a gas seal is necessary it should not be split or slotted.

Each collar 5 is provided with a peripheral groove 16 on the inner face thereof for receiving a sealing ring 6. The sealing rings are preferably round and made of rubber, synthetic rubber or some other suitable material having elastic properties. The inner face 15 of each collar is tapered for cooperation with an outer face of the sleeve 4 so that, as the collars are moved toward each other and along the faces 13 and 14 of the sleeve, a gripping action between the collars and the tubes and between the sealing rings and the tubes will be obtained. Moreover, as these collars are moved toward each other, the sleeve 4, if split, will be compressed radially, and an additional gripping action will be obtained thereby.

Each plate 7 is triangular in shape and is provided with a centrally disposed opening through which one of the tubes may extend. The opening through each plate is preferably substantially the same diameter as the tube to be mounted therein and is provided with serrations to cause it to tightly grip the tube extending therethrough. Each plate 7 is split in the manner indicated at 17 and has projecting lugs 18 thereon. These lugs have openings therethrough for receiving the bolt 10 and, as the nut 11 is threaded on the bolt 10, the lugs 18 are pulled toward each other and the diameter of the centrally disposed opening in which the tube is positioned is reduced and a tight gripping action between the plate and the tube positioned therein is obtained. If desired, the tube may be slightly deformed in this way so as to provide a strong gripping action, although, where the coupling is used for high frequency electrical lines, such deformation of the tube is not desirable as it has a tendency to create resonance in the circuit.

Each plate 7 is provided with holes 19 for receiving the bolts 8. When the parts of the joint have been brought together, threading of the nuts 9 on the threaded ends of the bolts 8 will pull the plates 7 toward each other and the collars will be moved inwardly and will ride along the sloping faces 13 and 14 of the sleeve so that the collars themselves will tightly grip the tubes. Of course, this operation is performed before the plates are brought into tight, gripping relationship with respect to the tubes.

It will thus be seen that the joint formed by my coupling not only provides a tight joint with the tubes, but also provides the necessary seal to prevent the escape of any gases.

Various metals may be utilized for the parts of the coupling, the choice of the material for the metallic portions of the coupling being determined by the material of the tubing. If the tubes being joined together are copper, a bronze sleeve, brass collars and brass plates are preferable. However, the tubes may be made of any suitable soft metal other than copper, such as aluminum and the like. In the choice of materials, it is merely necessary to avoid using metals which will set up an electrolytic effect.

Referring now to the embodiment shown in Figures 6 to 10, inclusive, it comprises an inner sleeve 30, an inner ring 31, an outer sleeve 32, a metallic end ring 33, sealing rings 34 and 35 in the inner ring 31, a sealing ring 36 positioned in a recess in the outer sleeve 32, end plates 37 and bolts 38 and nuts 39 for moving toward each other the plates 37.

The inner sleeve 30 has an inner diameter substantially the same as the outer diameter of the pipe members 2 and 3 to be joined together. It has an inwardly extending nib or projection 40 against which the ends of the tubes may abut. This nib extends radially of the sleeve a distance approximately the same as the thickness of the tubes to be joined so that the inner face of the nib will be approximately in line with the inner faces of the tubes. The inner face of the sleeve 30 is provided with serrations 41 to provide a gripping action between the sleeve and the tubes when the joint is formed. The inner and outer faces of the sleeve are not parallel to each other, the outer diameter being smaller at one end than at the other end so as to provide a sloping outer face for cooperation with the sloping inner face 42 of the outer sleeve 32. The inner sleeve is slotted so that, as the joint is formed, the inner diameter of the inner sleeve will be reduced and the sleeve pressed into tight gripping engagement with the tubes.

The inner ring or collar 31, which is positioned to one side of the inner sleeve, has an inner diameter substantially the same as the outer diameter of the tubes being connected together. The inner face of this ring or collar is provided with a groove 43 which carries the O ring 35. This O ring provides a seal against egress of gases from the interior of the tubes. The outer diameter of this ring or collar is not uniform. The end closest the inner sleeve is bevelled, as indicated at 44, to cooperate with the sloping inner face 42 of the outer sleeve 32. Adjacent the other end of this ring the outer face has a groove 45 which carries the sealing ring 34. This sealing ring extends between the ring or collar and the outer sleeve, and provides a seal against egress of gases from the interior of the tubes.

The outer sleeve 32 has an outer diameter substantially greater than the diameters of the tubes and is provided with a recess for receiving the inner sleeve and the inner ring and another recess for receiving the end ring 33 and the sealing ring 36. The one recess is open at the one end of the sleeve and the other recess is open at the other end of the sleeve. Between these recesses the inner diameter of the outer sleeve is approximately the same as the outer diameters of the tubes. The face 42 of the recess forming the chamber in which the inner sleeve and inner ring are positioned is tapered for cooperation with the tapered outer surfaces on the inner sleeve and inner ring so that, when the plates 37 are moved toward each other and the outer sleeve moved along the inner sleeve, the latter will become contracted into tight engagement with the tubes.

The end ring 33 and the sealing ring 36 extend around the one tube and are positioned within the groove in the one end of the outer sleeve. This end ring does not provide any gripping action on the tube, but, as the joint is formed, it exerts pressure on the sealing ring 36 so that it is in tight contact with the tube 3. This sealing ring prevents egress of gases from the interior of the tubes.

The plates 37 are similar to the plates 7 of the embodiment shown in Figures 1 to 5, inclusive, and are slotted and provided with lugs for permitting the clamping of them on the tubes. These plates also have openings in them to receive the bolts 38 for pulling the plates toward each other in the assembly of the coupling. The openings through the plates 37 may or may not

have serrations for providing a tight grip on the tubes. In this embodiment, the inner sleeve is slotted and serrated and a tight grip on each tube is obtained by this arrangement so that it is not necessary that the openings through the plates 37 be provided with the serrations to afford a strong gripping action between the plates and the tubes.

As is apparent from the above description, the plates 37 are moved toward each other by the bolts 38 and the nuts 39 and, as they are moved toward each other, the inner sleeve is forced into gripping engagement with the tubes. After the parts have been moved longitudinally to the position illustrated in Figure 6, the plates are clamped on the tubes in the manner illustrated in Figure 2.

It will be seen, from what has been stated, that this embodiment also provides the necessary electrical connections between the tubes, a sealing of the tubes against egress of gases contained therein, and the necessary gripping action to prevent longitudinal movement of the tubes from disrupting the joint. In this embodiment, various different metals may be employed for the metallic parts and various elastic materials may be employed for the sealing rings. Where copper tubing is used, the sleeves, rings and plates are preferably of bronze or brass. The sealing rings are preferably made of natural rubber, synthetic rubber or some other synthetic elastomer.

In the embodiment shown in Figure 11, the tubes 2 and 3 are joined by a coupling comprising an inner sleeve 50, a plate 51, a collar 52 integral with the plate 51, sealing rings 53 and 54 carried by the plate and collar, a plate 55, a sleeve portion 56 integral with the plate 55, a sealing ring 57 carried by the plate and sleeve 55 and 56, and bolts 58 and nuts 59 for moving the plates axially toward each other.

The inner sleeve 50 is similar to the inner sleeve 4 of the embodiment shown in Figure 1 and has an inwardly extending nib against which the ends of the tubes abut. This nib extends inwardly a distance approximately the same as the wall thickness of the tubes so that the inner face of the nib is in the same plane as the inner faces of the tubes. The outer diameter of the sleeve 50 decreases from the center toward each end to provide a bevelled face 60 for cooperation with the bevelled inner face 61 of the collar-like extension of the plate 51, and a tapered face 62 for cooperation with the inner tapered face 63 of the sleeve-like extension of the plate 55.

The plate 51 and its collar-like extension 52 are provided with an inner groove 64 and an outer groove 65 in which the sealing rings 53 and 54 are positioned. The ring 53 effects a seal between the collar or plate and the tube extending therethrough, and the sealing ring 54 effects a seal between the collar and the sleeve 50 which extends over the recess in the outer face of the collar.

The plate 55 and the integral sleeve 56 carry a recess 66 in which the sealing ring 57 is positioned. This sealing ring effects a seal between the sleeve and plate 55 and the tube 3 which extends therethrough.

In this embodiment, as the plates 51 and 55 are pulled toward each other by the bolts 58 and the nuts 59, the collar-like extension of the plate 51 rides on the one bevelled face of the inner sleeve and the sleeve-like extension 56 of the plate 55 rides on the other bevelled face of the inner sleeve, and the collar and sleeve are caused

to grip the tubes extending therethrough. In the case of small tubing, it is not necessary that the inner sleeve be slotted, but, in some instances, it may be desirable to slot the inner sleeve so that the sleeve can be made to more tightly grip the tubes.

Thus it will be seen that in this embodiment of my invention the necessary electrical connection between the tubes will be effected, the tubes will be tightly gripped so that the joint cannot be pulled apart by the axial pressures encountered in normal use, and the joint will be sealed against egress of gas from the tubes.

In Figure 12, I have shown a further embodiment of my invention.

The coupling of this embodiment comprises an inner sleeve 70, a collar 71, sealing rings 72 and 73 carried by the collar, an outer sleeve 74, a sealing ring 75 extending between the outer sleeve and the tube 3, and a nut 76 internally threaded for cooperation with the external threads on the sleeve 74.

The inner sleeve 70 is similar to the inner sleeve 30 of the embodiment shown in Figures 6 to 10, inclusive, except that the slope of the outer face is greater in the case of the embodiment shown in Figure 12. The sleeve 70 has a nib 77 against which the ends of the tubes abut and the inner face of the sleeve is serrated to provide the desired gripping action on the tubes. The sleeve is preferably slotted to increase the gripping action on the tubes, although, for tubes three-eighths of an inch in diameter or less, slotting of this sleeve is not necessary.

The collar 71 may be made integral with the sleeve 70, although, in Figure 12, it is shown as being a separate part. This collar has an inner diameter substantially the same as that of the tube around which it extends. The inner face is provided with a groove 78 and the outer face is provided with a groove 79 in which the sealing rings 72 and 73, respectively, are positioned.

The outer sleeve 74 has an inner diameter adjacent the one end sufficiently great to permit it to extend over the collar and the sealing rings carried thereby. The end portion of the sleeve extending over the collar has a uniform inner diameter. The other end of the sleeve has a uniform inner diameter substantially the same as that of the tube 3 and between these two portions the diameter progressively decreases from the larger to the smaller diameter so as to provide a bevelled face 80 cooperating with the bevelled outer face of the inner sleeve 70. The outer sleeve is provided with a recess 81 near one end thereof in which the sealing ring 75 is positioned.

The nut 76 has a radially extending flange 82 against which the collar 71 abuts. When the parts are placed in position, the threading of the nut 76 on the sleeve 74 pulls the sleeve 74 along the inner sleeve 70, and the inner sleeve is forced into tight engagement with the tubes.

Thus it will be seen that in this embodiment also the requisite gripping of the tubes, the sealing of the tubes against egress of gases therefrom, and the requisite electrical connection between the tubes are obtained.

While I have shown and described one embodiment and several modified forms of my invention, it will be understood that my invention is not limited thereto. For example, the necessary gripping action between the end plates and the tubes can be obtained in various ways. Also, the inner and outer sleeves or collars may assume various shapes. It is contemplated that my in-

vention may be embodied in any of the several forms falling within the scope of the appended claims.

I claim:

1. A coupling for joining together coaxial tubes comprising a sleeve extending around the adjacent ends of the tubes to be joined, said sleeve having an inner diameter substantially the same as that of the tubes to be joined and a radially extending stop member intermediate the ends of the sleeve, said sleeve also having tapered outer surfaces, an outer member extending at least partially over said sleeve and having a tapered inner face cooperating with a tapered outer surface of the sleeve, a sealing ring positioned between said outer member and the adjacent tube for effecting a seal therebetween, a second outer member extending partially over said sleeve and having a tapered inner face cooperating with a tapered outer surface of the sleeve, a sealing ring positioned between the adjacent tube and said second outer member, and means for moving said outer members axially long the tapered outer surfaces of said sleeve to force parts of the coupling into gripping engagement with the tubes.

2. A coupling for joining together coaxial tubes comprising an inner sleeve extending around the adjacent ends of the tubes to be joined, said sleeve having an inner diameter substantially the same as that of the tubes to be joined and tapered outer surfaces, an outer member having a tapered inner face surrounding and cooperating with a tapered outer surface of the inner sleeve, sealing means extending between each of said outer members and the adjacent tube, and means for moving the outer members toward each other axially of the tubes and for causing said members to ride over the tapered outer surfaces of the sleeve whereby parts of the coupling are brought into gripping engagement with the tubes.

3. A coupling for joining together coaxial tubes comprising an inner sleeve extending around the adjacent ends of the tubes to be joined, said sleeve having an inner diameter substantially the same as that of the tubes to be joined and tapered outer surfaces, an outer member surrounding the inner sleeve and having a tapered inner surface cooperating with a tapered outer surface of the sleeve, a second outer member having a tapered inner surface for cooperation with a tapered outer surface of said inner sleeve, at least a part of said second outer member extending between the inner sleeve and said first mentioned outer member, sealing means extending between each of said outer members and an adjacent tube, and means for moving the outer members axially of the tubes toward each other

and along the tapered outer surfaces of the inner sleeve.

4. A coupling for joining together a tube and an outer member adjacent thereto, comprising a slotted inner sleeve located at the end of the tube, said inner sleeve having an inner diameter substantially the same as that of the tube and a radially extending stop member resting against the end of the tube, said inner sleeve having a tapered outer surface, a second sleeve extending peripherally around the tube and at least partially over the inner sleeve and having a tapered inner surface cooperating with the tapered outer surface of the inner sleeve, a plurality of sealing rings of rubber or the like, one of said sealing rings forming an airtight seal between the tube and said second sleeve, at least one of said rings forming a seal between the second mentioned sleeve and the outer member, and means for compressing radially the inner sleeve while moving the outer sleeve toward the outer member.

5. A coupling for joining together coaxial tubes comprising an inner sleeve extending around the adjacent ends of the tubes to be joined, said sleeve having an inner diameter substantially the same as that of the tubes to be joined and tapered outer surfaces, an outer member extending over the said sleeve and having a tapered inner surface cooperating with the tapered outer surface of the inner sleeve, a second outer member having a tapered inner surface cooperating with a tapered outer surface of the inner sleeve, said first mentioned outer member extending partially over the second mentioned outer member, sealing means between the outer member and the adjacent tube and between the second mentioned outer member and its adjacent tube, sealing means between the first mentioned and second mentioned outer members, and means for moving the outer members longitudinally along the tapered outer surfaces of the inner sleeve for bringing parts of the coupling into tight engagement with the joined tubes.

JEAN MERCIER.

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