

Feb. 20, 1945.

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2,369,849

JOINT FOR ELECTRICAL CONDUCTORS

Filed May 4, 1943

Fig. 1.

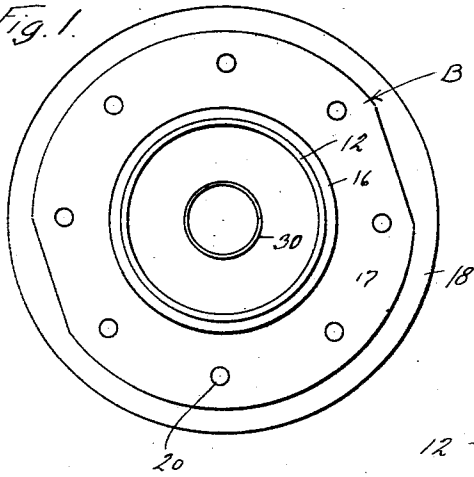
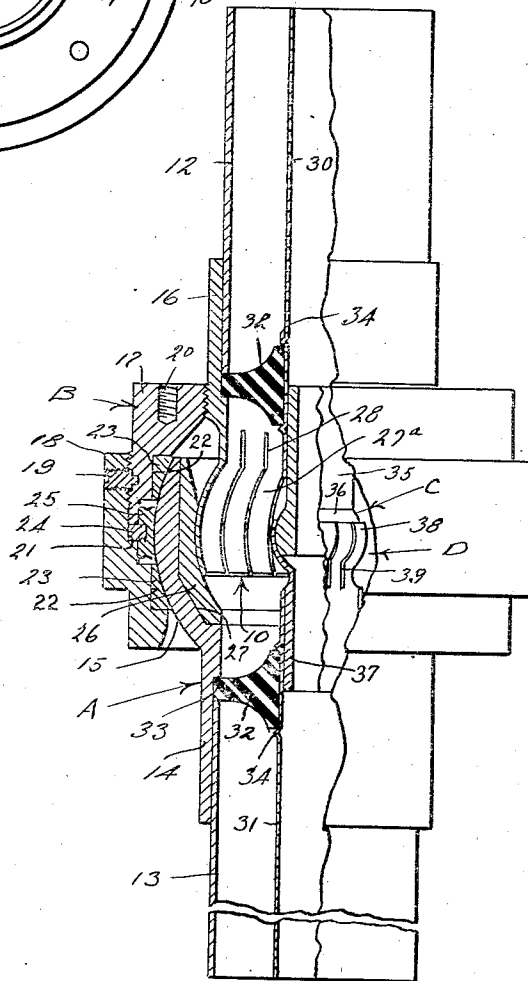


Fig. 2.



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UNITED STATES PATENT OFFICE

2,369,849

JOINT FOR ELECTRICAL CONDUCTORS

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Application May 4, 1943, Serial No. 485,612

10 Claims. (Cl. 174—21)

This invention relates to electrical conductors and relates more particularly to joints for tubular electrical conductors. A general object of this invention is to provide a practical, effective and very dependable swivel joint for electrical conductors.

Another object of this invention is to provide a universal joint and swivel joint for tubular electrical conductors that allows free relative rotation and universal movement between the connected conductor sections while maintaining complete and uninterrupted electrical transmission between the sections.

Another object of this invention is to provide a joint of the character mentioned useful in connection with multiple tubular high-frequency transmitting conductors.

Another object of this invention is to provide an electrical conductor connection of the character referred to that may conduct or handle a selected gas or preserve a reduced pressure and which embodies effective sealing means for retaining the gas or negative pressure.

Another object of this invention is to provide a conductor joint of the character referred to that embodies dependable self-lubricating ball and socket contact or conducting means for the individual tubular conductors.

A further object of this invention is to provide a conductor connection of the character mentioned that remains effective for a long period of operation and requires no adjustment, lubrication, or other manual servicing.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is an end view of the joint or connection provided by this invention and Fig. 2 is a side elevation with the principal parts broken away to appear in longitudinal cross section.

The multiple conductor connection of the invention may be said to comprise, generally, outer ball and socket members A and B adapted to be associated with tubular conductor parts, contact or conducting means 10 associated with the members A and B for maintaining an electrical connection therebetween and ball and socket contact or conducting members C and D adapted to be associated with inner conductor sections for maintaining an electrical connection therebetween.

The ball and socket members A and B are adapted to be secured to the adjacent or opposing ends of outer tubular conductor sections 12 and 13 of the multi-tube conductor. The ball member A is a tubular element and may be an integral or one piece part. In the preferred con-

struction illustrated the member A has a tubular outer position 14 for receiving or connecting with the outer conductor section 13. In practice the conductor section 13 enters the tubular portion 14 of the ball member A and may be secured thereto by solder, a weld, or screw threads, it being preferred that this connection be fluid and pressure tight. A head portion having a spherical external surface 15 continues inwardly from the portion 14. The spherically curved surface 15 is finished smooth and is of substantial extent.

The socket member B is preferably sectional to facilitate the assembly of the connection or joint. The socket member B comprises a tubular outer section 16 connecting with the part 12 of the outer electrical conductor. The conductor part 12 fits within the tubular section 16 and is secured and sealed therein by solder, welding, threads or other means. The socket member B further includes a section 17 screw threaded on the inner portion of the section 16 and a section 18 screw threaded on the end portion of the section 17. A screw 19 may set or lock the sections 17 and 18 against relative turning. The end of the section B may have spaced threaded sockets 20 to facilitate the mounting or attachment of the socket section when the same is to be attached to a support or the like.

The interiors of the sections 17 and 18 are shaped to form a socket for the reception of the ball member A and to carry sealing means for packing or sealing between the socket section and the spherically curved ball surface 15. The inner extremity of the section 17 is spaced from an annular internal shoulder on the section 18 to leave an annular internal groove 21 in the socket member. The sections 17 and 18 have complementary and opposing internal annular recesses or grooves 22.

The invention includes wear taking and sealing parts on the interior of the socket member B for cooperating with the spherically curved surface 15 of the ball member A. Wear taking rings 23 are inserted and fixed in the grooves 22 of the sections 17 and 18. The rings 23 have spherically concaved surfaces for contacting the spherically curved surface 15 of the ball member A. The wear rings 23 may be formed of bronze impregnated with a suitable lubricant to be self-lubricating. It will be observed that the wear taking rings 23 provide spaced bearing surfaces of substantial area on the interior of the socket member B for cooperating with the spherically curved surface 15 of the ball member A.

The packing or sealing means for sealing between the members A and B includes a ring 24 of brass or the like held in the groove 21 in the interior of the member B. When the sections 17 and 18 are assembled the ring 24 may be securely

gripped in the groove 21. A sealing ring 25 is carried by the ring 24. The ring 24 projects inwardly from the groove 21 and its projecting portion is roughened or toothed. The sealing ring 25 has a groove receiving this roughened portion of the mounting ring 24 to be dependably retained thereon. The sealing ring 25 may be formed of rubber, rubber composition, synthetic rubber or other selected sealing material. An internal surface of substantial extent is provided on the ring 25 to conform to and seal with the spherically curved surface 15 of the ball member A. The opposite ends of the sealing ring 25 may be relieved or grooved to give the ring greater resiliency. It will be seen how the sealing ring 25 spaced between the wearing rings 23 seals with the ball surface 15 to prevent the leakage of air, gas or other fluids between the ball and socket sections A and B.

The means 10 serves to maintain extensive and adequate contact between the members A and B for the transmission of electrical energy, say high frequency current. The means 10 is characterized by ball and socket contact elements within the ball and socket assembly A—B described above. In the construction illustrated the contact means 10 includes a contact insert 26 seated and fixed within the enlarged head portion of the ball member A. The insert 26 has an internal spherically concaved surface 27 whose axis of curvature is coincident with the axis of the ball surface 15. The insert 26 is formed of a suitable conducting material. In practice it may be preferred to form the insert 26 of bronze impregnated with a suitable lubricant.

The contact means 10 further includes a contact ball 27^a for cooperating with the contact socket or insert 26. The contact ball 27^a projects or continues from the inner end of the section 16 of the member B and may be an integral part of the section 16. The contact ball 27^a is a hollow or tubular part having a relatively thin wall and is flared or enlarged to be partially spherical. The external spherically curved surface of the contact ball 27^a is of substantial extent and has ample cooperation with the surface 27 of the insert 26. The contact ball 27^a remains in extensive cooperation with the socket contact or insert 26 in all relative positions of the ball and socket members A and B. In accordance with the invention the contact ball 27^a has a multiplicity of spaced axial cuts or slots 28 which divide the contact ball into a plurality of fingers having substantial flexibility and resiliency. The slots 28 may continue into the cylindrical inner portion of the socket 16. The parts are proportioned and related so that the contact fingers of the ball 27^a are confined or flexed inwardly to some extent to be constantly urged outwardly into effective contact with the insert 26 by their own resiliency. The ball and socket contact means 10 maintains extensive uninterrupted electrical connection between the outer electrical conductor parts 12 and 13 at all times and with the members A and B in all relative positions.

The ball and socket contact members C and D are associated with an inner or internal tubular conductor to maintain electrical contact between the parts of the conductor. In the construction illustrated the parts 30 and 31 of the inner conductor are thin-walled tubes of copper or the like extending centrally and longitudinally through the outer conductor parts 12 and 13. Ring-like insulators 32 of suitable dielectric material have

their peripheral portions engaged and held between the inner ends of the outer conductor parts 12 and 13 and internal shoulders 33 on the portion 14 and section 16. The insulators 32 are engaged about the inner conductor parts 30 and 31 to hold them centralized and annular ridges 34 are provided on the conductor parts 30 and 31 at the ends of the insulators to prevent relative axial movement between the parts.

The ball member C is tubular and has what may be termed a tubular stem portion 35 secured to the inner conductor part 30. The stem portion 35 is seated within the conductor part 30 and may be secured and sealed thereto by solder, welding, screw threads, or the like. The ball contact C comprises an external enlargement or head formed on the inner end of the stem portion 35 and provided with a spherically curved external surface 36. The surface 36 is of substantial extent and is finished.

The socket contact member D is a tubular element having a cylindrical tubular stem 37 entering the inner conductor part 31. The stem 37 is soldered, welded, threaded or otherwise secured and sealed to the conductor part 31. A hollow partially spherical head 38 is provided on the inner end of the stem 37 and has a finished spherically curved internal surface which cooperates with the surface 36 of the ball contact C. The head 38 is provided with a plurality of spaced axial slots 39 which divide it into a plurality of flexible resilient fingers. The resiliency of these fingers holds the socket head 38 in complete, effective contact with the surface 36 of the ball contact C at all times and with the joint elements in all angular positions. It may be preferred to form the ball contact C of bronze or the like impregnated with a suitable lubricant so that the ball and socket contact means C—D for the inner electrical conductor is self-lubricating.

It is believed that the utility and practicability of the electrical connection provided by the invention will be readily understood from the foregoing detailed description. The cooperating ball and socket members A and B connect the conductor parts for free relative universal movement and free relative rotation. The self-lubricating wearing rings 23 insure the long life of the connection and the sealing ring 25 prevents the leakage of gas and other fluid from between the joint parts. The ball part 27^a cooperating with the spherical surface 27 of the socket contact 26 provides for the full, uninterrupted transmission of electricity between the conductor parts 12 and 13 at all times and with the parts in the various annular positions. The contact means 10 is self-lubricating. The ball and socket contact means C and D embodying the resilient socket 38 which grips about the surface 26 preserves full uninterrupted electrical engagement between the conductor parts 30 and 31 under all conditions of operation and with the joint parts in all angular positions. If desired, a selected gas may be maintained or conducted through the inner tubular conductor or a reduced pressure condition may be maintained in the conductors and connection.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A connection for tubular electrical conduc-

tors including, a socket member on one conductor, a ball member on the other conductor engaged in the socket member establishing a closed connection between the conductors for universal relative movement, a socket contact on the interior of the ball member and a resilient tubular ball contact on the socket member engaging in the socket contact to maintain electrical connection between the conductors.

2. A connection for tubular electrical conductors including a socket member on one conductor, a ball member on the other conductor extending into the socket member, wear taking parts inserted in the socket member cooperating with the ball member to mechanically connect the conductors for relative universal movement, a socket contact on the interior of the ball member and a tubular ball contact in the socket member engaging in the socket contact to maintain electrical connection between the conductors.

3. A connection for tubular electrical conductors including a socket member on one conductor, a ball member on the other conductor extending into the socket member, wear taking parts supported in the socket member cooperating with the exterior of the ball member to mechanically connect the conductors for relative universal movement, a socket contact on the inner wall of the ball member, and a tubular ball contact in the socket member engaging in the socket contact to maintain electrical connection between the conductors, the ball contact being thin-walled and provided with spaced axial slots to have resilient fingers which bear in the socket contact.

4. A connection for tubular electrical conductors including a socket member on one conductor, a ball member on the other conductor extending into the socket member, wear taking parts supported in the socket member cooperating with the ball member to mechanically connect the conductors for relative universal movement, a sealing ring in the socket member sealing with the ball member to prevent the leakage of fluid between the members, a socket contact on the interior of the ball member and a tubular ball contact in the socket member engaging in the socket contact to maintain electrical connection between the conductors.

5. A connection for tubular electrical conductors including a socket member on one conductor, a ball member on the other conductor engaged in the socket member establishing a closed joint connecting the conductors for universal relative movement, a contact on the interior of the ball member having a spherically concaved surface, and a tubular thin walled ball contact of resilient material in the socket member engaged in said surface to maintain electrical connection between the conductors, the ball contact having spaced axial slots providing resilient fingers which bear on said surface.

6. A connection for multi-tube electrical conductors including a socket member to be secured to the outer tube of one conductor, a ball member to be secured to the outer tube of the other conductor and engaged in the socket member to connect the conductors against separation and for relative universal movement, ball and socket contact elements within said members fitting one within the other to maintain said outer tubes in electrical connection, and ball and socket con-

tacts secured to the inner tubes of the conductors and fitting one within the other to maintain said inner tubes in electrical connection.

7. A connection for multi-tube electrical conductors including a socket member to be secured to the outer tube of one conductor, a ball member to be secured to the outer tube of the other conductor and engaged in the socket member to connect the conductors for relative universal movement, a socket contact in the ball member having a spherically curved concave surface, a tubular ball contact in the socket member engaging in said surface to maintain said outer tubes in electrical connection, a socket contact on the inner tube of one conductor, and a ball contact on the inner tube of the other conductor engaging in the last named socket contact to maintain the inner tubes in electrical connection.

8. A connection for multi-tube electrical conductors including a socket member to be secured to the outer tube of one conductor, a ball member to be secured to the outer tube of the other conductor and engaged in the socket member to connect the conductors for relative universal movement, a socket contact supported in the ball member having a spherically curved concave surface, a tubular ball contact carried by the socket member engaging in said surface to maintain said outer tubes in electrical connection, a thin walled socket contact on the inner tube of one conductor, and a tubular ball contact on the inner tube of the other conductor engaging in said thin walled socket contact to maintain the inner tubes in electrical connection, said thin walled socket contact having axial slots which render it resilient.

9. A connection for multi-tube electrical conductors including a socket member to be secured to the outer tube of one conductor, a ball member to be secured to the outer tube of the other conductor and engaged in the socket member to connect the conductors for relative universal movement, sealing means for sealing between the socket and ball members to prevent the leakage of fluid between the members, ball and socket contact elements in said members fitting one within the other to maintain said outer tubes in electrical connection, and ball and socket contacts secured to the inner tubes of the conductors and fitting one within the other to maintain said inner tubes in electrical connection.

10. A connection for multi-tube electrical conductors including a socket member to be secured to the outer tube of one conductor, a ball member to be secured to the outer tube of the other conductor and engaged in the socket member to connect the conductors for relative universal movement, a socket contact in the ball member having a spherically curved concave surface, a tubular ball contact in the socket member engaging in said surface to maintain said outer tubes in electrical connection, insulators engaged in the ball and socket members for supporting the inner tubes of the conductors, a socket contact on the inner tube of one conductor, and a ball contact on the inner tube of the other conductor engaging in the last named socket contact to maintain the inner tubes in electrical connection.

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