A unique quick connect electrical coupler, comprising a female coupling half having electrical contact means, magnet means and tapered recess means therein. A male coupling half having electrical contact means and magnet means therein and tapered projecting means adapted to be received in said recess means in said female coupling half to automatically align said male and female coupling halves relative to one another, said electrical contact means and said magnet means in said male and female coupling halves being in contacting alignment with one another when said coupling halves are coupled together, and said tapered projecting means and recess means preventing lateral displacement of the coupling halves relative to one another when they are coupled together.

9 Claims, 8 Drawing Figures
QUICK CONNECT ELECTRICAL COUPLER

BACKGROUND OF THE INVENTION

This invention relates to quick connect electrical couplers, and more particularly, relates to a quick connect coupler for low voltage electrical current, wherein magnet means is used to maintain the coupler in connected relationship.

Conventional electrical couplers require matching or fitting of male or female parts on the coupler sections, as for example, the spaced slots and spaced projections on the receptacle and plug, respectively, of a typical household electrical outlet fitting. Such conventional couplers require careful hand and eye coordination in order to properly match or fit the interfitting projection and recess means thereon, and they are subject to damage due to blows, pulls or other forces exerted thereon laterally or in a direction other than normal to the axis of insertion of the projections into the recesses. Further, the conventional couplings must be provided with a substantial mechanical interlock between the coupling halves to insure that the couplers or connectors do not become disconnected; and, accordingly, excessive force is frequently required in order to connect and/or disconnect the couplings.

With the present invention, an economical and easy to use quick connect electrical coupler is provided which eliminates all of the aforementioned problems found in conventional electrical couplers.

With the present invention, a pair of coupling halves or members are provided, each having magnet means and electrical contact means therein and with one of the members having a projection which interfits into a recess in the other coupling member. The magnet means in the coupling halves serve to securely hold the halves together without requiring any mechanical interlock or the like, and the interfitting projection and recess means automatically aligns or indexes the coupling halves relative to one another so that very little hand and eye coordination is required in order to properly align and mate the coupling halves. In fact, when the coupling halves are positioned in close proximity to one another, the magnet means actually urge the coupling halves together and into properly assembled relationship with a quick "snap" action.

Further, in accordance with the present invention, the magnet means may comprise either a permanent magnet or an electromagnet and may be used as both the means for holding the coupling halves together and as the electrical contact means in the coupling halves. Moreover, the interfitting projection and recess means in the coupling halves requires the coupling halves to be separated from one another with a straight, axial pull and thus the surfaces must be parted in a direction normal to each other and not with a shear or lateral motion and the holding power of the magnets in the coupling halves is accordingly substantially increased, thus rendering the electrical coupler highly reliable in environments where conventional electrical couplers might become dislodged due to vibration or the like. Further, the self-indexing and magnetic attraction between the coupling halves makes the coupler highly desirable where simplicity and ease of coupling and uncoupling the electrical connector is required. One example of use of the present invention would be in a space vehicle or the like, wherein economy, compactness, reliability and ease of operability are important considerations in the design of all of the components in the space craft, and particularly of connections in control circuits and the like.

OBJECTS OF THE INVENTION

It is an object of this invention to provide a quick connect electrical coupler wherein magnet means is used in the coupling halves to hold the coupling halves together and interfitting tapered projection and recess means are on the coupling halves to automatically align the coupling halves relative to one another and to prevent separation thereof by other than an axial pull or movement therebetween.

Another object of this invention is to provide a quick connect electrical coupler, wherein a pair of coupling members each having magnet means and electrical contact means therein are held together solely by the attraction between the magnets in the coupling halves and wherein the coupling halves are automatically aligned relative to one another by tapered interfitting projection and recess means on the coupling halves.

A still further object of the invention is to provide a quick connect electrical coupler which has magnet means therein to hold the coupling halves together and wherein the coupling halves may be connected together in any rotational position relative to one another.

Yet another object of the invention is to provide a quick connect electrical coupler wherein magnet means is used in the coupling halves to hold the coupler together and wherein a plurality of electrical contact means are provided in each of the coupling halves for interconnecting a plurality of electrical circuits.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a first form of electrical coupler in accordance with the invention.

FIG. 2 is an enlarged sectional exploded view of the coupler of FIG. 1.

FIG. 3 is a front plan view of the male half of the coupler seen in FIG. 2 and is taken along line 3—3.

FIG. 4 is an exploded perspective view of a second form of quick connect electrical coupler in accordance with the invention.

FIG. 5 is a sectional end view of the coupler of FIG. 4.

FIG. 6 is a side sectional view of the coupler seen in FIG. 4.

FIG. 7 is an enlarged exploded sectional view of a third form of quick connect electrical coupler, and;

FIG. 8 is a front plan view of the male coupler half taken along line 8—8 in FIG. 7.

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, wherein like reference numerals indicate like parts throughout the several views, a first form of quick connect electrical coupler is indicated generally at 10 in FIG. 1 and comprises a generally circular, disc shaped male coupling half 11 and a generally circular, disc shaped female coupling half 12.

The male coupling half 11 has an annular, ring shaped magnet 13 and an annular, ring shaped insulating spacer 14 disposed immediately radially inwardly of the annular magnet 13 and in abutting contact therewith. The magnet 13 has front and rear annular faces 13a and 13b, respectively, and the spacer 14 similarly
3,810,258

3 has front and rear faces 14a and 14b, respectively, lying in the same planes on the face of magnet 13. A cylindrically shaped magnet 15 is disposed radially inwardly of the insulating spacer 14 and in contact therewith and has a forwardly projecting conical tip 16 thereon extending beyond the plane of the front faces 13a and 14a of magnet 13 and spacer 14.

The female coupling half 12 is similarly constructed, and has a magnet 13f and spacer 14f identical to the magnet 13 and spacer 14 in the male coupling half, except that the magnets 13 and 13f have opposite polarities. Further, the female coupling half 12 has a magnet 17 in the center thereof fitted within the insulating spacer 14 and has a conical recess 18 therein of substantially the same size and shape as the conical tip 16 on the magnet 15 in the male coupling half 11.

A pair of lead wires or cables 19 and 20 are connected with the magnet 15 and magnet 13, respectively, in the male coupling half 11 and lead to a suitable point of use, or source of electrical energy, as desired. A similar pair of wires or the like 21 and 22 are connected with the magnets 17 and 13f in the female coupling half 12 and lead to a suitable point of use or to a source of electrical energy.

The outer marginal edge and the rear face of the male coupler half 11, and the wires 19 and 20, are encased in a suitable insulating material 23 such as plastic or the like. The outer marginal edge and rear face of the female coupling half 12, and the wires 21 and 22, are also similarly encased in a suitable insulating material 24 such as plastic or the like. A radially outwardly extending flange 25 is provided on the radial marginal edge of the female coupling half for connecting the female coupling half in an opening O or the like in a suitable housing means, wall, partition, or the like 26 by means of rivets or the like 27 extended through the flange 25 and an adjacent portion of the housing or wall or the like 26.

A modified form of the invention is illustrated in FIGS. 4 through 6, wherein a multiple type coupler 28 is provided. The multiple type coupler 28 comprises a male coupler half 29 and a female coupler half 30. Both the male and female coupler halves are elongate, rectangulally shaped members and the male coupling half comprises a plurality of parallel, aligned magnets 31, each having a conical, forwardly projecting tip 32 thereon. The magnets 31 are embedded in an insulating material 33 with the conical tips 32 projecting from the front face of the insulating material 33 and the opposite ends of the magnets 31 flush with the opposite or rear face of the insulating material. Each magnet 31 has a wire 34 embedded in the rear end thereof and extending at a right angle therefrom along the rear face of the male coupler half 29 for connecting the magnets 31 with either a point of use of electricity or with a suitable source of electricity, as desired. The top, bottom and opposite end edges and rear face of the male coupler half 29, and the wires 34 are encased or covered with a suitable insulating material 35 such as plastic or rubber or the like.

The female coupler half 30 is similarly constructed, except that a plurality of magnets 31f each having a conical recess 32f in the forward end thereof, of substantially the same size and shape as the conical tips 32 on the magnets 31 in the male coupling half, are provided so that the male and female coupling halves may be mated together.

Additionally, the female coupling half 30 includes an outwardly directed flange 36 on the top and bottom and opposite end edges thereof formed integrally with the covering or covering material 34, for mounting the female coupling half 30 in an opening or the like O in a wall, partition, or housing, or the like 26, by means of a plurality of rivets or the like 27 extended through the flange 36 and an adjacent portion of the wall or partition or the like 26.

Further, in the invention illustrated in FIGS. 4 through 6, either the insulating means 33 or the contact means 31 may comprise the magnet means, as desired. In FIGS. 7 and 8, a still further form of coupler 37 is illustrated, and it is similar in shape and appearance to the form of the invention illustrated in FIGS. 1 through 3. In this form of the invention, however, the magnet means for the male and female coupling halves 38 and 39 together comprises an annular, ring shaped magnet 40 interposed between a center electrical contact 41 of metal or the like and having a conical tip 42 thereon, and a peripheral electrical contact 43 of metal or the like. The magnet 40 and peripheral contact 43 each have parallel front and rear faces 40a and 40b, and 43a and 43b, respectively, terminating in common, parallel planes. A pair of wires 44 and 45 are connected with the peripheral contact and the center contact, respectively, for establishing communication between the contacts and a suitable point of use or source of electrical energy, as desired.

As in the previous embodiments of the invention, the peripheral marginal edge and the rear face or surface of the male coupler half and the wires 44 and 45 are encased in a suitable insulating material 46 such as plastic or rubber or the like. The insulating material also includes a pair of forwardly projecting, radially spaced, annular walls 47 and 48 extending forwardly between the metal contacts and magnet to insulate them from one another.

The female coupling half 39 is formed substantially identically to the male coupling half, except that the center electrical contact 41f has a conical recess 42f therein of substantially the same size and shape as the conical tip 42 on the center contact 41 of the male coupling half. Additionally, the female coupling half 39 includes an annular, radially outwardly extending flange 49 on the marginal peripheral portion thereof formed integrally with the cover or case 46 for connecting or mounting the female coupling half in a suitable opening O in a wall, partition, or housing 26 or the like by means of a plurality of rivets or the like 27 extended through the annular flange 49 and an adjacent portion of the wall or partition or the like 26.

In all of the above forms of the invention, the magnets may comprise permanent magnets or electromagnets as desired, and may consist of any suitable magnet material such as Alnico, or a ceramic type magnet, or the like.

Further, the size and particular shape of the couplers may be varied without departing from the scope of the invention and as many separate electrical contacts and/or magnets in each coupler half may be provided, as desired, and the electrical contacts may be suitably plated or coated with a suitable material to prevent or retard corrosion. Basically, the invention provides a quick connect electrical coupler, wherein the male and female coupler halves are brought into close proximity with one
another, and the magnets in each of the halves will then forcibly attract or draw the halves together with a "snap" action and the tapered, interfitting recess and projecting means automatically aligns the coupling halves with one another and without requiring close hand and eye coordination to connect the electrical coupler together. Further, the coupling halves are prevented from being separated in a lateral direction, and in at least two forms of the invention, the coupler halves may be assembled together in any relative rotational position therebetween.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by those claims.

What is claimed is:

1. A quick connect, self-aligning electrical coupler comprising a male coupler half and a female coupler half, ring shaped magnet means in each coupler half, said magnet means in one coupler half aligned with the magnet means in the other coupler half and operable to releasably hold the coupler halves together, said magnet means comprising the only means to hold the halves together, a first electrical contact means in each coupler half, a conical projection on said first electrical contact means in one coupler half and a complementary, cone shaped recess in the first electrical contact means in the other coupler half to receive the projection and align the coupler halves relative to one another, and second, aligned, ring shaped electrical contact means in the coupler halves spaced radially outwardly from the first electrical contact means, said ring shaped electrical contact means and ring shaped magnet means enabling said coupler halves to be operatively connected together in any relative rotational position therebetween.

2. A quick connect electrical coupler as in claim 1, wherein each coupler half has a front and back face and opposite edge portions, said back face and opposite edge portions covered with an insulating material.

3. A quick connect electrical coupler as in claim 2, wherein said first electrical contact means in each coupler half comprises a cylindrically shaped member extending from the front face to the back face of the coupler half.

4. A quick connect electrical coupler as in claim 3, wherein insulating means is between the cylindrical and ring shaped contact members.

5. A quick connect electrical coupler as in claim 4, wherein said electrical contact means in each coupler half comprises said magnet means.

6. A quick connect electrical coupler as in claim 4, wherein the magnet means comprises an annular ring shaped magnet between the cylindrical and annular electrical contact means in each coupler half.

7. A quick connect electrical coupler comprising a male coupler half and a female coupler half, each coupler half comprising an elongate, rectangularly shaped member, at least three aligned, spaced apart, electrical contact means in each coupler half spaced along the length thereof and aligned with the contact means in the other coupler half, said contact means comprising magnet means to hold the coupler halves together, said magnet means comprising the only means holding the coupler halves together, insulating means between the spaced apart contact means in each half insulating the contact means in each half from one another, and indexing means on each coupler half including conically shaped projection means on the contact means in one half and complementary, conically shaped recess means in the contact means of the other half to receive the projection means and align the coupler halves relative to one another.

8. A quick connect electrical coupler comprising a first, rectangularly shaped coupler half and a second rectangularly shaped coupler half, each coupler half having a front and back face and opposite edge portions, an insulating material on said back face and opposite edge portion of each coupler half, a plurality of aligned, parallel, cylindrically shaped electrical contact means in each coupler half extending from the front face to the back face thereof, a conical projection on the contact means in one coupler half and a conical recess in the contact means on the other coupler half of substantially the same size and shape as the projection to receive the projection and index and align the coupler halves together, insulating means between the contact means of each half insulating the contacts of each half from one another, and aligned magnet means in the coupler halves operable to releasably hold the coupler halves together, said contact means comprising the magnet means.

9. A quick connect electrical coupler comprising a first, rectangularly shaped coupler half and a second rectangularly shaped coupler half, each coupler half having a front and back face and opposite edge portions, an insulating material on said back face and opposite edge portion of each coupler half, a plurality of aligned, parallel, cylindrically shaped electrical contact means in each coupler half extending from the front face to the back face thereof, a conical projection on the contact means in one coupler half and a conical recess in the contact means on the other coupler half of substantially the same size and shape as the projection to receive the projection and index and align the coupler halves together, insulating means between the contact means of each half insulating the contacts of each half from one another, and aligned magnet means in the coupler halves operable to releasably hold the coupler halves together, said insulating means between the contact means comprising the magnet means.

* * * * *