

[54] **MAGNETIC SELF-ALIGNING ELECTRICAL CONNECTOR**

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339/126 R, 335/205

[51] **Int. Cl.** **H01r 11/30**

[58] **Field of Search** 339/12 R, 12 V, 12 L,
339/12 G, 64 R, 64 M, 65, 27, 46, 47 R, 47
C, 48, 222, 253 R, 125 R, 125 L, 126 R, 126
J; 335/205, 285; 248/206 A

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[57]

ABSTRACT

A magnetic self-aligning electrical connector comprising a pair of connector or coupling halves each having electrical contact means therein and one of said coupling halves having magnetic means therein disposed opposite means in said other coupling half for cooperation with said magnet means to hold said coupling halves together with the electrical contact means in electrically conducting contacting relationship with one another, said electrical contact means in one of said coupling halves mounted for movement relative to the coupling half to insure alignment between the electrical contact means even though the coupling halves are misaligned.

15 Claims, 6 Drawing Figures

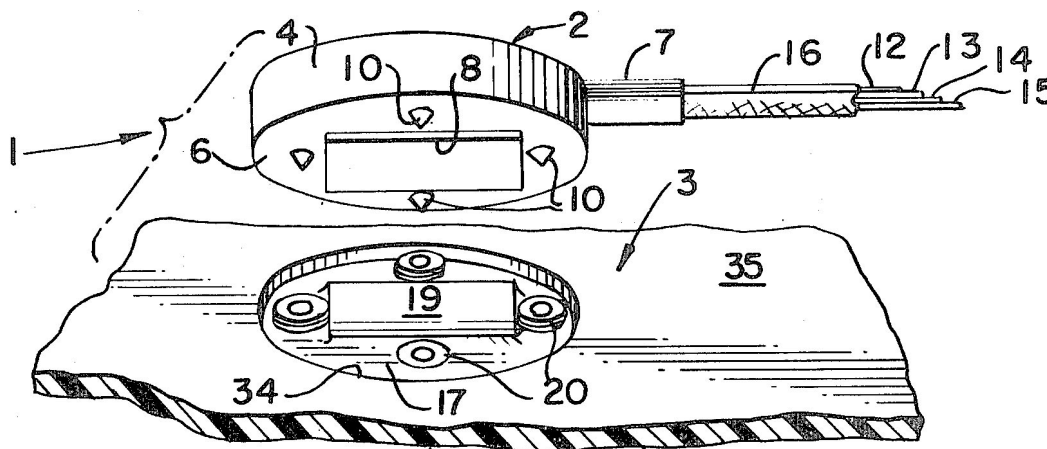


FIG. 1.

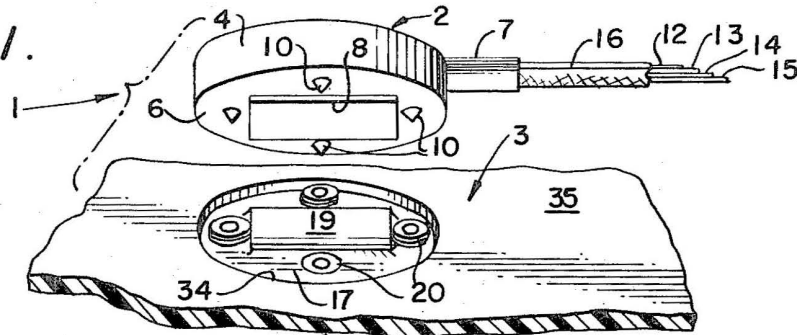


FIG. 2.

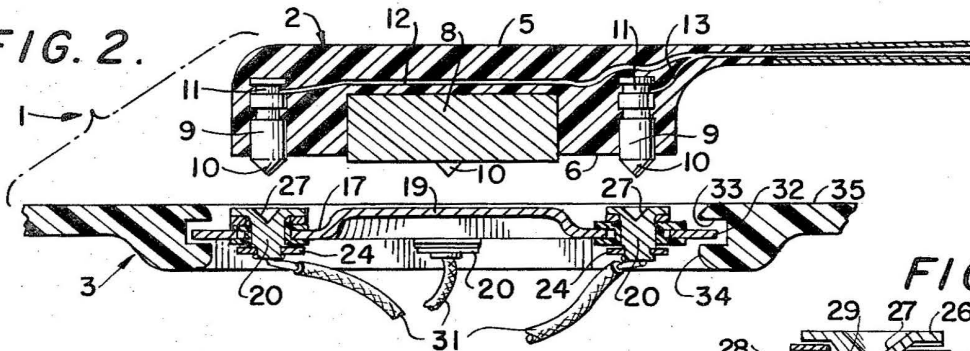


FIG. 3.

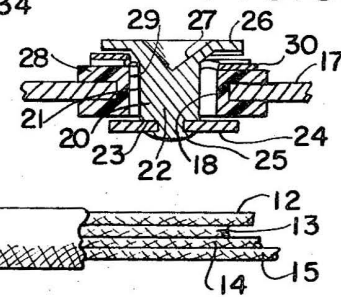


FIG. 4.

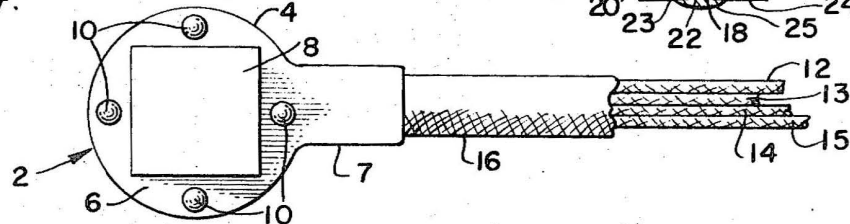


FIG. 5.

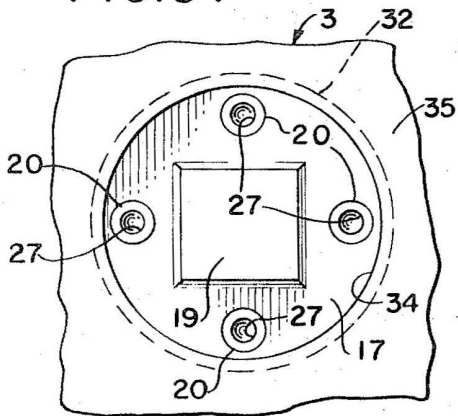
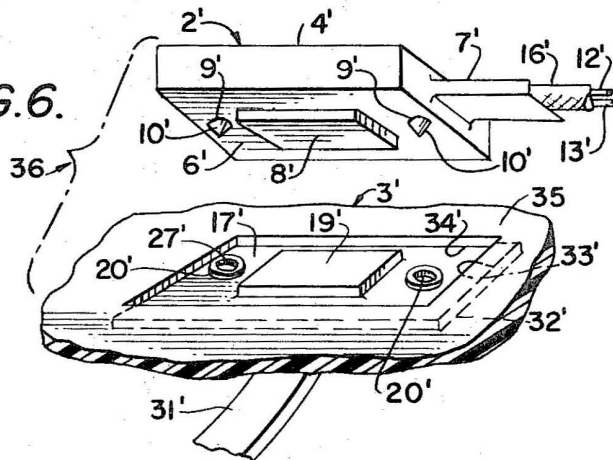


FIG. 6.



MAGNETIC SELF-ALIGNING ELECTRICAL CONNECTOR

SUMMARY OF THE INVENTION

This invention relates to a quick connect electrical connector for low voltage electrical current, wherein magnet means is used to hold the coupling halves together.

In the prior art, various electrical connectors are known for conducting low voltage electrical currents and the like and such connectors usually have threaded connections or clamping means for holding the coupling halves together, or rely upon frictional engagement between projecting means on a male coupling half and recess means on a female coupling half to hold the coupling halves together. Such prior art devices require considerable hand and eye coordination in order to properly align the parts of the coupling halves to insure positive connection therebetween and a good electrical contact between the electrical contact means in each of the coupling halves.

With the present invention, male and female coupling halves are provided with the male coupling half having magnet means therein and fixed electrical contact means projecting beyond one face thereof. The female coupling half has means therein for cooperation with the magnet means in the male coupling half for holding the coupling halves together, and electrical contact means are floatably mounted in said female coupling half in substantial alignment with the electrical contact means in the male coupling half so that when the coupling halves are brought together, the magnet means holds the coupling halves together against relative displacement therebetween, and the floating electrical contact means are enabled to move a limited amount to compensate for misalignment between the coupling halves and to insure a good electrical connection therebetween. The magnetic self-aligning electrical connector of the present invention is simple and economical to manufacture and is quickly and easily connected together with only a minimum of hand and eye coordination required.

The electrical connector of the present invention may be used in any application where a secure connection is required between the coupling halves of a low voltage electrical connector and wherein it is desirable to be able to connect a coupler or connector with only a minimum of hand and eye coordination required. For example, the electrical connector of the present invention can be used in the signalling device described and illustrated in U.S. Pat. No. 3,644,919, wherein it is desirable to have a readily connected and disconnected electrical connector for establishing electrical conduction or connection between the signalling units positioned at the ankles or knees of the person and the signalling device or box mounted at the waist or other portion of the body of the person using the signalling device.

An object of this invention is, therefore, to provide a magnetic self-aligning electrical connector which is quick and easy to connect and which requires only a minimum of hand and eye coordination in order to insure proper alignment of the electrical contacts in the respective coupling halves. In particular, it is an object of this invention to provide an electrical connector having magnet means and fixed electrical contact pins in

one half of the connector and means in the other coupling half for cooperation with the magnet means for holding said coupling halves together and floating electrical contact means in the other coupling half for cooperation with the contact pins when the coupling halves are joined together to insure proper electrical connection between the coupling halves. Even further, another object of the invention is to construct the electrical contact means in the respective coupling halves so that they are self-aligning and so that they cannot be separated with lateral movement therebetween but must be separated with a straight axial pull, thus substantially increasing the holding force or effect of the magnet means for holding the coupling halves together.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top perspective fragmentary view of an electrical connector or coupler in accordance with the invention and showing the male coupling half spaced upwardly from the female coupling half;

FIG. 2 is an enlarged sectional view of the electrical connector of FIG. 1 and showing the male and female coupling halves in aligned spaced apart relationship;

FIG. 3 is an enlarged fragmentary view of a portion of the connector of FIG. 2 and showing the details of construction of one of the electrical contact means in the female coupling half;

FIG. 4 is a view of the bottom face of the male coupling half of FIG. 1;

FIG. 5 is an enlarged plan view of the top face of the female coupling half of FIG. 1; and

FIG. 6 is an exploded perspective fragmentary view of a second form of electrical connector in accordance with the invention and wherein only two electrical contacts are provided.

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, wherein like reference numerals indicate like parts throughout the several views, a unique magnetic self-aligning electrical connector is indicated generally at 1 in FIG. 1 and comprises a male coupling half 2 and a female coupling half 3. The male coupling half 2 comprises an insulating body 4 of a suitable rubber or plastic material or the like and having a generally circular configuration with a substantially planar upper face 5 and a substantially planar lower face 6. An integral extension 7 extends radially from one side of the body 4. A generally rectangularly shaped magnet 8 of a suitable magnetic material, such as Alnico or ceramic or the like, and preferably a permanent magnet, is embedded within the lower face 6 of the body 4 with the bottom side of the magnet 8 extending slightly below the face 6 of the body 4.

A plurality of fixed electrical contact pins 9 made of brass or other suitable material are also embedded within the body 4 spaced outwardly from the opposite side and end edges of the magnet 8 and have conical tips 10 thereon projecting downwardly below the face 6 of the body 4. Each of the pins 9 has an annular notch or groove 11 adjacent the upper end thereof for connection thereto of a suitable electrical lead or wire 12, 13, 14 and 15, respectively, which lead from the pins 9 through the body 4 and extension 7 to a suitable source of electricity or point of use of electricity, as desired. The electrical leads 12, 13, 14 and 15 connected with the respective fixed contact pins 9 may be con-

fined or embedded in a suitable sheath or casing such as a band or tape type covering 16.

The female coupling half 3 comprises a substantially circular plate 17 made of steel or other suitable ferromagnetic material and having a plurality of openings 18 spaced around the marginal edge thereof and a rectangularly shaped raised portion 19 in the center thereof spaced between the openings 18. A plurality of floating electrical contacts 20 are mounted in the openings 18 spaced around the plate 17 and each contact 20 has an elongate body 21 with a reduced diameter end 22 on the lower end thereof defining a shoulder 23. A retaining washer 24 is disposed over the reduced diameter end 22 and against the shoulder 23 and is held thereon by crimping the reduced diameter end 22 over the washer 24 as indicated at 25. The upper end of each contact 20 has a radially outwardly extending flange 26 thereon and a central conically shaped recess 27 therein of substantially the same size and shape as the conical tip 10 on the electrical contact pins 9.

An insulating sleeve 28 of a suitable plastic or rubber material or the like is fitted within each opening 18 and is interposed between the electrical contacts 20 and the steel plate 17 to insulate the contacts 20 from the plate 17.

As seen best in FIG. 3, each insulating sleeve 28 has a central opening 29 therethrough of substantially larger diameter than the outer size of the body 21 of the electrical contact 20 so that the contact 20 is enabled to move relative to the insulating sleeve 28 and plate 17. Further, the retaining washer 24 and radially outwardly extending flange 26 are spaced further apart than the width or thickness of the insulating sleeve 28 so that the contact 20 is enabled to move a limited distance axially relative to the opening 18 and sleeve 28. A suitable spring washer 30 of conventional construction is fitted around the body 21 of contact 20 beneath flange 26 and between the flange 26 and insulating sleeve 28 to constantly urge the contact 20 upwardly relative to plate 17.

A suitable electrical lead or wire 31 is connected to the lower end of each contact 20 as by soldering or the like and extends to a suitable point of use or source of electrical energy, as desired.

The marginal edge 32 of the plate 17 is loosely received in an annular notch or channel 33 formed in an opening 34 in a suitable partition, wall, or casing 35 or the like.

In use, the male coupling half 2 is brought into close proximity with the female coupling half 3 as seen in FIG. 2, and the magnetic attraction between magnet 8 and upstanding portion 19 of plate 17 causes the coupling halves to move toward one another with a "snap" action. The loose fit of the extreme marginal edge 32 of plate 17 in the channel 33 of casing or partition 35, and the floating mounting of the contacts 20 in the plate 17 enables the plate 17 and electrical contacts 20 to move a limited distance to insure alignment of the electrical contacts 9 and 20 in the male and female coupling halves, respectively, upon engagement of the tapered ends 10 of the pins 9 with the recesses 27 of the contacts 20 even though the male and female coupling halves may be somewhat misaligned. Accordingly, all that is needed to properly and accurately connect the male and female coupling halves of the invention is to bring the halves into close proximity with one another and the magnet means will then pull or draw the cou-

pling halves together with the tapered pins and recesses in the respective coupling halves insuring proper alignment between the electrical contact means and the respective coupling halves. Moreover, the interfitting tapered pins and recesses prevent separation of the coupling halves in a lateral direction relative to one another and requires that they be separated with a straight, axial movement, thus substantially increasing the holding force of the magnets.

In FIG. 6, a modified electrical connector 36 is illustrated and is substantially identical with the form of the invention illustrated in FIGS. 1 through 5 except that a substantially rectangularly shaped male coupling half 2' is provided, having a housing 4' with only two electrical contacts 9' embedded therein. The electrical contacts 9' are constructed identically to the contacts 9 in the FIG. 1 embodiment and have conical tips 10' projecting downwardly below the lower face 6' of the male coupling half 2'. Similarly, a magnet 8' is embedded in the underside of the coupling half 2' and projects slightly downwardly below the face 6' thereof. A suitable sheath, such as a tape or the like 16' extends from one end of an integral extension 7' in one end of the male coupling half 2' and encloses a pair of electrical leads 12' and 13' extending from the contacts 9' to a suitable source or point of use of electricity.

The female coupling half 3' is also substantially identical to the female coupling half 3 in the embodiment illustrated in FIGS. 1 through 5 and has a substantially rectangularly shaped opening 34' in a casing or partition 35' or the like. A generally rectangularly shaped steel plate 17' having an extreme outer peripheral marginal edge portion 32' is mounted within the opening 34' with the edge 32' loosely received in a shallow channel or recess 33'. A pair of electrical contact means 20' are mounted in the plate 17' adjacent the opposite ends thereof and a raised portion 19' is in the center of the plate 17' between the contacts 20'. Each contact 20' has a conically tapered recess 27' in the center thereof for mating cooperation with the conical tips 10' on the electrical contacts 9' in the male coupling half 2'. In all other respects, the form of the invention illustrated in FIG. 6 is identical to the form of the invention illustrated in FIGS. 1 through 5.

As many electrical leads and contact points may be provided in each coupling half as desired in order to connect as many different electrical circuits as desired, and any suitable materials may be used for the electrical contacts, the housings or casings, the magnets, and the plates for cooperating with the magnets, as desired. Further, the electrical contacts may be suitably plated or coated to reduce or prevent corrosion and to insure a durable, good electrical connection.

If the present invention is used in the signalling device illustrated and described in U.S. Pat. No. 3,644,919, the electrical connector shown in FIGS. 1 through 5 would be used at the signalling device 10 mounted at the waist of the person, with two of the leads 12 and 13 connected to the sending unit 14 at one ankle and the other two leads 14 and 15 connected to the sending unit 15 at the other ankle of the person. The electrical connector illustrated in FIG. 6 would be used at each sending unit.

Although the magnet has been described and illustrated herein as being on the male coupling half, the magnet could equally as well be on the female half and the ferromagnetic plate for cooperation therewith on

the male half. The same is of course true with respect to the male and female electrical contacts.

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 magnetic, self-aligning electrical connector, comprising a pair of mating coupling halves having opposed, confronting faces, magnet means in one coupling half at said face, electrical contact means in said one coupling half at said face, a plate floatably mounted in said other coupling half for both lateral and perpendicular movement relative to said other coupling half, said plate including a magnetically permeable means in alignment with said magnet means for cooperation therewith to hold the coupling halves together, and electrical contact means carried by said magnetically permeable means for movement therewith and in alignment with the contact means in said one coupling half and engageable therewith to establish electrical connection between the halves, said contact means in said coupling halves having interfitting tapered projection and recess means, to thus align said contact means even if said coupling halves are misaligned.

2. A magnetic self-aligning electrical connector as in claim 1, wherein said one coupling half comprises a body made of a suitable insulating material and having an upper face and a lower face, said electrical contact means fixedly embedded in said body with said tapered portions thereof extending downwardly below the lower face of said body, said magnet means being embedded in said body in the lower face thereof and exposed at said face, and electrical leads connected with said electrical contact means and extending through said body and beyond one edge thereof.

3. A magnetic self-aligning electrical connector as in claim 1, wherein said magnet is a permanent magnet.

4. A magnetic self-aligning electrical connector as in claim 3, wherein said magnet is substantially rectangularly shaped.

5. A magnetic self-aligning electrical connector as in claim 4, wherein said magnetically permeable means comprises said plate, said plate comprising steel and having a raised portion extending upwardly therefrom for cooperation with said magnet in said one coupling half, said electrical contact means in said other coupling half being mounted through openings spaced around a marginal edge portion of said steel plate.

6. A magnetic self-aligning electrical connector as in

claim 5, wherein said other coupling half includes a wall, an opening through said wall, the extreme outer marginal edge portion of said steel plate loosely received in a channel in said wall in surrounding relationship to said opening, said plate closing said opening.

7. A magnetic self-aligning electrical connector as in claim 6, wherein said electrical contacts in said other coupling half are mounted in said plate between said extreme outer marginal edge thereof and said raised portion thereof.

8. A magnetic self-aligning electrical connector as in claim 7, wherein insulating means is positioned between said electrical contacts and said steel plate in said other coupling half to insulate said contacts from said steel plate, said contacts being loosely received in said insulating means for limited movement relative to said plate.

9. A magnetic self-aligning electrical connector as in claim 8, wherein each said electrical contact in said other coupling half has a reduced diameter lower end defining a shoulder thereon below the plate, a retaining washer received over said reduced diameter end and against said shoulder, said reduced diameter end being crimped over said retaining washer to hold said retaining washer on said contact, and a radially outwardly extending flange on the other end of said contact in overlying relationship to said plate and said insulating means, said retaining washer and said flange spaced apart a distance greater than the thickness of said plate and said insulating means.

10. A magnetic self-aligning electrical connector as in claim 9, wherein a conical recess is in the upper end of each said electrical contact in said other coupling half for mating cooperating relationship with the conical tip on said contact means in said one coupling half.

11. A magnetic self-aligning electrical connector as in claim 10, wherein a spring washer is interposed between said insulating means and said radially outwardly extending flange to constantly urge said electrical contact means upwardly relative to said plate.

12. A magnetic self-aligning electrical connector as in claim 11, wherein said one coupling half is generally circular in shape.

13. A magnetic self-aligning electrical connector as in claim 12, wherein there are four electrical contacts in each coupling half spaced outwardly from the opposite side and end edges of said magnet and said raised portion of said plate, respectively.

14. A magnetic self-aligning electrical connector as in claim 11, wherein said one coupling half is generally rectangular in shape and has two electrical contacts therein.

15. A magnetic self-aligning electrical coupler as in claim 1, wherein said electrical contact means carried by said plate are mounted thereon for movement relative thereto.

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