Sept. 27, 1960 N. B. WALES 2,954,542

FLOATING BUFFER SELF-ALIGNING ELECTRICAL CONNECTOR

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Fig. 1.

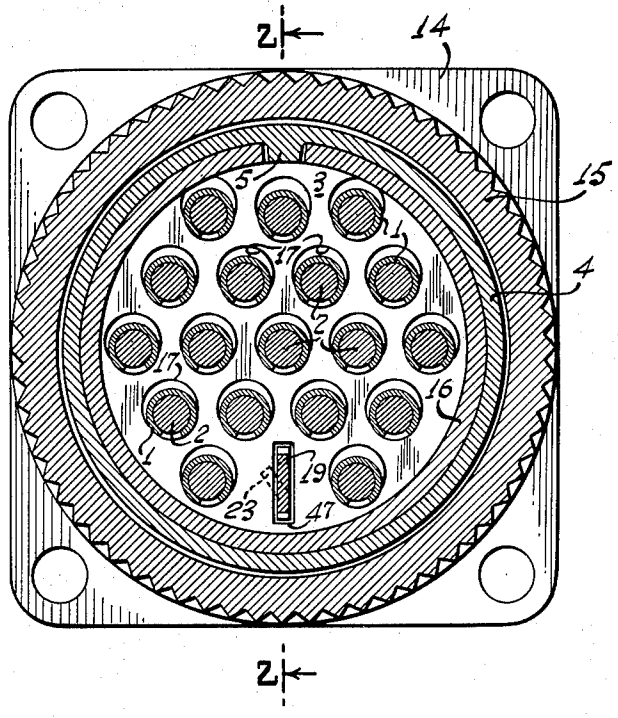
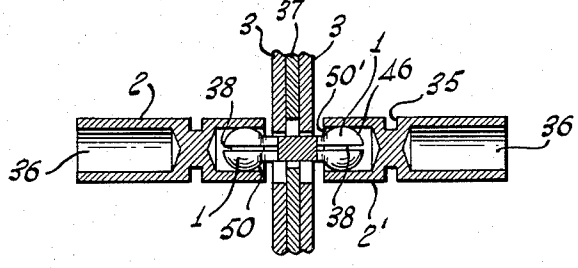


Fig. 4.



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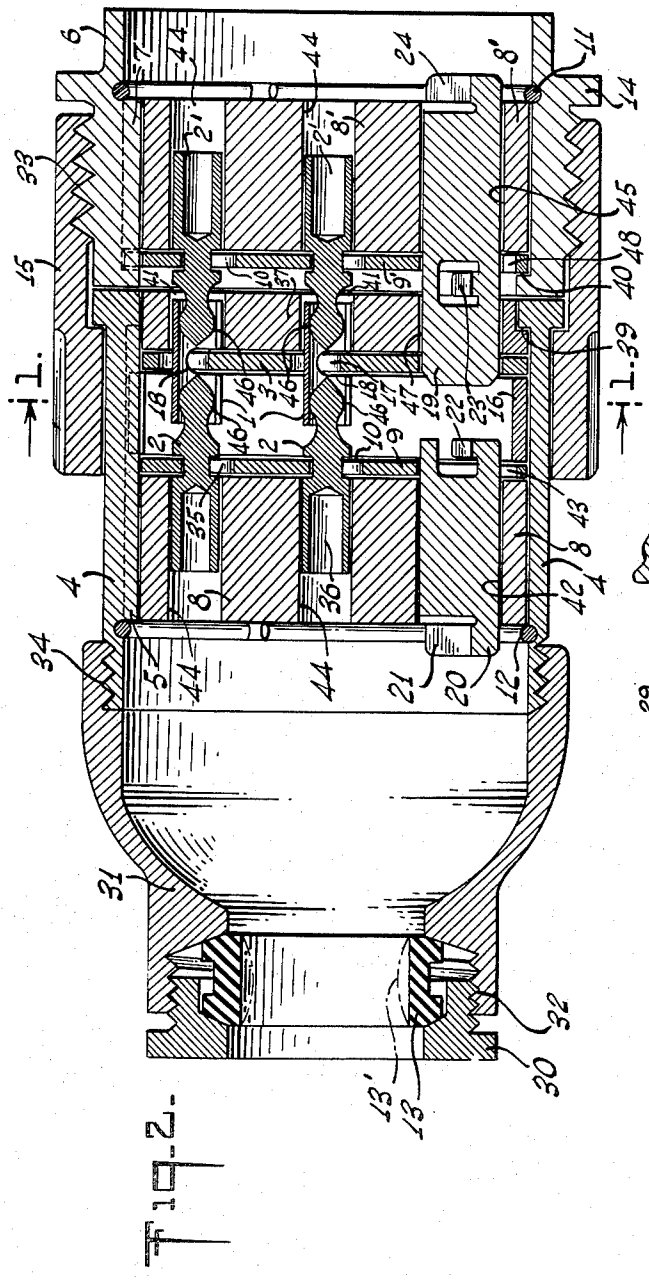


Fig. 2.

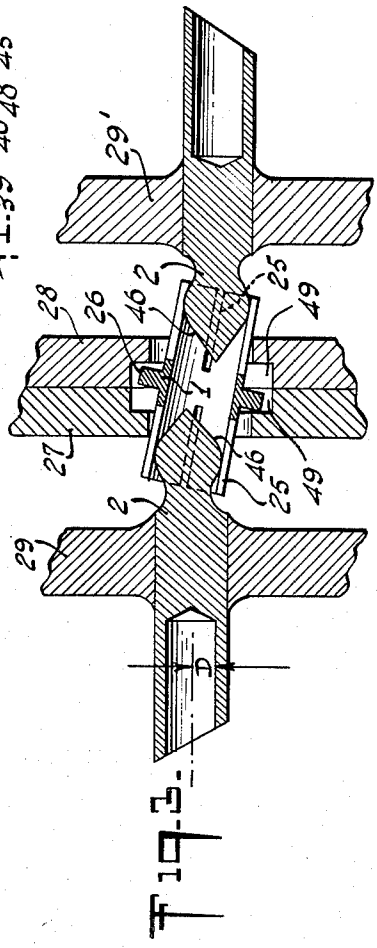


Fig. 3.

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FLOATING BUFFER SELF-ALIGNING ELECTRICAL CONNECTOR

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3 Claims. (Cl. 339—64)

This invention relates to a separable electrical connector in which a floating self-aligning captive buffer member resiliently interconnects two identical cable terminating members on spherical contacting surfaces.

Many advantages result from this step beyond the existing connector art. In the present connector art it is conventional to use a male terminal member associated with one connector body and a female terminal associated with a second directly mating connector body. One or both of these terminals are made to be resilient to supply the necessary contact pressure. This leads to the contrary metallurgical requirement that a terminal be at once resilient and at the same time malleable (in the case of crimp type terminals), or, resilient and capable of being subjected to heat without losing its resiliency (in the case of solder type connectors). My invention overcomes these limitations by the use of a resilient floating buffer member which engages two identical non-resilient terminal members at its opposite ends, thus allowing the material comprising the terminal members to be chosen to be the optimum material for the connecting method used, whether solder or crimp type, and allowing the material comprising the buffer member to be chosen to be the optimum material for resiliency in maintaining contact pressure, since this buffer member, being separate, need never be subjected to soldering levels of temperature, or to crimping deformations.

My invention teaches the use of spherical areas of contact between the floating buffer member and the terminal members so that the buffer member may align itself automatically in the manner of a universal joint so as to compensate for any limited misalignment of the terminal members to be connected. This self-aligning feature thus makes possible the use of multiple-connector hermetically sealed terminal plates which rigidly hold and are bonded to their terminals, even through the corresponding terminals are not in perfect alignment due to manufacturing tolerances.

In addition, this floating buffer construction removes a major cause of connector failure by substantially obviating the vibratory stresses suffered by directly mating terminals.

In the preferred form of this invention, the buffer member is a doubly female member which resiliently embraces two male non-resilient spherically surfaced terminal members at its two opposite ends. This permits the use of sheet metal stamping and forming techniques in the manufacture of these spring buffer connectors.

However, within the scope of my invention it is equally feasible to use a doubly male, resilient, spherically surfaced buffer member internally engaging two female, cylindrical, non-resilient terminal members at each of its ends.

It is a characteristic of this invention that the foregoing resilient buffer members are provided with means for holding them captive in a free-floating manner with respect to one of the two separable connectors.

My invention discloses a gang locking plate means for retaining all of the terminal members within the body of

a connector plug. In this way, the cable wires can be connected to the terminal members at an unconfined work station, and then inserted into the connector plug body, where a single actuation of the said gang locking plate will secure all such terminals simultaneously.

This technique insures a superior opportunity for inspection or repair, and minimizes the fabrication labor for cable and connector assembly.

A feature of this disclosure also provides a dual purpose key member which serves both as a polarizing key and as a sub-assembly securance means whereby the said gang locking plate is slideably secured to a connector plug body for ease of terminal assembly.

One object of my invention is to provide a connector design affording economy of manufacture and a superior degree of reliability.

A second object is to provide self-aligning means to make possible the separable interconnection of multiple rigidly bonded terminals.

A third object is to disclose a method of separable electrical interconnection which minimizes the stresses on its terminals.

A fourth object is to provide a design of connector plugs which permits the simultaneous locking or unlocking of an array of terminals to a connector plug by the displacement of a single unitary gang locking member.

Other objects are implicit in the following specifications and claims.

In the drawings:

Figure 1 is a section in transverse elevation through the axis of a preferred embodiment of my invention;

Figure 2 is a longitudinal section through 2—2 of Fig. 1;

Figure 3 is an alternative form of my invention showing its application to an hermetically sealed type of connector; and

Figure 4 is an alternative form of the connection means of my invention showing the inverse type of floating resilient buffer connector.

Referring to Figs. 1 and 2 it may be seen that the separable connector illustrated consists of two facing sets of eighteen identical terminals 2, one set of which is positioned by the cylindrical insulating plug 8 within the female cable shell 4, while the other set is positioned by an identical insulating plug 8' within the male chassis-mounted shell 6.

Each terminal, 2, is provided with a cavity 36 into which the bared end of its cable wire may be either crimped or soldered. The terminals 2 are each provided with an annular locking groove 35 into which the gang insulating locking plates 9 may be engaged to constrain each terminal 2 within its insulating positioning block 8 or 8'.

The floating buffer connectors 1 of this embodiment consist of spring metal semi-cylinders formed from sheet metal and provided with an equatorial slot 18 which serves both to provide means to constrain the buffer connector within its insulating mounting plates 3 and 37, and to make its two spring contact pressure actions independently able to grasp the spherically shaped outer ends of terminals 2 at either end. Thus, the evolved shape of the stampings from which buffer members 1 are formed may be seen to have an H configuration.

The holes 17 in gang locking plate 3 are congruent with the corresponding holes 41 in the buffer retaining plate 31. However, when the holes 17 and 41 are placed in congruence, the circular peripheries of the corresponding plates 3 and 37 respectively are eccentric with respect to one another. This condition can occur only when the buffer assembly is removed from the constraint of shell 4, and it is in this condition that the buffer members 1 are inserted during assembly of the plug and while holes 17 and 41 are concentric. After insertion of buffer springs 1 through both plates 3 and 37 (preferably in a

jig), the plate 3 is displaced radially with respect to plate 37 so that their outer peripheries are concentric as in Figs. 1 and 2. This causes the lower lips of holes 17 to enter the equatorial slots 18 of buffer springs 1 thereby loosely entrapping them and allowing this sub-assembly to be inserted into the shell 4 until seated against retaining shoulder 39 of shell 4 as shown in Fig. 2. An internal key 5 integral with shell 4 assures the phasing of plates 3 and 37 with respect to one another and with respect to the terminal body plug 8 which also engages key 5.

The eighteen terminal members 2 of shell 4 are retained within their insulating positioning block 8 by means of the insulating gang locking plate 9 which has a geometry with respect to block 8 similar to the geometrical relation between plates 3 and 37 as previously described. In addition, a retaining metal key 20 is provided so that when key 20 is inserted into mating slot 42 of block 8 and into slot 43 of plate 9, the bending down of tabs 21 and 22 which are integral with key 20, will form a subassembly in which plate 9 is slideably retained against the face of block 8. Thus, when sub-assembly 2—8—20 is removed from shell 4, the gang locking plate 9 may be slideably displaced with respect to block 8, under the constraint of key 20 and tabs 21 and 22, until the locking holes 10 of plate 9 are concentric with the terminal cavities 44 of block 8. In this condition, terminals 2 with their attached cable wires (not shown) may be either inserted or removed.

After the insertion of terminals 2 into this sub-assembly, plate 9 can be slideably displaced relative to block 8 until their outer peripheries are concentric. This will cause the upper lips of holes 10 to engage the annular grooves 35 of terminal members 2 thereby simultaneously locking all pins 2 to block 8.

The sub-assembly of the female cable shell 4 is completed by inserting the foregoing sub-assembly 2—8—9—20 into shell 4 and against the insulating split spacing ring 16 where it is locked by the snap ring 12 which engages an internal groove in shell 4. During the foregoing final assembly, the outer spherical surfaces 46 of terminal members 2 were each caused to enter and expand the corresponding left semi-cylindrical female ends of the floating spring buffer member 1 thereby setting up good electrical contact pressure between each terminal 2 and its buffer 1.

The female cable plug is completed by a bell fitting 31 which secures to shell 4 by screw threads 34, and by a compression fitting 30 which can distort rubber grommet 13 to cable clamping position 13' when it is screwed into the threads 32 in bell 31. It is to be noted that the design of grommet 13 is such that its internal dilation is due to cantilever bending primarily, and to compressional volumetric distortion in only a secondary degree. This allows for a wider accommodation of cable diameters than would be possible if only volumetric dilation were used to clamp the cable.

The male chassis plug consists of shell 6 with the square integral mounting flange 14, into which the terminal positioning block 8', the gang locking plate 9', and the male terminals 2' are assembled against shoulder 40 by means of snap ring 11 in an identical manner to the assembly of the corresponding parts pertaining to shell 4.

Internal key 7 integral with shell 6 assures the phasing of sub-assembly 8'—9' with respect to the mounting flange ears 14.

The sub-assembly key 19 with its locking tabs 23 and 24 may be seen to be identical to the locking key 20 and its tabs 22 and 21 except that the outer end has been extended to form a polarizing key capable of entering the mating slots 47 in plates 37 and 3 of the female plug, but only when the two separable plugs are properly aligned.

The slot 45 of plug 8' thus corresponds to slot 42 of plug 8, and slot 40 of plate 9' corresponds to slot 43 of plate 9.

The screw threads 33 of shell 6 allow the mating threads in knurled sleeve 15 to lock the two separable shells 4 and 6 together after the entrance of the spherically surfaced heads 46 of terminal members 2' into the unoccupied ends of the spring buffer clips 1.

It is evident that the cylindrical bodies of buffer 1 can now take up positions which are not parallel to the common axis of the two shells 4 and 6 to accommodate any departures from coaxiality between the corresponding terminal members 2 and 2' due both to the looseness of constraint provided by slots 18 and to the spherical surfaces of contact provided at both ends of the buffer members 1. This accommodation is accomplished under constant contact pressure at surfaces 46, and, since the buffer members 1 can transmit negligible bending stress to their terminal members 2 due to this geometry of accommodation and the frictional nature of engagement. The terminals 2 and their associated wires are thus very largely strain free.

Figure 3 serves both to illustrate the geometery of accommodation between non-coaxial terminal members afforded by my resilient buffer members, and to illustrate an alternative construction of such a buffer member within the scope of my invention.

In Fig. 3 the buffer 1 is turned by a lathe from a resilient metal so as to comprise a hollow cylindrical sleeve having a retaining shoulder 26. The outer portions of the sleeve are then slotted by slots 25 so as to form two independently resilient cavities capable of embracing the spherical surfaces 46 of the male terminal members 2 and 2' at either end.

Shoulders 26 are loosely trapped within the cavities 49 of the insulating plates 27 and 28 to form the buffer sub-assembly. The terminals 2 and 2' of Fig. 3 are shown to be bonded to the ceramic plates 29 and 29', respectively, to form a rigid hermetic seal. These two rigidly supported terminals 2 and 2' are shown to be approximately parallel but non-coaxial by the displacement D such as that which might be due to manufacturing inaccuracies. Nevertheless, the buffering action of sleeve 1 due to the universal jointing action afforded by the two spherical contacting surfaces 46 still allows perfect pressured electrical connection between terminals 2 and 2', while at the same time preventing any except negligible bending strains to be imposed on the rigid bonds to ceramic sealing plates 29 and 29'.

If it is desired to construct a hermetic seal such as that of Fig. 3, but without any soldered joints at all, it is evidently possible to make each male member 2 double ended so as to have an identical spherical surface 46 on each side of sealing plate 29 or 29' thereby permitting the use of a male cable assembly with crimp type terminals such as that of shell 4, Fig. 2, on each side of the hermetic seal.

Figure 4 illustrates the inverted form of my invention in which the resilient buffer member still contacts identical terminal members on spherical contact surfaces at either end, but in which the buffer member 1 consists of a doubly male dumbbell shaped metal turning which is split by slots 38 on either end to provide independent resilient spherically surfaced contacts. The plates 3 and 37 serve to loosely constrain the buffer as before. In this case the terminal members 2 are provided with the cylindrical nonresilient female cavities 50 to engage the resilient buffer members 1.

What I claim is:

1. In a separable electrical connector, the combination comprising a first plurality of metal terminal members, a groove in each of said first terminal members, a second plurality of metal terminal members, a groove in each of said second terminal members, a plurality of elongated two-ended metal buffer members each resiliently contacting one of said first terminal members at one of its said ends on a first partially spherical contact surface and resiliently contacting one of said second terminals at its

other said end on a second partially spherical contact surface, a first insulating terminal block for locating said first plurality of terminal members in spaced relation to one another, a first insulating gang locking plate having apertures adapted simultaneously to engage said first grooves, a first means for constraining said first locking plate relative to said first terminal block whereby said first apertures are in engaged relation to said first grooves, a second insulating terminal block for locating said second plurality of terminal members in spaced relation to one another, a second gang locking plate having apertures adapted simultaneously to engage said second grooves, a second means for constraining said second locking plate relative to said second terminal block whereby said second apertures are in engaged relation to said second grooves, and means for loosely constraining said buffer members in spaced relation to said first insulating terminal block.

2. In a connector in accordance with claim 1, means to retain said first gang locking plate in sliding constraint with respect to said first terminal block, and combination means both to retain said second gang locking plate in sliding constraint with respect to said second terminal block and to polarize the engagement of said second plurality of terminals with the corresponding said plurality of buffer members.

3. In a separable connector, the combination comprising a first plurality of terminal members each having a partially spherical contact surface, a second plurality of terminal members each having a partially spherical

contact surface, a first insulating terminal block for locating said first plurality of terminal members in spaced relation to one another, a second insulating terminal block for locating said second plurality of terminal members in spaced relation to one another, a plurality of unitary buffer members each formed from an H-shaped spring metal blank so as to possess two independent interconnected split cylindrical female cavities for resiliently embracing one of the partially spherical contact surface of said first plurality at one end and for resiliently embracing a corresponding one of the partially spherical contact surfaces of said second plurality at its other end, a third insulating block for loosely locating said buffer members in spaced relation to one another, and an apertured insulating plate adapted to enter each space between the said two cylindrical cavities of each buffer member whereby to loosely restrain said buffer members in an axial direction with respect to said first and third insulating blocks.

References Cited in the file of this patent

UNITED STATES PATENTS

1,531,917	French	Mar. 31, 1925
2,086,424	Koehler	July 6, 1937
2,606,233	Schymik	Aug. 5, 1952
2,658,183	Klostermann et al.	Nov. 3, 1953

FOREIGN PATENTS

533,310	Great Britain	Feb. 11, 1941