

Dec. 30, 1947.

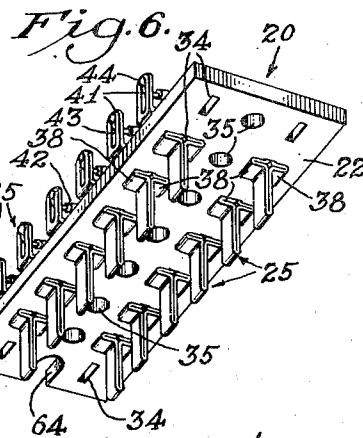
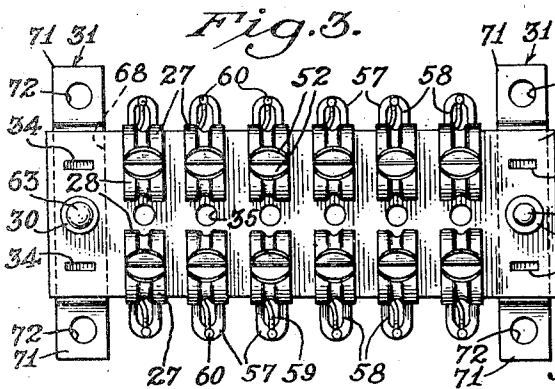
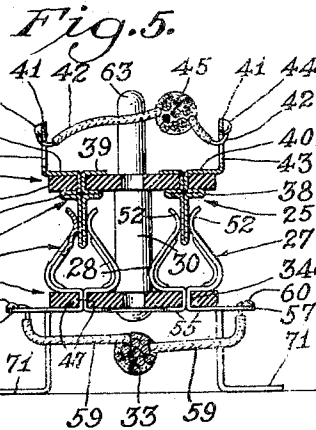
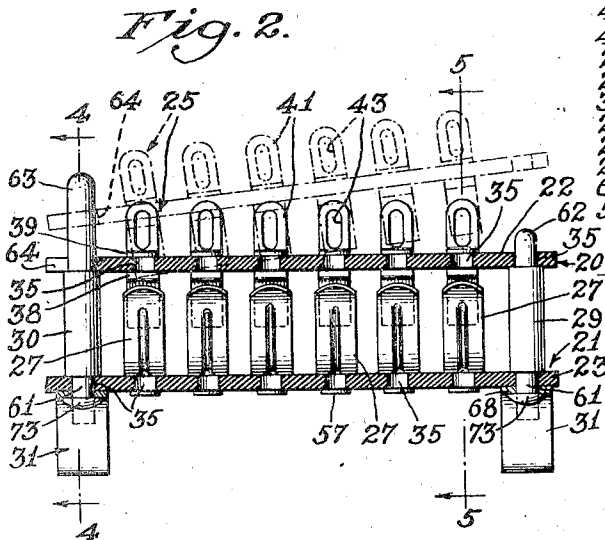
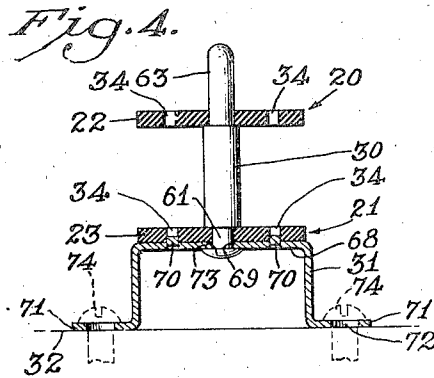
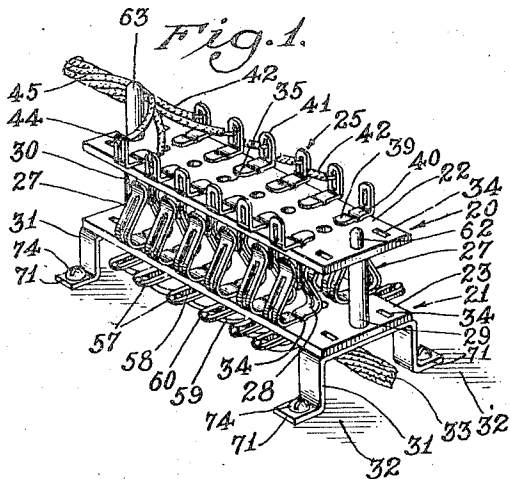
W. L. GARBERDING

2,433,358

SEPARABLE ELECTRICAL CONNECTOR

Filed Oct. 8, 1941

2 Sheets-Sheet 1



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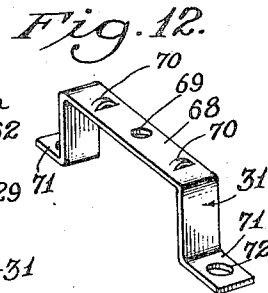
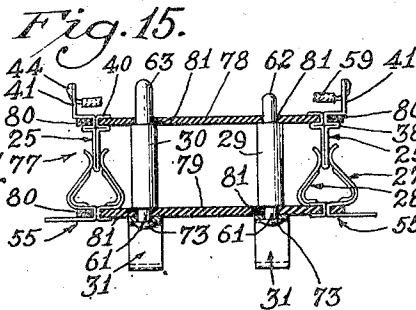
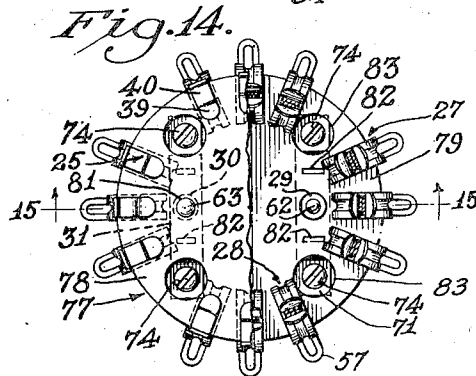
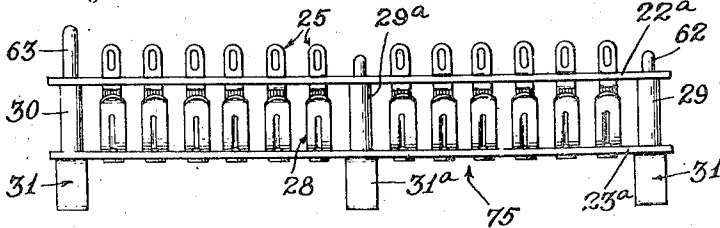
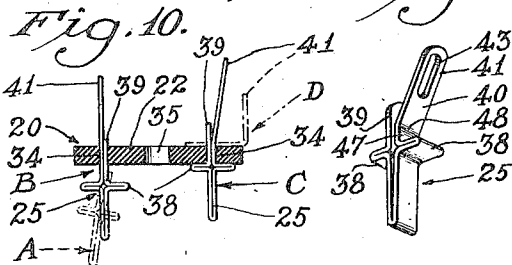
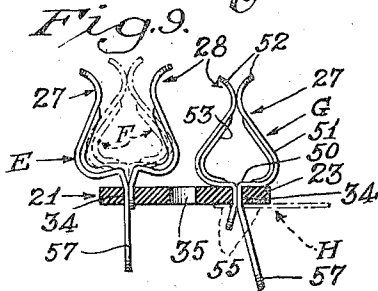
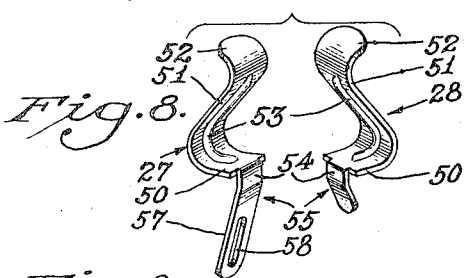
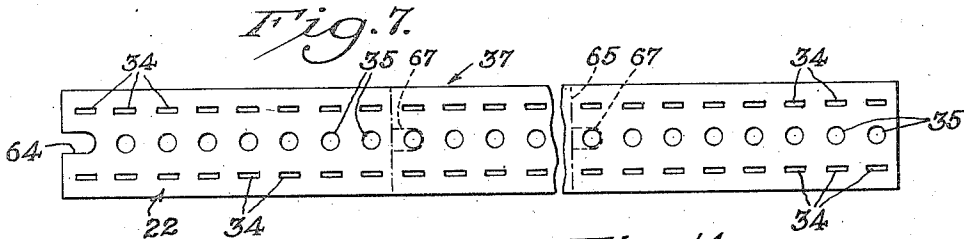
W. L. GARBERDING

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SEPARABLE ELECTRICAL CONNECTOR

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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SEPARABLE ELECTRICAL CONNECTOR

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Application October 8, 1941, Serial No. 414,106

9 Claims. (Cl. 173—328)

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This invention relates to improvements in separable electrical connectors, and more particularly concerns a connector of the strain separable type which may be equipped with a variable plurality of electrically independent contacts.

There is a substantial and growing demand for this kind of connector for quickly and conveniently effecting connection or separation of the several conductors of a multi-strand cable leading to or forming part of the several electrical circuits such as are present in coin games, radios, automatic record players, and the like. In these devices the operating apparatus is generally assembled in a removable unit housed within a cabinet. By the use of a gang or plural connector in which the male and female contact members are mounted on separable carrying elements or blocks, all of the electrical circuits of the removable units can be connected with, or disconnected from, the main cable by the simple expedient of separating the connector, thus greatly facilitating the removal and replacement of the operating unit.

Prior attempts to meet this demand have resulted in two principal styles of separable plural connectors.

In the one style, a pair of molded base elements carries the separable contact members molded in place or secured within special sockets, grooves, or apertures, in the molded elements. The molded parts for such a connector are expensive, highly susceptible to breakage, and relatively inflexible as to variations in size, so that for every different size of connector a different set of molds is required. Another disadvantage of the molded type of connector resides in the relatively complex and expensive structures required for the contact members.

The other major style of plural connector is that in which the contact members are carried by strip panels which are die cut from sheets or strips of insulating material. This style of connector has the distinct advantage over the molded variety of connector in the simplicity with which the size of the connector may be varied merely by cutting the panel strips which carry the contact members longer or shorter, as required. The prior forms of this style of connector have, however, been of unduly complex and expensive construction. They have been lacking in reliability because the electrical contacts have been of poor design and so liable to distortion that defective connections have been all too frequent. Apparently one of the principal defects has resulted from attempts to use the

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plug and jack type of contacts wherein round plugs are engaged by jacks. If, in removing or replacing the plug-carrying element of such prior connectors, it is twisted or tilted relative to the jack-carrying element, the jacks are often bent open and consequently fail to make proper electrical connection with the plugs. Trouble has also been experienced due to improperly designed and constructed soldering lugs on the contacts, and especially the male contacts which are usually carried by the removable element or assembly of the connector unit.

The principal object of the present invention is the improvement of the die cut panel style of separable connector to effect refinements and simplifications in structure, provide a more efficient and reliable construction, and attain substantial economies in manufacture.

Another object of the invention is to provide a separable connector of this kind in which all of the parts are adapted to be made by high speed, relatively simple die cutting or stamping and screw machine methods of manufacture, and in which all of the parts can be assembled quickly and secured together with simple tools and quick-acting assembly fixtures.

Another object of the invention is to provide a gang type electrical connector in which the several parts are standardized to a high degree and fewer different parts are required than in prior constructions.

Still another object of the invention is to provide an electrical connector of this general type which is constructed to be assembled without the use of screws, rivets, or other separate fastening devices, and which embodies self-fastening features in the functional elements of the assembly.

Another object of the invention is to construct the separable connector in such a way as to be practically foolproof and free from any danger of damage to, or distortion of, the contacts due to careless manipulation, thus assuring at all times uniformly perfect electrical contact between all of the several co-operating contact members.

A further object of the invention is to provide a separable electrical connector, having a plurality of independent sets of contacts, which is easier to connect or disconnect than is the case with prior devices.

A still further object is to provide a strain separable electrical connector which is particularly adaptable to be made up in various sizes and shapes.

It is also an object of my invention to improve the design and construction of the contacts for the connector. In this regard an aim is to provide a novel soldering lug arrangement.

Another object is the origination of an efficient, economical method of making a separable connector.

Other objects and advantages will become apparent from the following detailed description and from the accompanying drawings, in which:

Fig. 1 is a perspective view of a plural-contact type of separable connector embodying the features of my invention;

Fig. 2 is a longitudinal vertical sectional view through the connector on a larger scale;

Fig. 3 is a top plan view of the base unit of the connector with the mating assembly removed;

Fig. 4 is a transverse vertical sectional view taken substantially along line 4—4 of Fig. 2;

Fig. 5 is a transverse vertical sectional view taken substantially along line 5—5 of Fig. 2;

Fig. 6 is a bottom perspective view of the blade-contact carrying unit alone of the connector;

Fig. 7 is a fragmental schematic plan view of an insulating strip blank from which the panels for the separable units of the connector are adapted to be made;

Fig. 8 is an enlarged perspective view, prior to assembly, of a pair of the spring fingers which co-operate to form a female contact;

Fig. 9 is a transverse sectional view through the panel of the base unit of the connector, showing certain steps in assembling the spring contact fingers with such panel;

Fig. 10 is a transverse sectional view through the panel of the blade contact unit, showing certain steps in assembling the blade contacts with the panel;

Fig. 11 is a perspective view of one of the male or blade contact members prior to assembly with the device;

Fig. 12 is a perspective view on an enlarged scale of one of the leg members by which the device is supported;

Fig. 13 is a side elevational view of a modified form of the invention, showing how the invention may be embodied in a separable connector comprising a plurality of multi-contact sections;

Fig. 14 is a top plan view of a further modified form of the invention, of circular form; and

Fig. 15 is a transverse sectional view through the circular connector, taken substantially along line 15—15 of Fig. 14.

Referring first to Figs. 1 to 6, inclusive, the features of the invention may be embodied in a connector unit having separable contact-carrying assemblies 20 and 21 of elongated form including separate insulating panels 22 and 23, respectively. Each of the panels has two longitudinally aligned series or gangs of electrically independent contacts. The panel 20 carries male or blade contact members 25, and the panel 21 carries cooperatively opposed pairs of female or spring finger contact members 27 and 28. Each pair of opposed spring finger contacts 27 and 28 is arranged to receive one of the blade contacts 25 frictionally therebetween.

In the connected condition of the device, the panels 22 and 23 are maintained in predetermined spaced parallel relationship by means of index pin posts 29 and 30 located adjacent the respective opposite ends of the gangs of contacts. Leg brackets 31 may support the panel 23 of the unit 21 in spaced relation to a supporting structure 32, such as a wall or panel of the apparatus

with which the connector is used, so as to allow for the passage of a multi-strand cable 33 of which the individual strands lead to the respective contacts on the panel 23.

The panels 22 and 23 are preferably of a standardized construction, and are made from strips of sheet insulating material of a type susceptible of being die cut or sheared and punched to size. One type of material suitable for this purpose is the product known to the trade as "Bakelite." Each of the panels is of identical length and width and has a plurality of sets of uniformly spaced and proportioned apertures comprising longitudinally elongated, preferably rectangular contact-anchoring apertures 34 adjacent the longitudinal edges of the panels and intermediate transversely aligned index post apertures 35.

In the manufacture of the panels 22 and 23, they may be cut in the preferred length from punched strip blanks 37 (Fig. 7) of any suitable initial length. In this way the panels can be manufactured by possibly the least expensive method without waste of the sheet material from which they are cut, except for the slugs of material removed in punching the apertures.

According to the present invention the blade contact members 25 and the spring finger contact members 27 and 28 are designed to be anchored to the respective carrying panels 22 and 23 by engaging in the apertures 34. Because of the equal spacing of the aperture 34 in each of the panels, the blade and spring finger contact members will thus match exactly.

Each of the blade contact members 25 (Figs. 5, 6, 10 and 11) comprises a body composed of a strip of sheet metal which is a good electrical conductor, and which is of adequate gauge and stiffness to serve the intended purpose but can readily be die-formed into the desired shape. Such a material is readily obtainable on the open market.

The blade portion of the contact 25 is formed by closely folding the metal body strip upon itself. At a uniform distance from the folded end of the blade are provided shoulders 38 engageable with the face of the panel 22. The shoulders 38 are formed by means of laterally extending, closed right-angular flange folds lying in a common plane. The end portions of the folded strip extend beyond the shoulders 38 in parallel abutment and are adapted to project through one of the apertures 34 and beyond the face of the panel 22 opposite to the face against which the shoulders 38 engage.

One of the end portions of the contact 25 is adapted to be bent over against the adjacent face of the panel 22 to provide a clenching flange 39 which preferably extends inwardly of the panel. The remaining end portion of the contact strip is adapted to be bent over to form a clenching flange 40 extending toward the adjacent edge of the panel 22. In this way the flanges 39 and 40 and the respectively opposing shoulders, together with the integral portions 47 of the contact strip which join them, form oppositely opening channels within which the intervening portions of the panel are firmly engaged. As a result, the blade contact 25 is held solidly against movement relative to the panel 22 due to longitudinal pushing or pulling strain on the blade. In addition, the relative dimensions of the apertures 34 and the portions of the contacts extending therethrough are preferably correlated to effect a reasonably close fit so as

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to avoid relative movement of the contacts and the panel 22 in any direction transversely of the contacts.

The flange 40 is preferably sufficiently longer than the flange 39, to provide a terminal lug 41 to which may be soldered the end of an electrical conductor 42 (Figs. 1, 5 and 6). An elongated eye 43 in the lug 41 receives the end of the conductor 42 and facilitates anchoring thereof by means of solder 44. The length of the clenching flange 40 is preferably correlated with the spacing of the apertures 34 from the edge of the panel 22, so that the lug 41 may be bent up, preferably right angularly, along the edge. Thereby the lugs 41 along the opposite edges of the panel cooperate to form a trough therebetween for receiving a multi-strand cable 45 from which the conductors 42 extend, or an aggregation of individual conductors.

Each of the blade contact members 25 is initially formed up substantially as shown in Fig. 11, ready to be assembled with the panel 22. In this condition of the contact member, the flange 39 extends straight at right angles to the associated shoulder flange 38, and the flange 40 extends from a bend line 48 from its companion portion 47 at a slightly diverging angle from the flange 39.

In assembling the blade contact 25 with the panel 22, the following steps, severally indicated in Fig. 10, may be followed: The end of the lug 41 is inserted into one of the apertures 34, substantially as indicated in phantom outline at A, and pushed through up to approximately the end of the flange 39. Then the contact member is slightly flexed as permitted by the inherent resiliency of the material to bring the flange 39 into parallelism with the flange 40, so that the flange 39 can also be pushed through the aperture 34, substantially as indicated at B. The third step comprises pushing the contact member into its final position wherein the shoulder flanges 38 engage the face of the panel 22, and the flanges 39 and 40 are fully projected through the aperture 34 so that the flange 40 can spring back to its divergent relation to the flange 39, as shown at C. Thereupon the contact member can be fastened permanently in place by spreading the flanges 39 and 40 apart and bending them against the adjacent face of the panel 22, as indicated by the dash-dot-dash outline D.

All of the assembly steps A, B and C can be easily and quickly accomplished by hand, or by mechanism devised for this purpose, and the step D can be performed by the aid of a simple bending tool. For example, the panel 22 may be manually supplied with a full set of the contacts 25 through the assembly steps A, B and C, and the assembly may then be placed in a simple fixture (not shown), in which all of the clenching flanges 39 and 40 are simultaneously bent over into clenching position. In the interim between completion of the step C and the step D, the contact members 25 are held against falling away from the panel 22 by the temporary interlocking action of the divergent flange 40.

The terminal lug 41 may be bent up into the preferred position either as an incident to the assembly step D or as a separate action following completion of the step D. The completed blade contact assembly will appear substantially as shown in Figs. 1 and 6.

The spring finger contact members 27 and 28 are preferably of substantially identical construction, except for one feature as will be pointed out.

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Thus, both of the finger members may be made with the same set of dies, except for the slight, readily effected change necessary to accommodate the single difference just mentioned. The material from which the spring fingers are made may be the same sheet metal as that used for the blade contact member 25, in keeping with my aim to standardize on parts and material wherever practicable.

Each of the spring finger members 27 and 28 is formed from a strip of the sheet metal and comprises a base 50 and a substantially S-shaped finger portion 51, which curves upwardly and inwardly from the base and terminates in an outwardly curved or longitudinally convex-surfaced bearing tip 52. A longitudinally extending central reinforcing bead 53, starting at the base 50 and terminating just short of the tip 52, increases the resiliency of the finger portion 51 and enables the use of a less expensive sheet metal for the finger member.

The base portions 50 of the spring finger members 27 and 28 serve as locating shoulders which are adapted to rest flatwise against the base of the panel 23 in abutting, longitudinal alignment, and the convex bearing surfaces of the tip 52 are preferably so disposed that in this relation of the members they are adapted to engage one another, as seen in Fig. 3.

In order to anchor the spring contacts 27 and 28 to the panel 23, each is equipped with a clenching flange structure, similar to that described in connection with the blade contact member 25, adapted to function in cooperation with the base portion 50 to secure the spring members in place. Thus, the base portion 50 of each of the spring members has a right angularly extending flange adapted to abut the flange of the opposite finger flatwise and extend into one of the apertures 34 in the panel 23. A clenching flange 55 extends from each of the flange portions 54, and is adapted to be bent into engagement with the base of the panel 23 directly opposite the portion of the panel engaged by the base portion 50 of the fingers. As a result, the base 50, flange portion 54, and clenching flange 55 form a laterally opening channel within which the intervening portion of the panel 23 is clamped.

The finger member 27 is adapted to be mounted adjacent to the edge of the panel 23 and differs from the member 28 only in that it has a terminal lug extension 57 on its clenching flange 55 adapted to extend beyond the panel edge. An eye 58 in the lug 57 is adapted to receive the end 59 of an electrical conductor extending from the cable 33. Through this arrangement it will be observed (Figs. 1, 3 and 5) that the conductor end 59 can conveniently be soldered, as indicated at 60, to the upper face of the outer end of the lug 57.

As shown in Fig. 8, the spring finger members 27 and 28 are initially formed complete, except that the clenching flanges 55 are bent at only a slight angle to the connecting flange portions 54. In this way, the finger members can be assembled with the panel 23 (Fig. 9) by first introducing the clenching flanges 55 in parallel relation into one of the apertures 34, substantially as indicated at E. Thereafter, the spring finger members are flexed toward one another, substantially as shown in broken outline at F, to bring the flange portions 54 into parallelism. Thence the flange portions 54 are pushed on through the aperture 34 until the bases 50 are seated on the panel, as shown in full outline at G. As soon as the bases 50 are seated and the flange portions 54 are entirely

within the aperture 34, the clenching flanges 55 snap apart and serve as interlocks to prevent accidental displacement of the finger members from the panel.

After the panel 23 has been supplied with a full set of pairs of the finger contact members, the assembly may be put into a suitable fixture and the clenching flanges 55 bent tightly against the adjacent face of the panel, substantially as indicated in broken outline at H.

Thereafter the co-operating pairs of finger contact members 27, 28 are ready to receive the blade contacts 25, which can be inserted between the opposed, broad bearing faces of the tips 52 by forcing the blades inwardly between the tips with enough pressure to cause the spring fingers to yield to the extent of the thickness of the respective blades. The resiliency of the spring fingers assures a firm grip upon the blade contacts, and thus a good electrical connection. Moreover, the pressure exerted by the spring fingers results in a scraping interaction with the faces of the blade members during insertion between the fingers, which will remove scale or oxide that might interfere with a proper electrical contact between the surfaces.

In addition to serving as spacers for the panels 22 and 23, the posts 29 and 30 serve also as means for indexing and thus assuring proper assembly of the entire blade contact assemblies 20 and 21, and as connecting means for securing the leg brackets 31 to the panel 23. To this end, each of the posts 29 and 30 may be formed from the same diameter metal rod stock, such as brass, and with the opposite ends appropriately shaped as for example in a screw machine.

Both of the posts 29 and 30 have uniform diameter body portions of equal length, and reduced diameter opposite end portions which are adapted to extend through selected ones of the apertures 35 in the contact-carrying panels 22 and 23. In the preferred arrangement of the connector unit, as shown in Figs. 1 to 6, the posts are located adjacent the ends of the panel, one set of apertures removed from the endmost sets of contacts.

The post ends which engage the panel 23 are each formed with a reduced diameter portion 61, dimensioned to extend through the endmost of the apertures 35 and substantially beyond the opposite face of the panel. The opposite end of the post 29 is formed with a rounded, reduced diameter portion 62 serving as an index pin to fit through the aperture 35 of the adjacent end of the panel 22. The corresponding end of the post 30 is formed with a reduced diameter, rounded tip index pin portion 63 of somewhat greater length and slightly larger diameter than the index pin 62. Thus, the index pin 63 will not fit through any of the apertures 35, but must be received in an enlarged opening or notch 64 in the panel, and it will be impossible to assemble the contact-carrying panel 22 in the unit wrong end about. This assures at all times that the blade contacts 25 will register with the proper finger contacts. The notch 64 opens inwardly from the end of the panel 22 and takes the place of the endmost aperture 35.

Formation of the notch 64 may be accomplished at the time the panel 22 is cut from blank strip 37. Hence, as shown in Fig. 7, the notch 64 may be formed at the free end of the blank before the panel 22 is cut from the blank, and each succeeding panel 22 is similarly notched before it is severed from the strip. The slug, which is notched out after one of the panels 22 has been

cut off along a line 65, is delineated in Fig. 7 by dot-dash outline and indicated by the numeral 67.

In assembling the blade contact assembly 20 with the finger contact assembly 21, the elongated index pin 63 serves as a guide for assuring proper registration of the contact in the first instance. Thus, referring to Fig. 2, the notched end of the panel is brought to register with the index pin 63, as indicated in broken outline, by a longitudinal movement of the panel 22 toward the pin. The blade contact assembly is then pushed toward the finger contact assembly while maintaining the registration with the index pin 63, until all of the blade contacts have been received by the finger contacts and the index pin 62 registers with its aperture 35. The shoulders on the end of the full diameter body portion of the posts 29 and 30, at the bases of the integral index pins 62 and 63, receive the opposing face of the panel 22 and determine the fully assembled relationship of the contact-carrying assemblies with one another.

Both of the leg brackets 31 are of identical construction and are held in place by the reduced diameter end portions 61 of the spacer posts. To this end each of the leg brackets 31 comprises a body formed from a strip of appropriate sheet metal formed in inverted substantially U-shape (Fig. 12). The base or web 68 of the bracket is of substantially the same length as the width of the panel 23 and has a central aperture 69 of approximately the same diameter as the reduced diameter post end 61 to be received therethrough. Adjacent each of its ends the web 68 is formed with an identical index boss 70, which may be integrally struck up therefrom in the form of a transversely extending loop and which is of a width and length to be received within one of the elongated apertures 34 at the end of the panel 23.

Each of the leg portions of the bracket 31 is provided with a laterally extending attachment flange or foot 71 formed with a screw aperture 72.

In assembly, the leg bracket 31 is placed with the web 68 flatwise against the opposing face of the panel 23 and with the indexing bosses 70 in registration with the appropriate apertures 34, as seen in Fig. 4. The end portions 61 of the associated posts will then project through the aperture 69, and being of slightly greater length than the combined thickness of the panel 23 and the web 68, will project beyond the web, as shown in dot-dash outline in Fig. 2. The projecting tip of the end portion 61 may be upset to form a rivet head 73. Thus, the web 68 and the panel 23 are permanently fastened together between the rivet head 73 and the opposing shoulder of the larger diameter portion of the associated post, and the post at the same time secures itself in the assembly. Although the leg bracket 31 is fastened only at its center, the index bosses 70 prevent rotation about the axis of the connecting portion 61.

In use, the finger contact assembly 21 of the connector may be secured in place upon the base 32 by screws 74 driven through the foot-flange apertures 72 of the leg brackets, substantially as shown in Figs. 1 and 4. The frictional grip of the contact fingers 27 and 28 on the blade contacts 25 holds the blade contact assembly 20 firmly in place in the connector unit until the contact assemblies are forcibly separated by pulling the blade contact assembly away from the finger contact assembly.

A highly desirable feature of the connector of the present invention is that it may be constructed in a great variety of practical lengths to pro-

vide variable numbers of contacts to meet special requirements. Thus, the connector unit may be constructed longer or shorter than shown in Fig. 1 to have a greater or lesser number of contacts, although the twelve-contact arrangement, that is, six to a side, has been found most suitable for general utility.

As shown in the modified form of Fig. 13, a plurality of these connector units may be constructed as one multiple unit 75. In the multiple unit shown, there are just twice the number of contacts as contained in the unit of Fig. 1, and due to the great length of the contact-supporting panels 22^a and 23^a, one set of contacts is omitted at the center of the multiple unit and an additional connecting post 29^a, as well as an additional leg bracket 31^a, is provided at this point. In other respects, the unit 75 may be substantially the same as the previously described connector unit.

For some uses, a circular form of connector unit 77 as shown in Figs. 14 and 15 may be preferred. In this form of the connector, a pair of similarly constructed round disc panels 78 and 79 are provided for supporting the blade contacts 25 and finger contacts 27, 28, respectively. Thus, each of the discs has an annularly arranged series of contact-receiving apertures 80, of the same dimensions as the apertures 34 previously described in connection with the elongated form of connector. The spacing of the aperture 80 from the periphery of the disc is substantially the same as the spacing of the apertures 34 from the edges of the panels 22 and 23. The blade contact 25 and the finger contact members 27 and 28, are, therefore, adapted to be secured in place on the respective disc panels the same as on the elongated panel, and the terminal lugs 41 and 57 of the respective contacts will be adjacent to or project from the periphery of the disc for convenience in connecting the electrical conductors thereto.

To accommodate the spacer posts 29 and 30, each of the disc panels 78 and 79 is provided with a pair of diametrically aligned apertures 81, which are spaced radially inwardly from the peripheries of the discs sufficiently to assure sufficient gaps between them and the nearest contact members and avoid jumping or sparking of the electrical current passing through the contacts. One of the apertures 81 in the blade-contact disc panel 78 is of slightly larger diameter so as to accommodate the elongated index pin 63, which assures proper assembly of the blade-carrying sections of the connector.

A pair of the leg brackets 31 is secured in place against the outer face of the finger-contact disc panel 79 in spaced parallel relation by means of the respective rivet-headed lower extensions 61 of the posts, and the disc panel 79 is formed with indexing holes 82 for receiving the index bosses 70 of the leg brackets. In addition, both of the disc panels 78 and 79 are formed with registering screw driver apertures 83 which permit access therethrough to the attaching screws 74.

From the foregoing, it will be apparent that my invention provides many refinements and simplifications of structure as compared with prior devices of this type. My construction is quite reliable and highly efficient, every part being carefully designed for the utmost in functional value to be attained with the minimum use of material. In contradistinction to all prior separable connectors of similar type, a device constructed according to my invention requires no separate fasten-

ing devices, such as screws, rivets, or the like, for holding the parts assembled. All parts which are required to be secured in place are formed with self-fastening features or are anchored by engagement with the securing means of other functional parts of the device. Thus, the blade contact members and the spring finger contact members have self-securing flanges, and the index pin and spacer posts secure not only themselves but the leg brackets in place upon their supporting panel.

All parts of the device, moreover, are as nearly as possible of standardized construction, so that the parts can be made in very few and simple manufacturing steps. The metal parts can be manufactured with three sets of dies, namely, one set for making the blade contact members, one set with a replaceable section for making the spring finger contact members, and a third set for making the leg brackets. The index pin and spacer posts are simply made in a screw machine.

The standardized contact-carrying panels can be made with the same set of dies, with the addition of a notching punch for completing the blade-contact panel in the rectangular forms of the device. In the round form of the device, the only change required in making the blade-contact panel is the substitution of a larger diameter punch for one of the index pin holes.

Manufacturing costs of my device are considerably lower than in prior devices, all of which require either more complex dies or manufacturing processes and generally a greater number of manufacturing operations.

Economy is also effected in assembling the device of the present invention, not only because of the smaller number of different parts, but also because of the simplified manner in which the parts are adapted to be assembled. Although the connector may be assembled readily by hand, with the aid of simple tools, the design is also eminently suitable for efficient, high-speed, automatic or semi-automatic machine assembly.

In the use of the device, it is practically fool-proof because unless the contact-carrying assemblies of the device are properly indexed, so that the proper contacts are joined, the connection cannot be made. The indexing arrangement positively requires that the contacts be brought together in one way only, that is, the blade contacts must enter the spring finger contacts with a knife action. Therefore, the contact members are saved from the distorting effect of improper manipulation.

Furthermore, the blade and spring finger contact arrangement is in and of itself less liable to distortions resulting from careless manipulation, and does not necessarily require perfect centering of the blade contacts in the finger contacts, because the flat form of the blades and substantial width of the jaws of the finger contacts allow for some relative shifting of the contacts in the direction of the plane of the blade contacts. A perfect electrical connection between the contacts is thus assured at all times.

Another decided advantage of the present invention is the flexibility permitted as to size, capacity and form.

While I have illustrated and described certain preferred embodiments of my invention, it should be understood that I do not thereby intend to limit my invention to the specific forms disclosed, but contemplate that modifications and alternative constructions or substitutions may be made

without departing from the scope and spirit of my invention.

I claim as my invention:

1. In an electrical connector, a contact member comprising a resilient sheet metal finger of substantially S-shape having a convex-surface bearing tip and a base lying substantially perpendicularly to a plane tangential to the main bearing area of the bearing tip, said base serving as a locating shoulder to rest against the face of a supporting panel, a flange portion extending right-angularly from said base for projection through an aperture in the supporting panel, and a clenching flange extension on said right-angular flange portion adapted to be bent into engagement with the opposite face of the supporting panel in opposition to said base for clamping the contact member in place on the panel.

2. In combination in a strain separable electrical connector construction, a contact-supporting panel having an aperture therethrough, a bracket for supporting said panel in spaced relation to a carrying member in a manner to enable the reception of electrical conductors between the panel and said carrying member, said bracket having a portion thereof in supporting engagement with the opposing face of the panel, said portion having an aperture therethrough registering with the panel aperture, and a spacer and indexing post for detachably supporting a second contact-carrying panel in spaced relation to the first-mentioned panel for mating of the respective contacts carried by the panels, said post having a reduced diameter portion projecting through the aperture in the first-mentioned panel and the registering aperture of the supporting bracket, a base shoulder on the post surrounding the reduced diameter portion in engagement with the opposing panel face area surrounding the panel aperture, the free end of the reduced diameter portion having means extending laterally therefrom in opposition to said shoulder and tightly engaging the opposing face area of the bracket portion to cooperate with the shoulder to clamp the panel and bracket together in assembled relation and likewise secure the post into a unit with the panel-bracket assembly.

3. A connector construction as defined in claim 2 wherein the bracket-engaged panel has another aperture, and the panel-engaging portion of the bracket has a rotation-preventing projection extending into said spaced aperture.

4. A strain separable electrical connector structure comprising an electrical contact member fashioned from a strip of sheet metal, said member including a contact portion, a base portion integral with and bent to extend laterally to one side of the contact portion for flat engagement against the face of a relatively non-yielding contact-carrying panel having a narrow elongated contact-anchoring aperture therethrough, an integral right-angularly bent portion on the base portion extending in a direction away from the contact portion and adapted to project through the anchoring aperture in the carrying panel, and a relatively flexible but bendable integral clenching flange extending as a continuation of said right-angular portion but bent at an obtuse angle thereto toward the same side as said base portion, said flexible flange being adapted to be flexed into substantial alignment with said right-angular portion to enable the passage of the flange through the narrow aperture in the non-yielding carrying-panel and trailing insertion of

the right-angular portion into the aperture, the length of said right-angular portion being at least as great as the thickness of the panel so that after insertion thereof into the aperture the flange can freely flex back to obtuse angularity to cooperate with said base portion to interlock the contact member against accidental displacement from the panel prior to bending of the flange into clenching position against the panel.

5. In combination in a separable connector, a relatively thin insulating panel of substantially non-yielding material, a narrow rectangular aperture in said panel, a contact structure formed from a pair of companion sheet metal members having oppositely extending portions engaging one face of said panel at the respective opposite sides of the aperture and having portions bent at right angles to the first-mentioned portions and projecting through said aperture, said last-mentioned portions being in juxtaposition and substantially filling said aperture and mutually preventing transverse movement of such portions within the aperture, and a clenching flange bent at right angles to and extending laterally from each of said portions within the aperture and engaging the face of said panel opposite to and clampingly relative to the first-mentioned portions for clamping the contact structure in place on the panel.

6. In combination in a strain separable connector construction, a contact-supporting panel having a rectangular aperture therethrough, a sheet metal contact structure comprising oppositely extending U-shaped attachment portions with the webs of the U's extending through and substantially filling said aperture so that the webs exert mutual support against movement of the webs transversely of the aperture, the sides of the U's being in gripping relation to the panel therebetween at the respective opposite sides of the aperture, a contact portion projecting from one side of each U and cooperating with the companion contact portion for separably engaging with a mating contact for closing an electrical circuit therethrough, and a soldering lug on the remaining side of one of the U's and projecting away from the panel for attachment of an electrical lead of the circuit.

7. In an electrical connector, a relatively thin and substantially non-yielding insulating panel, said panel having a narrow substantially rectangular aperture therethrough, and a contact structure carried by the panel comprising: a pair of resilient sheet metal fingers of substantially S-shape having convex-surfaced bearing tips in mutually opposing juxtaposition adapted to receive a blade contact member slidably therebetween, base portions integral with each of said fingers and lying flatwise against a face of said panel at respectively opposite sides of said aperture in edgewise abutment at the aperture, a flange portion extending right-angularly from each of said base portions and extending through said aperture in face-to-face juxtaposition, and a clenching flange extending from each of said right-angular flange portions and cooperating with the opposed base portion to clamp the respective fingers in place on the panel, at least one of said clenching flanges having a soldering lug extension projecting substantially beyond said panel to facilitate soldering an electrical lead thereto.

8. In combination in a strain separable connector of the character described, a contact-carrying panel adapted to be disposed in substan-

tially parallel relation to a supporting surface, means for maintaining said panel in a given spaced relation to the panel of a complementary contact assembly when said latter panel is in parallel relation to the first-mentioned panel with the contacts in mating relation, said means comprising a pair of posts having their ends formed of reduced diameter and extending entirely through the first-mentioned panel, brackets for supporting the first-mentioned panel in said spaced relation to the supporting surface, and said brackets having thin broad shoulders engaging the contiguous surface of the panel in face-to-face relation, said shoulders having apertures therethrough through which the projecting end portions of the posts extend, said post end portions being deformed into clamping relation to said shoulders for securing the brackets in permanent assembly with the first-mentioned panel.

9. In an electrical connector, a contact member comprising a resilient sheet metal finger of substantially S-shape having a convex-surface bearing tip and a base lying substantially perpendicularly to a plane tangential to the main bearing area of the bearing tip, said base serving as a locating shoulder to rest against the face of a supporting panel, a flange portion extending right-angularly from said base for projection through an aperture in the supporting panel, and a clenching flange extension on said right angular flange portion adapted to be bent into engagement with the opposite face of the supporting panel in opposition to said base for clamping the contact member in place on the panel, said base and the adjoining portion of the metal finger having a longitudinal reinforcing bead to increase the resiliency thereof and avoid bending

out of shape even though the sheet metal of the finger is thin and of relatively low inherent resiliency.

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