

March 7, 1961

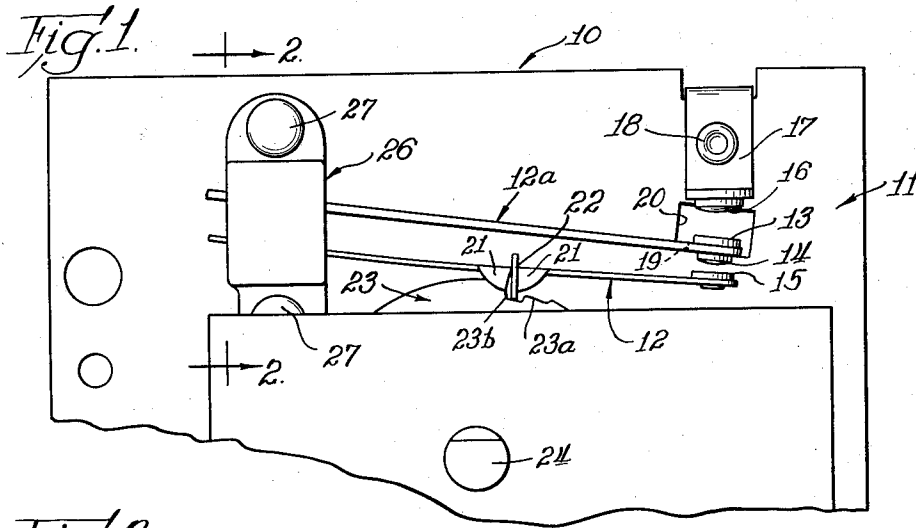
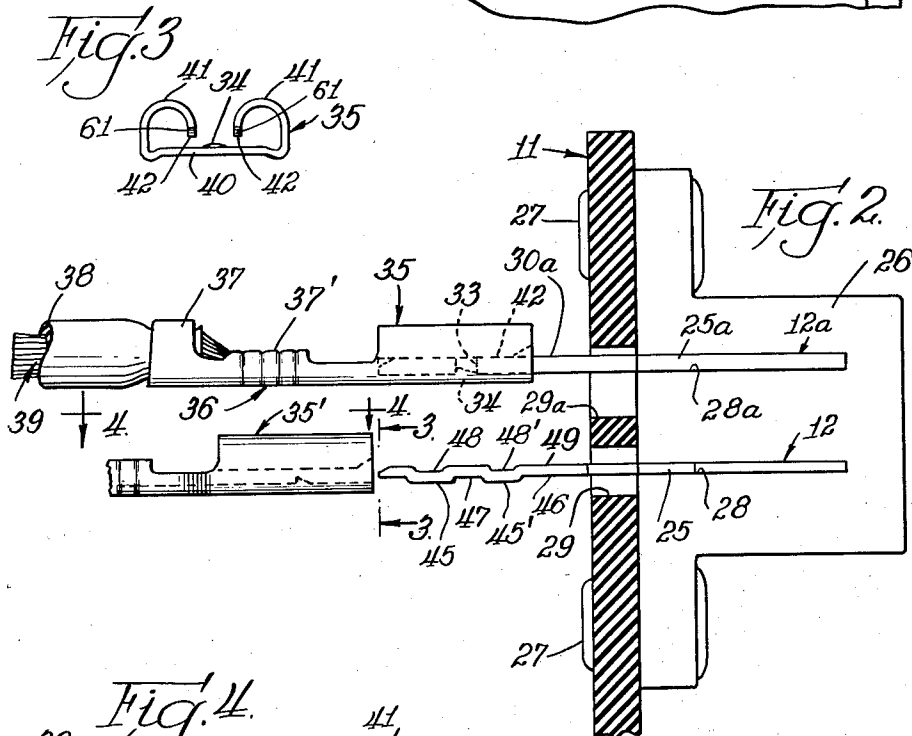
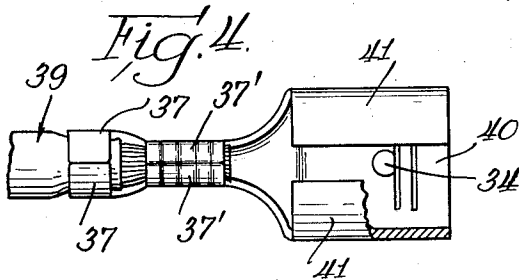
R. B. ELLIS

2,974,302

ELECTRICAL TERMINAL CONSTRUCTION

Filed June 11, 1958

4 Sheets-Sheet 1



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March 7, 1961

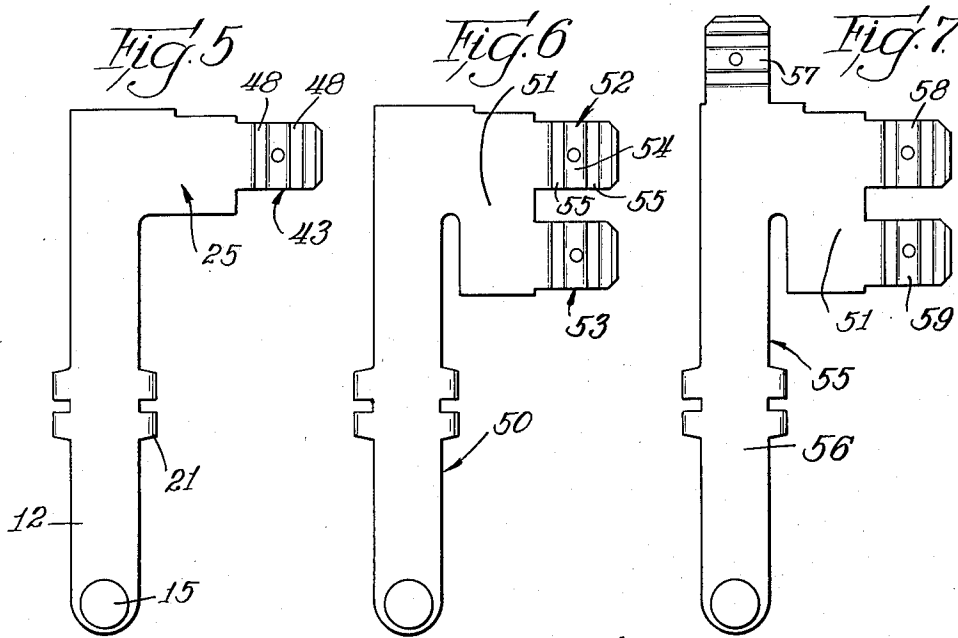
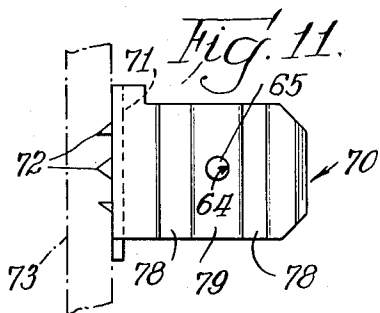
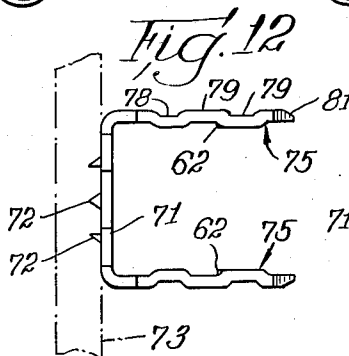
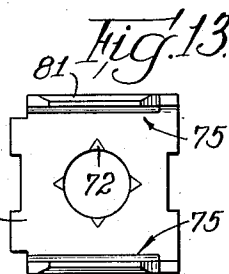
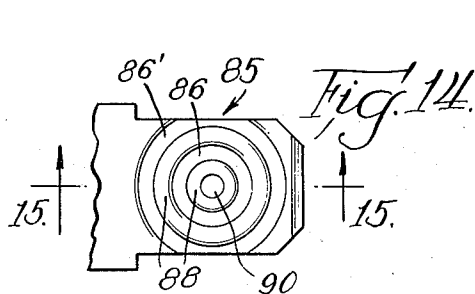
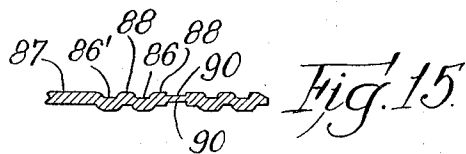
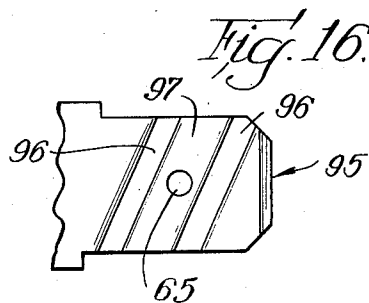
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ELECTRICAL TERMINAL CONSTRUCTION

Filed June 11, 1958

4 Sheets-Sheet 2



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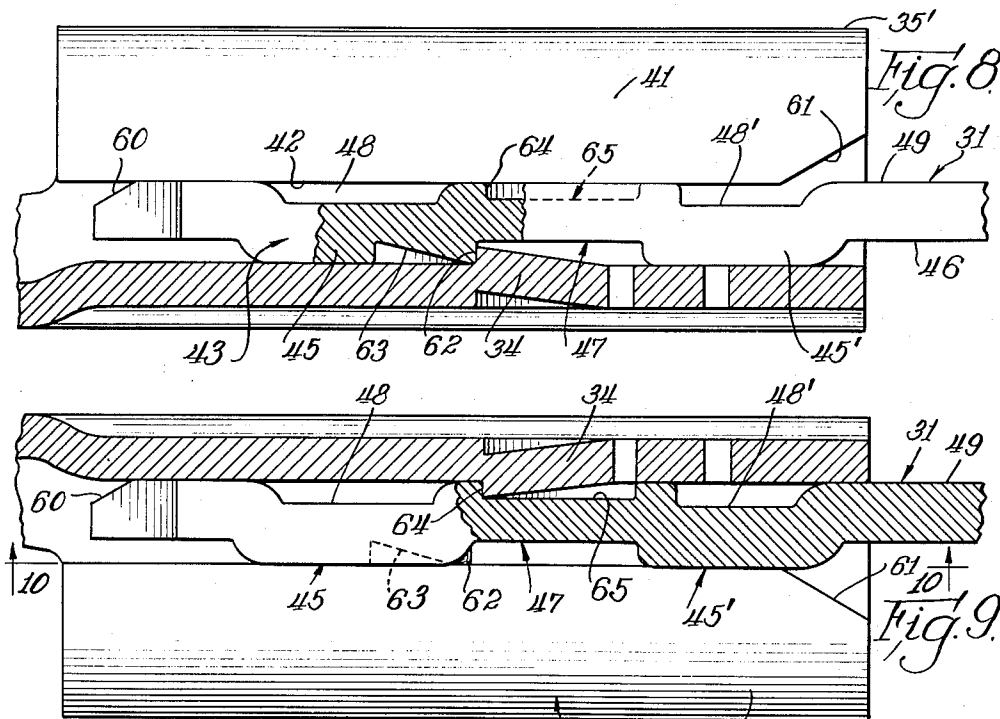
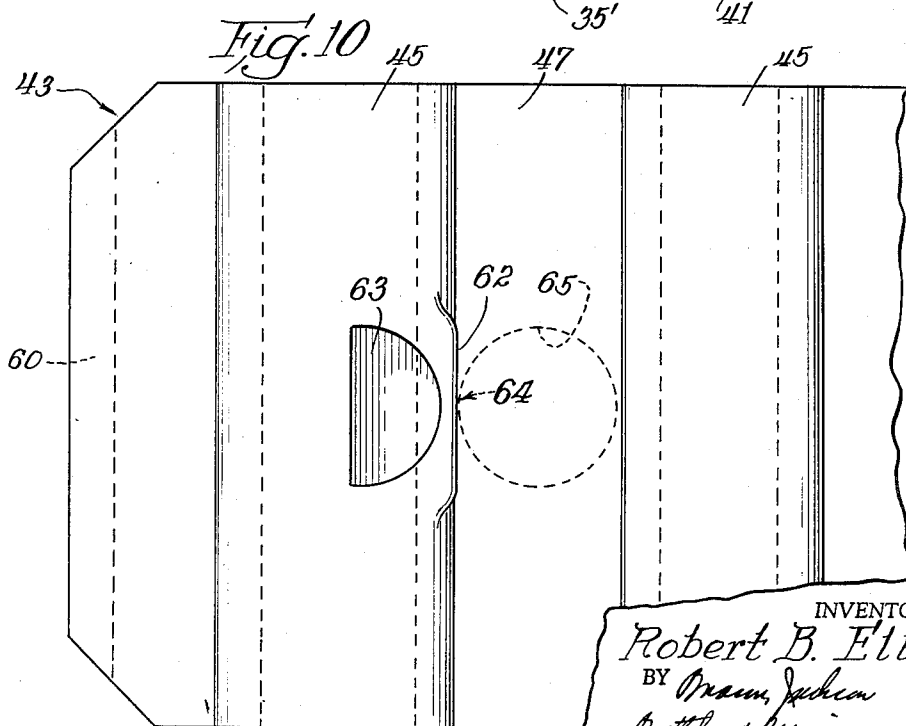
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ELECTRICAL TERMINAL CONSTRUCTION

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4 Sheets-Sheet 3



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ELECTRICAL TERMINAL CONSTRUCTION

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4 Sheets-Sheet 4

Fig. 17

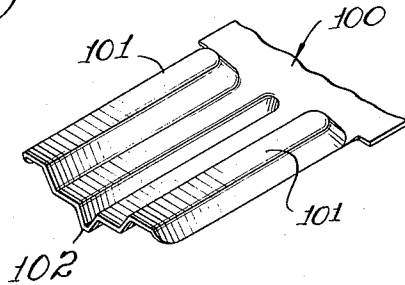
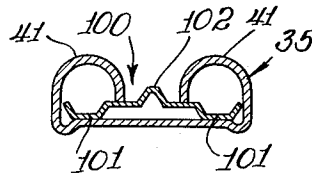


Fig. 18

Fig. 19

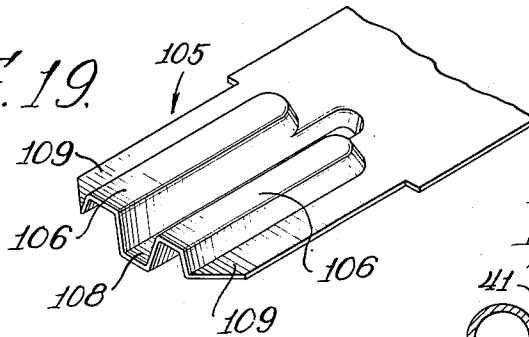
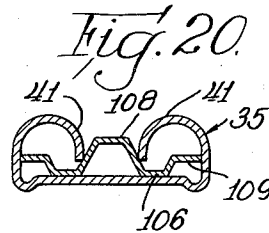


Fig. 20

Fig. 21

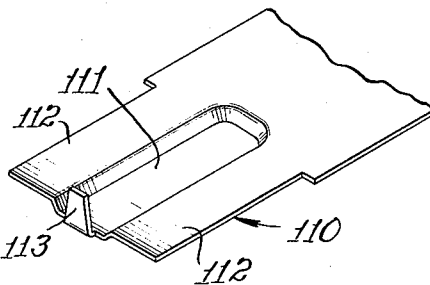
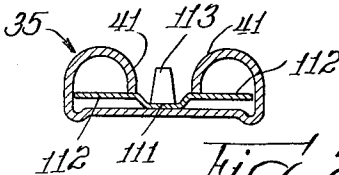


Fig. 22

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2,974,302

ELECTRICAL TERMINAL CONSTRUCTION

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Filed June 11, 1958, Ser. No. 741,314

8 Claims. (Cl. 339—278)

This invention relates generally to electrical terminal structures and more particularly to an improved terminal tab for use with female terminal connectors.

Various electrical devices, for instance, switches and automatic timing devices of the type set out in U.S. Patent No. 2,801,305 issued to A. D. Stolle et al., on July 30, 1957, employ various electrical components which require connection to electrical conductors. To this end, male terminal tabs are provided for use with female thrust-type connectors; such connectors being joined to suitable conductors, while contact is established by frictional engagement between the female connector and the male tab. In certain instances, and particularly in the automatic switch field, the industry has established required dimensions and weight of material for the female connector, so that such devices have become conventional of accepted standards. In the same vein, terminal tabs which cooperate with the connector devices likewise have been standardized at accepted size and thickness for cooperation with the standard terminal connectors.

As a result, the manufacturer of an assembled switch mechanism is confronted with the problem of utilizing standard terminal connectors in situations which may not necessarily demand a connector tab having the accepted requisite standards of dimension and thickness. This happenstance is found in certain cam operated switch blades, for example, such as the type illustrated and described in the above referred to Patent No. 2,801,305. In such instances, a flexible, laterally deflective leaf spring switch blade, bearing movable contact members for cooperation with stationary contacts, is operated to open and close in response to rotational driving of a suitably configured cam wheel. Circuit between the movable contacts on the switch blade and the stationary contacts which cooperate therewith may include the blade as a conductor and, therefore, the latter requires a suitable connector terminal tab for its association with a supply conductor or female connector. Generally, if the resiliency, requisite of the deflective spring switch blade, is maintained throughout the blade and tab, the latter proves too thin to properly fit within the standard female connector. Such tabs, therefore, have been constructed separately of thicker metal than the spring blade to meet the mating requirements of the female terminal connector, as shown in the above-mentioned Patent No. 2,801,305. This means, however, that added manufacturing operations are required for forming the separate terminal tabs and joining them to the flexible contact carrying spring elements. Generally, such operation may be accomplished by riveting, welding, or brazing a heavier metal tab portion to one end of the light flexible switch blade. Economies of manufacture favor avoiding such two-part construction by making the terminal tabs and switch blade or spring element integral portions of the same stamping, if possible. In other instances, wherein no spring element is required, as in providing a neutral terminal, use of the lighter weight metal is likewise favored to save weight and material.

It is to the above-stated problem that the improved terminal structure of this invention is directed. In brief, the present invention provides an improved male terminal

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tab or prong which is constructed of comparatively lightweight and resilient material, and integral with the spring stock used in a laterally deflective contact carrying spring element. The tab is configured and formed, however, to bear an effective cross-sectional thickness favorable for frictional connection with a standard female connector, normally used with a standard male terminal tab having a heavier cross-sectional thickness. Additionally, my improved connector tab may include suitable detent mechanism cooperative with detent means on the female connector, thereby to effectively lock the two together, while permitting engagement and separation under given conditions of thrust and pull, as will be recognized from description which follows. It may be stated also that the effective increased cross-sectional thickness of my connector tab is achieved simply by a waffle, ripple or crimping formation of lightweight resilient metal to provide adjacent lands and grooves having sufficient offset to present an effective cross-sectional dimension of desired value for cooperation with a standard female connector.

An important object of this invention is to provide a new and improved connector tab for connection with a standard female connector device and which, while constructed of conductive material having a cross-sectional thickness less than that required for interfitted frictional cooperation with the female connector, is so configured and formed as to present an effective cross sectional thickness of the dimension required by such connector.

Another object of this invention is to provide a terminal tab, as aforesaid, which bears a unique configuration presenting detent means cooperative with a female terminal connector to prevent their accidental disassociation.

A still additional object of this invention is to provide a new and improved terminal connector tab which effects economies of production and manufacture by savings of material without lessening effective operation and functioning.

The above and further objects, features, and advantages of this invention will appear to those familiar with the art from the following detailed description taken in conjunction with a preferred embodiment illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a partial front elevational view of a typical automatic switching mechanism employing a flexible contact carrying spring element embodying the features of my invention;

Figure 2 is an enlarged cross-sectional view taken substantially at line 2—2 of Figure 1 to demonstrate the operation of my improved terminal structure;

Figure 3 is an end elevational view looking at a female connector substantially from vantage line 3—3 of Figure 2;

Figure 4 is a top plan view of the female connector seen in Figure 3 with a portion thereof broken away and looking downwardly thereat, as taken from vantage line 4—4 of Figure 2;

Figure 5 is a top plan view of the contact carrying leaf spring element for the switch of Figure 1, equipped with a single terminal tab according to my invention;

Figure 6 is a top plan view, similar to Figure 5, showing a modified leaf spring element bearing two terminal tabs according to the invention;

Figure 7 is still another plan view, similar to Figures 5 and 6, demonstrating the features of a further modified form of leaf spring element including three terminal tabs;

Figure 8 is a partial enlarged view in side elevation, with portions shown in cross section, to illustrate the peculiar configuration of the improved terminal tab of this invention and its cooperation with the female connector illustrated in Figures 3 and 4;

Figure 9 is another enlarged view with portions shown in cross section, similar to Figure 8, demonstrating the cooperation of my improved terminal tab and the female connector, but with the position of the female connector reversed from its Figure 8 position;

Figure 10 is a partial enlarged bottom plan view of the terminal tab or prong illustrated in Figures 8 and 9 and at the same scale therewith, corresponding approximately to an upward view taken on the plane of the line 10—10 of Figure 9, to show particulars of the detent means embodied therein;

Figure 11 is a top plan view of a neutral terminal device embodying the features of this invention;

Figure 12 is a side elevational view of the neutral terminal device of Figure 11;

Figure 13 is an end elevational view of the device shown in Figures 11 and 12;

Figure 14 is a plan view of a modified terminal tab employing a modified friction holding means, employing concentric lands and grooves;

Figure 15 is a cross-sectional view taken at line 15—15 of Figure 14;

Figure 16 is another plan view, similar to Figure 14, showing another modified terminal tab of this invention in which oblique lands and grooves are employed;

Figure 17 is a perspective view of a further modified form of terminal tab according to this invention embodying longitudinally extending raised and depressed portions;

Figure 18 is a view in end elevation showing the tab of Figure 17 cooperatively mounted in the female connector of Figure 4;

Figure 19 is another perspective view of another modified form of male tab, similar to Figure 17, embodying this invention;

Figure 20 is an end elevational view showing the male tab of Figure 19 in cooperative connection with the female connector of Figure 4;

Figure 21 is still another perspective view of still another modified form of tab, similar to Figure 17; and

Figure 22 is a view in end elevation, similar to Figures 18 and 20, showing the tab of Figure 21 in cooperative engagement with the standard female connector of Figure 4.

In the accompanying drawings I have illustrated certain preferred embodiments of my improved terminal construction as used in association with a manually settable automatic time switch, but I wish it to be understood that the invention is not necessarily limited to such time switches. Referring first to Figure 1, this time switch is indicated generally by the reference numeral 10, and comprises a base plate or panel 11 of insulating material on which all of the parts of the switch assembly are mounted. Mounted on the front face of this base plate 11 is the blade assembly of the switch, which comprises a lower leaf spring blade 12 and an upper leaf spring blade 12a. The upper blade 12a carries upper and lower movable contacts 13 and 14 respectively, and the lower blade 12 carries an upper movable contact 15 adapted to engage with cooperating movable contact 14. The upper movable contact 13 on upper blade 12a is adapted to engage with a stationary contact 16 carried by a mounting clip 17 which is attached to the base plate or panel 11 by a rivet 18. Both switch blades 12 and 12a tend to flex downwardly into the contact opening positions shown in Figure 1, the downward flexure of the upper plate 12a being limited to the position shown by the engagement of a rearwardly projecting tongue 19 at the end of the blade element 12a against the bottom edge of a slot 20 punched out in the back panel 11.

The lower leaf spring blade 12 is formed with downwardly bent side wings 21 having tapering or V-shaped notches therein, in which a cam follower 22 is tiltably mounted for riding on the notched periphery of a cam disc 23. This cam disc is mounted on a time driven

shaft 24 which is driven from a small synchronous electric motor through a friction slippage clutch (not shown). A manual setting knob is mounted on the outer end of the time driven shaft 24, through which the cam disc 23 can be manually rotated in either direction to different time settings, the friction slippage clutch permitting such manual rotation of the cam disc. The cam follower 22 responds to shallow and deep notches 23a and 23b respectively in the periphery of the cam disc 23. The two upper switch contacts 13 and 16 separate when the cam follower 22 enters the shallow notch 23a; and all four contacts 13, 14, 15 and 16 separate when the cam follower enters the deep notch 23b. It will be noted that when all four contacts separate the lower switch blade 12 operates through a greater range of flexing movement than does the upper switch blade 12a. Most of the switch structure described above is more fully disclosed in the aforesaid Patent 2,801,305, to which attention is directed for more specific details.

The above described greater range of flexing movement of the lower switch blade 12 is one factor which makes it desirable to have the lower switch blade 12 composed of thinner stock than the upper switch blade 12a. The upper switch blade 12a is preferably composed of half hard brass stock having a thickness preferably in the order of approximately .032 inch. This .032 inch thickness has become a substantially standardized dimension for terminal prongs or terminal tabs that are to receive the now prevalent push-pull type of female connectors illustrated in Figures 3 and 4. Thus, by making the upper switch blade 12a of approximately this .032 inch thickness this switch blade can have its terminal prongs formed as integral extensions of the blade. On the other hand, the lower switch blade 12, because of its greater range of flexing movement, is desirably made of substantially thinner stock. For example, very good performance and long operating life have been obtained when this lower switch blade 12 is constructed of spring hard brass stock of approximately .0226 inch thickness; but it will be understood of course that this exact dimension is only exemplary and not limitative. This lower switch blade 12 also has terminal prongs projecting as integral extensions from the fixed end of the blade, and the manner in which these thinner terminal prongs are crimped, rippled or crinkled to increase the effective thickness thereof for receiving the same standardized female connectors will be presently described.

Referring briefly to the manner of mounting the two switch blades, it will be seen from Figure 5 that the lower switch blade 12 has an integral anchoring web portion 25 projecting laterally at the fixed end of the blade. The upper switch blade 12a is formed with a like integral anchoring portion 25a projecting laterally from its fixed end. These fixed ends of the two switch blades have anchored mounting in anchoring slots 28, 28a extending transversely through an insulating mounting block 26 which is secured to the base panel 11 by rivets 27. It will be seen that the mounting block 26 supports the leaf spring portions of blade elements 12 and 12a in cantilever fashion for free flexing action. The anchoring web portions 25, 25a of the two switch blades extend rearwardly from the anchoring slots 28, 28a of the mounting block into a companion pair of anchoring slots, 29, 29a which are punched out in the back panel 11. The anchoring slots 28, 28a in the mounting block 26 establish predetermined fixed positions of the two switch blades 12 and 12a in a vertical plane or in planes at right angles to the lengths of the blades. The other pair of anchoring slots 29, 29a establish predetermined fixed positions of the switch blades in a horizontal plane or in planes parallel to the lengths of the switch blades. This improved mounting of the two switch blades constitutes the invention of Anthony D. Stolle and Robert B. Ellis, and is fully disclosed in their copending application, Serial No. 736,755 filed May 21, 1958

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The anchoring web portion 25a of upper switch blade 12a extends through the upper anchoring slot 29a in the mounting panel 11 and projects beyond the back side of the panel in the form of a connective terminal tab or male prong portion 30a. Such tab portion includes a central opening 33 for receiving a detent projection 34 associated with the aforementioned female connector 35 adapted to be thrust onto the projecting tab or prong portion; such female connector 35 being of the conventional push-pull type and of a standard dimension for accepting the standard thickness of the terminal tab portion 30a.

The structure of connector 35, as shown, may include a shank portion 36 having wrap-around arm members 37 and 37' adapted to be bent and crimped to embrace the exterior insulation 38 and the wire core 39, respectively, of a supply conductor. A platform 40 also is provided at the outer free end of the shank portion 36 and such bears the central detent projection 34. The lateral edges of this platform are also reentrantly bent and turned to form tab engaging arm portions 41, 41', as best viewed in Figure 3, for example. With respect to such arm members 41, 41', the same terminate between the lateral limits for the platform portion 40 and in overlying spaced relation thereto. The spacing, so provided, between terminal ends 42, 42' of such arm members 41 and the upper face of the platform 40 constitutes the aforesaid dimension of approximately .032 inch, which is standard in these female connectors. As previously described, in order to be receivable in this socket space of .032 inch, the terminal tab 30a has this standard thickness of approximately .032 inch, this standard terminal tab 30a constituting an integral portion of the single stamping comprising the upper leaf spring 12a.

In operation, the female connector 35 is merely thrust or pushed onto the projecting terminal tab 30a to bring its upset detent projection 34 into registering alignment with the opening 33 formed in the terminal tab. In this manner, the detent projection 34 may resiliently snap into the opening 33 and thereby lock the terminal connector in place (see Figure 2). Disconnection between the terminal connector and tab 30a may be effected by merely pulling on the terminal connector with sufficient force to disengage the detent projection 34 from opening 33.

Those familiar with the art will recognize that the foregoing, concerning the structural aspects of terminal tab 30a and female connector 35, describes structures which are known and recognized in the art; the described cooperation between the connector and terminal tab being that of the normal situation for which the two elements are designed dimensionwise. As stated previously, the problem which this invention seeks to overcome, however, occurs when a standard terminal connector, such as 35' of Figure 2, which corresponds in all respects to terminal connector 35 previously described, is to be associated with the integral terminal portion of a thinner leaf spring stamping, such as the lower switch blade 12; it being recalled that the thickness of this lower switch spring member blade 12 is only approximately .0226 inch, or substantially less than that of the heavier upper switch blade 12a for which the standard female connector 35' is designed. The novel aspects and features of my invention which make this association possible will best be understood by examining, at this time, Figures 5 and 8-10 of the drawings.

As shown in Figure 5, the integral anchoring portion 25 of lower switch blade 12 is extended laterally in a narrower dimension to form a terminal tab or male prong section 43. Such tab or prong section is distinguished by a crinkled or rippled portion comprising a plurality (two in the illustrated instance) of parallel lands or projecting areas (Figure 2) extending outwardly or downwardly from one side of the general plane of the terminal tab 43, the first or outermost projecting land or ripple being designated 45, and the second projecting land or ripple

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being designated 45'. These downwardly projecting lands or ripples 45, 45' on the under face 46 of the terminal tab are separated by a lower groove 47, while additional upper grooves or depressions occur opposite the lands 45, 45' in the upper opposite face 49 of the tab, the first or outermost of these upper grooves being designated 48 and the second of these upper grooves being designated 48'. By properly controlling the upsetting and crimping operation of the tab or prong section 43, the thickness dimension presented between the bottom faces of the downwardly projecting lands or ripples 45, 45' and the upper opposite face 49 of the prong is sufficient to insure proper frictional connection with the terminal connector 35' (see Figures 8 and 9), being substantially equal to the standard thickness of the conventional male tab or prong 30a (i.e. approximately .032 inch). The projecting lands or ripples 45, 45' and the opposite grooves, 48, 48' of the rippled prong 43 preferably extend transversely of the longitudinal dimension of such rippled prong.

While the above-described flexible spring element 21, shown in Figure 5 in particular, relates to a single tab structure, it is intended that more than one such terminal tab may be provided in a given structure. As an example of such a modification, switch blade 50 of Figure 6 is referred to. It will be observed that blade 50 includes an integral anchoring portion 51 at its fixed end, of greater longitudinal dimension than the previously described anchoring portion 25. Extending laterally from this wider anchoring portion 51 is a pair of terminal tab sections 52 and 53, which are corrugated or crinkled according to the structural aspects of the tab section 43 previously described; the same including plural raised and depressed areas 54 and 55, respectively, to substantially increase the effective cross-sectional thickness of the tab over that presented by the cross section of the material from which it is constructed. In this case, the blade 50 is also preferably of light spring brass of the necessary thinness to provide the required range of spring flexure, similar to the lower switch blade 12 referred to previously.

Figure 7 sets forth a still further modified form of blade, designated 55 generally, which includes, integral with the flexible contact carrying blade portion 56, three terminal tab sections 57, 58, and 59; all constructed integral with blade 56, but developed with increased cross-sectional thickness in the manner previously used for tab section 43. It is believed that those familiar with the art will readily recognize and appreciate the versatility thus afforded by providing one or more of such terminal tab sections in association with resilient leaf spring elements, or like devices, according to my invention.

To better understand the features of such improved terminal tab structures, I will now set forth in detail certain outstanding particulars thereof as they are found and related to the terminal tab 43 of Figures 5, 8, 9 and 10; it being understood that the tab sections of the modified blade structures 50 and 55 of Figures 6 and 7, respectively, are of a like character with the tab section 43. As shown in the enlarged scale in Figures 8, 9 and 10, the tab section 43, in addition to having the projecting lands or raised areas 45, 45' and depressed areas or grooves 47 and 48, 48', also includes a chamfered or tapered outer end 60 for piloting the terminal tab between the depending arm members 41, 41' and the platform 40 of the female connector. To assist in this function, sloping pilot 65 and guide surfaces 61 are formed at the entry ends of the connector wall portions 41 (Figures 3 and 8) to cooperate with the chamfered face 60 of the terminal tab 43. The detent projection 34, which constitutes an upset portion of platform 40, having a substantially triangular-shaped cross section, see Figure 8, is adapted to enter the recess 47 formed in the bottom face of platform 40. Cooperation between detent 34 and recess 47, as shown in Figure 8, marks one operating relationship wherein the female connector 35' has been pushed over the male terminal 31 with the female detent projection 34 facing in an upward

direction to snap into the recess 47 of the male prong. To provide such locking engagement between the raised detent projection 34 and recess 47, a first locking wall or lip 62 is formed to project downwardly in the lower face 46 of the male terminal tab or prong 43, such first locking lip 62 being formed at one edge of the recess 47 by striking the first land or raised area 45 to provide a dimple impression 63 in the bottom face of the projecting area 45, such dimple impression displacing the required metal to form this first detent lip 62. This relation may best be understood by examining Figure 10 wherein the bottom face of the terminal tab 43 is illustrated.

In Figure 9, I have shown the female connector 35' and the male connector tab portion 43 in an inverted relationship wherein the female connector 35' has been turned over or reversed from its Figure 8 position. Thus, the reentrantly turned wall portions 41 thereof reside beneath the terminal tab 43. In this condition, the detent projection 34 overlies the upper face of the terminal tab 43 for locking cooperation with the leading edge of a second locking wall or lip 64 formed in an upwardly projecting direction in the upper face of the male terminal tab or prong 43, such second locking lip being formed by punching a centrally disposed circular recess 65 struck inwardly of the upper face 49 of the tab, preferably at a point intermediate the two grooves 48, 48'. It will be understood from the foregoing that the standard female connector 35' may be conveniently locked with either the first or second detent means 62 or 64 of the male terminal tab section 43, regardless of which face of the male terminal is presented to the female detent projection 34. This reversible or invertible feature provides greater convenience and facility in the mounting of the female connector 35' in either one of the two alternately inverted positions on the male terminal 43, which alternately inverted positions are shown in Figures 8 and 9. Here again, the raised lands 45, 45' and the depressed grooves 48, 48' preferably extend transversely of the longitudinal dimension of the male tab or prong 43.

Extensive tests of the above described embodiment have proven the efficacy of the female detent shoulder 34 and the two cooperating male locking lips 62 and 64 to sustain a very substantial pull-off or uncoupling force acting to separate the female connector from the male prong, even after several previous pull-off separations have been effected. Many manufacturers of household appliances and other equipment utilizing these general types of male terminal tabs and push-on female connectors have established standards calling for relatively high uncoupling or pull-off tensions, even after several prior pull-off operations have been performed.

Attention is also directed to the fact that there is a minimum tendency for resistance heating to occur between the female connector and the male terminal owing to the extensive areas of electrical contact between the connector and terminal. The raised areas 45, 45' extending entirely from side to side of the rippled male terminal 43 define large flat contacting surfaces for full span flat face engagement against the flat surface of the platform portion 40 of the female connector 35, when the connector and terminal have the assembled relation shown in Figure 8. In this assembled relation, the upper flat face 49 of the male terminal has flat surface engagement against the parallel flat lower surfaces 42 of the reentrantly curved arm members 41, 41. On the other hand, when the female connector 35 and the male terminal 43 have the reversed or inverted assembly relation shown in Figure 9, the contacting relation of the above current conducting surfaces is merely reversed. It should be noted that in both assembly relations, the current carrying capacity is not limited to line contact or point contact between the coacting surfaces (with resultant heating), but instead large current carrying capacity is assured by the engagement of flat large surface area contacts.

While the foregoing description is concerned with the

use of my invention in connection with resilient leaf spring elements, such as are provided in the automatic timing switch 10 of Figure 1, it is also intended that my invention be utilized in other devices where it is desired to increase the effective cross-sectional thickness of a connector. Such an additional area of use, for example, is found in a neutral terminal lug, such as terminal 70 illustrated in Figures 11-13 of the drawings. As shown in these figures, such a neutral terminal comprises a substantially U-shaped clip member having a bottom wall 71 from which project a plurality of triangular-shaped teeth 72, 72 for anchoring engagement with a supporting member, such as the base wall 11 found in the switch assembly of Figure 1, for example. A rivet member, or the like (not shown), is usually employed for securely attaching such a neutral terminal to the insulated backing member 73. In addition to base wall 71, terminal member 70 also includes a pair of laterally spaced arms 75, 75 which extend transversely of the base wall 71 to provide spaced-apart terminal tab projections for engagement with female connector devices, such as the devices 35, 35', illustrated in Figures 2, 3 and 4 of the drawings and described hereinabove. It will be seen from examining Figure 11, in particular, that each of the arms 75 includes a plurality of spaced depressions 78 and intervening raised areas or lands 79, similar to the construction used for the terminal tab 43, above described. This structure is accomplished as in the tab section 43 by suitable crimping and bending operations with the projections or lands in one face of the tab section 75 being opposed by corresponding depressions in the opposite face and vice versa. The extreme outer ends of each of the arm or tab portions 75 are chamfered suitably to assist in inserting the same into a female connector 35 and for that purpose includes a sloping outer edge 81, as viewed in the side elevational drawing Figure 12. It will also be recognized that the operation and functioning of the tab sections 75, 75 is substantially identical with that of the tab section 43 above described, except that such tab sections 75 are associated with a neutral terminal connector 70, as opposed to the operating switch blade structures of Figures 5, 6 or 7. Each terminal arm 75 is provided with the previously described detent locking formations 62 and 64.

In Figures 14 and 15, I have illustrated a modified tab 85 embodying a modified depression and raised projection pattern for effecting frictional engagement between a terminal tab of this invention and a female connector. Such pattern modification may be used for any of the tab sections above-described and includes a series of concentric depressions 86 and 86' formed inwardly of one face 87 of the terminal tab. Such depressions are separated by intervening raised areas 88, while the opposite face of the modified tab structure bears opposing raised projections and intervening grooves or depressions; it being understood that the several lands or grooves are substantially in the form of concentric circular areas, as illustrated. A central detent depression 90 is formed inwardly and centrally of both faces of the modified terminal tab 85 for locking cooperation with the detent projection 34 of the female connector; thereby serving, in addition to the frictional engagement between the tab section and the terminal connector, to hold the two members securely together.

In Figure 16, I have set forth a still further modified form of terminal tab 95. This form of tab structure includes a modified depressed and raised projection pattern for frictional locking engagement with the female connector. Such pattern comprises parallel-spaced grooves 96, 96, intervening raised area 97 at a slope or bias with respect to the tab's longitudinal axis, and the previously described detent locking formations 62 and 65 in opposite sides thereof.

In Figure 17, I have set out a tab structure 100 having a pair of parallel-spaced platform areas 101, 101 offset

in one direction from the general plane of the terminal. A third offset area of ridge 102 is provided intermediate platforms 101, but extending outwardly of the general plane of the terminal in a direction opposite the offset of platforms 101. The offset portion 102 is centrally between platforms 101 and parallel thereto; all three portions 101 and 102 extending lengthwise of the tab structure.

In Figure 18 it will be seen how the terminal 100 engages the arm portions 41 of the standard female connector 35 and intentionally locks therewith by friction.

In Figure 19 another modified tab structure 105, having a pair of parallel and lengthwise extending offset platform areas 106, 106 is shown. Similar to tab 100 of Figure 17, the platform areas 106 are separated by an oppositely directed offset portion or area 108. Areas 106 are further flanked by wings 109 that engage the interior side wall of the female type connector 35. In this latter regard, reference is made to Figure 20 wherein the central depressed platform portion 108 is shown extending upwardly between the arms 41 of the female connector 35 to effect frictional connection therewith.

In Figures 21 and 22 another terminal tab 110 having a single depressed and lengthwise extending platform area 111 is shown. This tab frictionally connects to the female connector 35 by means of the wing portions 112 which engage the downturned portions 41 of the female connector. A tongue portion 113, turned away from the central depressed area 111 and at the outer end thereof acts as an interlock means to require the tab to be positioned for engaging its central platform 111 with the platform 40 of the female connector, when inserting the tab 110 into the connector. In this respect, the central portions of tab 100 and portion 108 of tab 105 function in a like manner for the same purpose.

From the foregoing, those familiar with the art will readily recognize and understand the novel aspects of the present invention concerning particularly the provision of the projecting and depressed areas by crimping and bending the rather thin metal stock, whereby an increased effective cross section is gained. The use of the thinner sheet metal stock effects a very substantial savings in cost in each of the previously described embodiments, more than offsetting the almost negligible cost of die punching the alternate lands and depressions and detent formations. This operation of die punching the alternate lands and depressions and the detent formations 62, 63, 64 and 65 can be performed simultaneously with the blanking out operation by the same set of dies or by associated dies operating simultaneously with the blanking out step.

It will be appreciated also that while I have herein described my invention in association with a preferred embodiment and certain modified forms thereof, nevertheless numerous changes, modifications, and substitutions of equivalents may be entered into without necessarily departing from the spirit and scope of its invention. Consequently, it is not my intention to be limited to the particulars of the apparatus and structure hereinabove described and shown, except as may appear in the following appended claims.

I claim:

1. In a terminal structure for use with a standard female connector adapted to be thrust axially onto a projecting male terminal tab and presenting separated arm portions spaced from a platform portion containing a projecting detent means, the spacing between the said arm portions and said platform portion defining a dimension connectively receptive of the cross-sectional thickness of a standard terminal tab, the combination therewith of a specially formed male terminal tab comprising a metal body having a cross-sectional thickness substantially less than the distance between the arm and platform portions of the connector, a plurality of parallel spaced projections extending outwardly of one face of said body in a direction transverse of the longitudinal

dimension of said body and defining a plurality of relatively large flat current conducting surfaces on said male terminal tab adapted to engage flat current conducting surfaces on said female connector, said projections being opposed by corresponding depressions in the opposite face of said body, the extension of said projections beyond the general plane of said body serving to define an effective tab cross section for connective engagement with the female terminal connector, and separate oppositely facing detent lips formed in the opposite faces of said female body for detachable locking cooperation with the detent projection means of the terminal connector regardless of whether the female connector is assembled to have its detent projection means engage the detent lip on one side of said male terminal or to engage the detent lip on the other side of said male terminal.

2. In a terminal structure for use with a standard female terminal connector adapted to be thrust axially onto a projecting male terminal tab and presenting separated arm portions spaced from a platform portion containing a projecting detent means, the spacing between the said arm portions and said platform portion defining a dimension connectively receptive of the cross-sectional thickness of a standard male terminal tab, the combination therewith of a specially formed male terminal tab comprising a solid metal body section having a cross-sectional thickness substantially less than the distance between the arm and platform portions of the connector, a plurality of parallel spaced lands projecting outwardly of one face of said body section and extending in a direction transverse of the longitudinal dimension of said male terminal tab, said lands being opposed by corresponding parallel grooves in the opposite face of said body section, recessed areas in said one face separating said lands, the projection of said lands beyond the general plane of said body section serving to define with the normal reduced cross-sectional thickness thereof a cross section effective for connective engagement with the female terminal connector, and a pair of detent recess means formed in opposite faces of said male tab body section for detachable locking cooperation with the projecting detent means of the female terminal connector regardless of which tab face is disposed adjacent said projecting detent means, said pair of detent recess means being physically separated by said solid metal body section of the male terminal tab intervening therebetween, one of said detent recess means being formed by a dimple impression struck inwardly of said one face substantially at the intersection of one of said lands and an adjacent recessed area, and a detent locking lip formed by material displaced from said solid metal body section by the formation of said dimple impression and extending into said adjacent recessed area.

3. In a terminal structure for use with a standard female terminal connector of the type adapted to be thrust axially onto a projecting terminal tab, the terminal connector having laterally separated arm portions spaced over a central platform portion thereof which contains a detent projection, the spacing between the arm portions of the connector and the said platform portion thereof defining a dimension which is normally connective by frictional engagement with a standard terminal tab having a comparatively thick cross section, an improved male terminal tab comprising, a solid metal body section made of lightweight metal having a relatively thin cross section and formed integrally with a leaf extension thereof which acts as a leaf spring, said body section having a cross-sectional thickness substantially less than that required by the distance between the arm and platform portions of the female connector, a plurality of parallel spaced lands separated by parallel-spaced grooves formed in one face of said body section, said lands and grooves being opposed by corresponding grooves and lands, respectively, in the opposite face of said body section, said lands and grooves being formed sub-

stantially transversely of the longitudinal dimension of said male terminal tab, the projection of said lands beyond the general plane of said body section serving to define an effective cross-sectional thickness for the terminal tab to afford its frictional connective engagement with the arm and platform portions of the female terminal connector, and two separate detent recess means formed in opposite faces of said body section for locking cooperation with the detent projection of the female terminal connector regardless of which face of the body section is presented to the detent projection, said two detent recess means being physically separated from each other by said solid metal body section of the male terminal tab one of said detent recess means being formed by a dimpled impression struck inwardly of said one face of said body section substantially at the intersection thereon between one of said lands and an adjacent recessed groove, a detent locking wall formed by material displaced from said dimpled impression substantially paralleling said lands and extending at right angles to the plane of said tab means, and a sloping guide surface formed at one end of said tab means to assist the same in entering the spacing between the arms and platform portions of the female connector.

4. A male terminal tab or prong for slidably receiving a conventional female terminal connector which is adapted to be thrust endwise over said male prong, said conventional female connector comprising a platform portion provided with laterally separated arm portions having edges which are spaced from said platform portion to define therebetween a socket of a thickness dimension which is adapted to receive the thickness of a standard male terminal prong with a snug friction fit, said female terminal connector also being provided with a detent locking shoulder projecting from the surface of said platform portion between said laterally separated arm portions, the combination therewith of a specially constructed male terminal prong comprising a metallic body of a thickness substantially less than the thickness dimension of said socket in the female terminal connector, said metallic body comprising a rippled portion formed of a plurality of raised areas and grooves which extend substantially transversely of the longitudinal dimension of said male terminal prong, said raised areas resulting in the rippled portion having an effective sectional thickness which will receive the socket of said female connector with a relatively tight frictional push fit, a first detent lip formed in one side surface of said rippled portion, and a second detent lip formed in the opposite side surface of said rippled portion, said first detent lip being operative to establish detent engagement with the detent locking shoulder of said female connector when said female connector is pushed over said male prong in a first relationship which brings said locking shoulder into cooperative engagement with said first detent lip, said second detent lip being operative to establish detent engagement with the detent locking shoulder on the female connector when said female connector is pushed over said male prong in a second relationship which is inverted with respect to said first relationship.

5. The structural combination of claim 4 wherein the raised areas of said male terminal prong have flat contacting surfaces extending transversely of the male prong from side to side thereof so as to provide extensive flat areas of electrical conducting surface for pressure engagement against either said platform portion or against said laterally separating arm portions, depending upon which of the above mounting relationships said female connector has over said male terminal prong.

6. The structural combination of claim 4 wherein said first and second detent lips are physically separated by the solid body section of said male terminal prong intervening therebetween, and wherein the raised areas on the rippled portion of said male prong define a first

series of transversely extending flat contacting areas on one side of said male prong extending from edge to edge thereof, and the opposite side of said male prong defines a second series of transversely extending flat contacting areas also extending from edge to edge of the prong, said first and second series of flat contacting areas adapted to engage alternatively either the platform portion or the laterally separated arm portions of said female connector, depending upon which of the above mounting relationships said female connector has in its assembly over said male terminal prong.

7. A male terminal tab or prong for slidably receiving a female terminal connector which is adapted to be thrust endwise over said male prong, said female connector comprising a platform portion provided with laterally separated arm portions which are spaced from said platform portion to define therebetween a socket of a thickness dimension which is adapted to receive with a snug friction fit the thickness of a standard male terminal prong, said female terminal connector also being provided with a detent locking shoulder projecting from said platform portion between said laterally separated arm portions, the combination therewith of a specially formed male terminal prong of rectangular tongue-like formation having two parallel side edges and an end edge, said tongue-like formation being of a thickness substantially less than the thickness dimension of said socket in the female terminal connector, said tongue-like formation being provided with a plurality of raised areas and grooves extending from one of said parallel side edges to the other parallel side edge to produce a rippled formation having an effective sectional thickness which will receive the socket of said female connector with a relatively tight frictional push fit, a first detent lip formed in one side surface of said tongue-like formation, and a second detent lip formed in the opposite side surface of said tongue-like formation, said first detent lip being operative to establish detent engagement with the detent locking shoulder of said female connector when said female connector is pushed over said male prong in a first relationship which brings said locking shoulder into cooperative engagement with said first detent lip, said second detent lip being operative to establish detent engagement with the detent locking shoulder on the female connector when said female connector is pushed over said male prong in a second relationship which is inverted with respect to said first relationship.

8. The structural combination of claim 7 wherein said first and second detent lips are physically separated by the solid metal body section of said tongue-like formation intervening therebetween.

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