

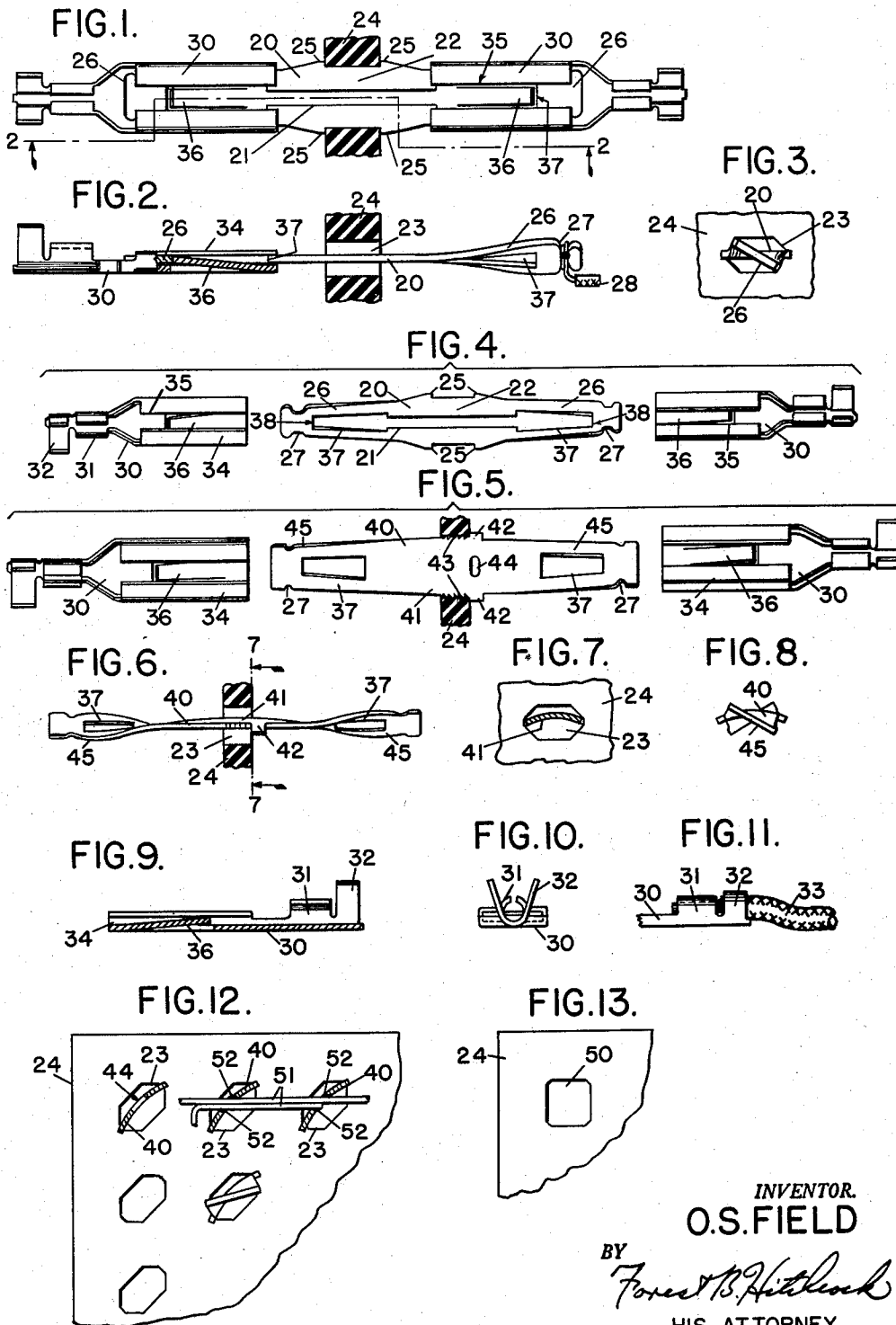
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TERMINAL WIRE CONNECTORS AND MOUNTING MEANS THEREFOR

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TERMINAL WIRE CONNECTORS AND MOUNTING MEANS THEREFOR

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This invention relates to electrical terminals and connectors for use on terminal boards, casing panels, relay housings and the like, and it more particularly pertains to quickly detachable connectors wherein electrical conductor connections may be made up or separated in a quick, efficient and reliable manner.

In various electrical control systems, such as railway signaling systems for example, a centrally located control machine is used to condition circuits for the operation of a number of electrical devices located throughout a track layout. This necessitates a vast network of wires carrying incoming and outgoing circuits which must converge and be interconnected with the control machine, usually by means of a terminal board located in the vicinity of the control machine. In most cases, the size of the terminal board is limited and the terminals and connectors are closely spaced. However, for testing purposes and necessary circuit changes and repairs, it is desirable that these terminals have easy accessibility thereto and be readily adaptable to connecting and disconnecting operations while at the same time provide reliable electrical conducting connections when connected together.

The present invention contemplates such a terminal mounting and quickly detachable connector means which is accessible from both sides of the terminal board and is universal in use to the extent that it may be easily changed out, removed or added to a board, may have wires either soldered or plug coupled thereto, and may be easily interconnected with other terminals where it is necessary to connect certain circuits together.

Generally speaking, the terminal element of the invention comprises a specially formed piece of flat resilient electrical conducting material which may be forced and sprung into position in a receptacle hole located in an insulation board wherein it is securely mounted under spring tension and held in position by means provided to prevent longitudinal movement. The ends of this panel terminal are provided with grooves to facilitate making wiring connections thereto. These terminal ends are also tapered and are provided with spiral twist and a longitudinal slot to coact with a sleeve connector.

The terminal element herein provided is somewhat similar to the usual solder-type terminals except that it is modified to receive quick detachable plug coupling means. This plug coupling means is a sleeve connector which is also formed from flat resilient electrical conducting material stock. This material is formed to make a generally rectangular sleeve with one side open and the other side provided with a tongue having its free end biased inward towards the center of the sleeve. The usual wire connecting facilities are also provided, at one end of the sleeve connector.

The plug connection between the terminal and the sleeve connector is completed by sliding the sleeve connector over the twisted end portion of the terminal until the tongue portion of the sleeve connector is received by the longitudinal slot in the terminal. The twisted end

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portion of the terminal is now under tension within the confines of the sleeve portion of the plug connector, thus maintaining a high degree of contact pressure between the two elements and providing a good electrical conducting connection. The sleeve connector wire terminal may be easily removed from the panel terminal and may be connected and disconnected as desired without destroying the efficiency of the connecting elements. Also, if necessary, the panel terminal may be removed from the insulation board and be replaced or used elsewhere.

One object of the invention is the provision of a terminal specially formed of resilient material which may be forced and sprung into or out of a hole in the terminal board and still be rigidly mounted when in position.

Another object of the invention is the provision of a panel terminal which may have wire connections soldered thereto but so constructed that a quick detachable sleeve connector may be coupled thereto.

Another object of the invention is the provision of spiral twists formed in each end of the terminal element which provides an electrical connection with the sleeve connector with a high degree of contact pressure between the two elements.

Other objects, purposes and characteristic features of the invention will be in part obvious from the accompanying drawing and in part pointed out as the description of the invention progresses. Reference will be made to the accompanying drawing which shows the invention in detail, like parts being referred to by like reference characters and in which:

Fig. 1 is a front assembly elevational view of one form of the invention showing the terminal mounted in the terminal board and sleeve connector terminals plug coupled to each end thereof;

Fig. 2 is a side elevational view of the Fig. 1 form of the invention shown partly in section as indicated by the line 2—2 of Fig. 1 with one sleeve connector removed to show the normal deformation in the panel terminal and the means for attaching a wire thereto;

Fig. 3 is an end view of the terminal of Fig. 1 shown to indicate the degree of deformation in the ends of the terminal;

Fig. 4 is a front composite view showing the elements of the invention as in Fig. 1 in their relative positions prior to assembly;

Fig. 5 is a front composite view of the elements of the invention showing a modified form of terminal mounted in the terminal board, the parts being shown in their relative positions prior to assembly;

Fig. 6 is a side elevational view of the modified terminal of Fig. 5 showing the terminal mounted in the terminal board and the normal deformations prior to plug coupling;

Fig. 7 is a sectional view of the modified terminal of Fig. 5 taken on the line 7—7 of Fig. 6 showing the portion which passes through the terminal board opening;

Fig. 8 is an end view of the modified terminal of Fig. 5 showing the degree of deformation in the plug coupler end portions;

Figs. 9, 10 and 11 are views of the sleeve connector unit of the invention to show the formation thereof and the means provided to facilitate making a detachable connection with the terminal;

Fig. 12 is a plan view of a portion of one side of the terminal board showing the preferred form and location of the punched holes therein for mounting the terminals. Also shown are some terminals in position and the means for electrically connecting one or more together; and

Fig. 13 is a plan view of a portion of one side of the

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terminal board showing a modified form of punched hole therein which provides two separate terminal mounting positions.

Referring now more particularly to Figs. 1 to 4 inclusive of the drawings, the type of terminal shown is preferably punched out of flat sheet stock of spring Phosphor bronze material although it is obvious that other types of resilient metal having proper qualifications and electrical conducting characteristics could be used. In general, the terminal 20 is rectangular in shape and is formed with a centrally located longitudinal slot 21 extending through most of the entire length of the terminal. The width of the terminal 20 at its center portion 22 is slightly greater than the length of its receptacle hole 23 in the terminal board 24 (see Fig. 12). Shoulders 25 are provided at the center portion 22 to form grooves, the length of which are comparable to the thickness of the terminal board 24.

The end portions 26 of the terminal 20, which comprise the areas from the shoulders 25 to the extreme ends, are tapered so that the width of the extreme ends of these end portions 26 is less than the length of the receptacle hole 23 located in the terminal board 24. Near the extreme ends of these end portions 26, grooves 27 are provided to facilitate making wiring connections thereto. These end portions 26 are also formed with a spiral twist therein of approximately 30°. As shown on the drawing, the twist in one end is preferably in an opposite direction from a common center line to the twist in the other end. However, it should be understood that both ends could be twisted in the same direction if desired, the direction of twist having no effect on its useful purpose.

The terminal 20 may be inserted into its receptacle hole 23 from either end and from either side of the terminal board 24. Assuming that it is desired to mount the terminal 20 from the left-hand side of the terminal board 24 as viewed in Figs. 1 and 2, the right-hand end portion 26 of the terminal 20 is inserted into the receptacle hole 23 and passed therethrough until the tapered sides of the right-hand shoulders 25 bear against the edges of the receptacle hole 23, this because the normal width of the terminal 20 at this mid-section 22 is greater than the length of the receptacle hole 23. Further right-hand movement of the terminal 20 into the receptacle hole 23 will require force which will cause the two sides of the slotted resilient terminal 20 to compress, thus reducing the overall width and allowing the two right-hand shoulders 25 to enter the receptacle hole 23. As this movement progresses, the right-hand shoulders 25 will move completely through the hole 23, whereupon the resilient nature of the metal terminal 20 will cause the two sides to spring outward and expand the width of the terminal 20. As shown in Fig. 1, the center portion 22 of the terminal which is normally wider than the opening limits of the receptacle hole 23, will now be spring biased against the sides of the receptacle hole 23 and the two shoulders 25 on each side of the terminal board 24 prevent longitudinal movement in either direction of the terminal 20. Thus, the terminal 20 is securely held in position in the terminal board 24 and wiring connections may be made as desired.

As previously mentioned, the end portions 26 of the terminals 20 are formed with tapered sides, have a slot 21 and grooves 27 therein and are deformed by twisting at an approximate 30° angle for reasons about to be explained. Where permanent external wire connections are desired, the wire such as 28 is wrapped around the grooves 27 and soldered in place as shown in Fig. 2. However, in most instances, plug connections to the terminal 20 are desirable and the special formation of these terminal end sections 26 is for the purpose of accommodating a standard type of sleeve connector such as shown in Figs. 9, 10, and 11 with special means added to form a connector which mechanically interlocks with

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the terminal 20 when in position, but is quickly detachable when removal is desired.

These sleeve connectors or wire terminals 30 are formed from a resilient electrical conducting metal such as Phosphor bronze, brass or the like. The wire connecting end of each wire terminal or sleeve connector 30 is provided with the usual clip 31 to facilitate fastening and soldering the metallic end of the wire 33, also a clip 32 to clamp the insulation part of the wire 33. The plug connector end of each terminal 30 is in the form of a rectangular shaped sleeve 34, the top side of which is split to form a slot 35. The bottom side of the sleeve end 34 of terminal 30 is partially sheared or punched out to form a tongue 36 having its free end bent inward to assume a normal position within the hollow portion of the sleeve end 34. The longitudinal slot 21 in the terminal 20 previously mentioned has enlarged end portions 37 to accommodate the tongue 36 of the wire terminal or sleeve connector 30 when in their plug connected positions.

Referring again to Figs. 1 to 4 inclusive, the plug connection is made merely by sliding the sleeve connector 30 over the twisted end portion 26 of the terminal 20, the tapered sides on the end portion 26 permitting easy entrance of the terminal 20 into the sleeve portion of wire terminal 30. The rectangular shaped sleeve end 34 of the wire terminal or sleeve connector 30 provides a rigid structure so that when the sleeve connector 30 is forced over the twisted end portion 26 of the terminal 20, the resiliency of the metal permits the spiral twist to flatten out within the confines of the sleeve 34. When a sleeve connector 30 reaches its full contacting position, the free end of the resilient tongue 36 springs up into position in the slot 37. The sleeve connector 30 is held in place on the terminal 20 by reason of the fact that the extreme end of the tongue 36 would butt against the end wall 38 of the slot 37 if removal were attempted. Ample contact pressure between the terminal 20 and the sleeve connector or wire terminal 30 is provided because the twisted end portion 26 of the terminal 20 is under tension within the confines of the sleeve 34, the various edges of the terminal end portion 26 exerting a constant pressure against the inner surfaces of the sleeve 34 at all contact points.

The sleeve connector or wire terminal 30 may be removed from the terminal 20 by use of a pointed tool, such as a screw driver or the like, being inserted in the slot 35 of the sleeve connector or wire terminal 30, the point of the tool bearing against the free end of the tongue 36. Movement of the tool against the spring tension of the tongue 36 will force the edge of the tongue 36 below the edge 38 of the slot 37, whereupon the sleeve connector or wire terminal 30 may be pulled off of the terminal 20. If necessary, due to damage or a change of location, the terminal 20 may also be removed from the terminal board 24. This is accomplished by squeezing the sides of the terminal 20 together near its mid section 22 with a suitable clamping tool, this being possible because of the resiliency of the metal and the presence of the slot 21. When the terminal 20 is compressed so that the width across the shoulder portions 25 is less than the length of the receiving hole opening 23 in the terminal board 24, the terminal 20 may be removed through the opening.

Referring now to Figs. 5 to 8 inclusive, a modified form of the invention has been shown wherein the structure and mounting means of the terminal is different but the same general structure for the plug coupler and wire attaching means has been retained. In this form of the invention, the terminal 40 is also generally rectangular in shape and is punched from flat sheet stock of a resilient electrical conducting material. The central portion 41 is provided with shoulders 42 and sawtooth serrations 43 on each side and a slotted hole 44 therethrough. The two end portions 45 are tapered so that the width near the shoulders 42 is greater than the width

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at their extreme ends. Each end portion 45 is provided with a rectangular slot 37 and grooves 27. These end portions 45 are also twisted at an angle approximating 30° so that they are adapted to receive a sleeve connector terminal 30 in a manner similar to that already described in connection with the terminal 20. The terminal board 24 and the receptacle hole 23 may also be the same as previously described.

Referring again to the central portion 41 of the terminal 40, and particularly to Figs. 6 and 7 of the drawings, it will be noted that a cross section at this point where the sawtooth serrations 43 are located shows the metal to be slightly dishd to form an arcuate shape. Also, the width of the terminal 40 as measured across the outside edges of the sawtooth serrations 43 is greater than the length of the receptacle hole 23. When assembling the terminal 40 in the receptacle hole 23, the terminal will pass freely through the hole until it reaches the point where the serrations 43 are located. The terminal must now be forced into the hole until the shoulders 42 bear against the terminal board 24. This is possible because the forcing action will cause the resilient metal to dish still more at this central portion 41 and thus reduce the overall width. With the terminal 40 now in position in the receptacle hole 23, the dishd central portion is under tension and it will be exerting pressure against the inner surfaces of the receptacle hole 23 with the result that the sawtooth serrations 43 will bite into the softer insulating material of which the terminal board 24 is made.

The above described mounting means securely holds the terminal 40 in the terminal board 24 and normal pulling and pushing forces exerted during the application and removal of the sleeve connector terminals 30 will not disturb the anchored position of the terminal 40. However, if it becomes necessary to remove the terminal 40 from the terminal board 24 due to damage or for other reasons, the use of a suitable clamping tool to create a pressure on the sides of the terminal 40 would cause the center portion 41 to dish still more, thus reducing its width and allowing removal, similar to the manner already explained in connection with the removal of the other form of terminal 20.

The shape and location of the receiving holes 23 in the terminal board 24 is so designed to allow free passage of the twisted terminals 20 and 40 during the mounting process, while at the same time it permits close spacing of the terminals and leaves a maximum of separation and insulation material between locations, thus tending to prevent electric current creepage across terminals (see Fig. 12). It should be understood that other types of receiving holes 23 could be provided if space permitted. As an example, in Fig. 13 there is shown a square receiving hole 50 having flat corners. This type of receiving hole provides two separate mounting surfaces for the terminals which permits the location of the terminal to be changed in the event that one mounting surface becomes damaged due to the insulation becoming chipped away or worn due to excessive terminal changes.

In Fig. 12 there has also been shown a means for electrically connecting together two or more terminals 40 by means of wire jumpers 51. As previously mentioned and shown in Fig. 5, the terminal 40 is provided with a slotted hole 44 located flush with one side of the terminal board 24 when assembled. Wire jumpers 51 may be passed through these holes 44 and any selected number of terminals 40 may be electrically connected together as desired, the wire jumpers 51 being soldered to the terminals 40, as shown at 52.

From the foregoing description and with reference to the drawings, it can be seen that a terminal, its mounting means and a sleeve connector means have been provided which gives good reliable service and yet is simple and economical to manufacture as the tolerances are not too critical. The resiliency of the metal allows for easy

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assembly and provides a spring bias effect to hold the terminal in position in the terminal board. It also provides a spring bias effect to produce a good electrical contact between the twisted portion of the terminal and the sleeve connector terminal.

Having shown and described two particular forms of the invention, it should be understood that various adaptations and deviations in the structure and the material used could be made without departing from the spirit of the invention within the scope of the appending claims.

What I claim is:

1. A terminal and wire connector for a terminal board comprising, a terminal of resilient flat conducting material adapted to be secured near its center within a terminal board with the ends of the terminal protruding normal to the respective surfaces of the board, said terminal having both of the extending portions twisted axially, and a relatively flat sleeve connector adapted at one end for the connection of a wire and having a rectangular opening at the other end, said opening being large enough to be receivable over either end of said terminal but being small enough to at least partially untwist the axial twist formed in said terminal, whereby the axial twist formed in said terminal insures good electrical contact between said sleeve connector and said terminal by a relatively high pressure connection.

2. A terminal and wire connector according to claim 1 wherein said terminal has oppositely disposed resilient detents adapted to bear against the respective surfaces of a terminal board to lock the terminal within a terminal board opening.

3. A terminal and wire connector according to claim 2 wherein the detents are formed in opposite longitudinal edges near the central portion of the terminal and they are made resilient by a longitudinal slot extending through the central portion of the terminal.

4. A terminal and wire connector for assembly within an opening in a terminal board comprising, a terminal of resilient flat conducting material, said terminal having a central portion receivable in the opening of the terminal board the breadth of the central portion being slightly greater than the breadth of the opening in the terminal board whereby the outer edges of the central portion of the terminal bear tightly against the sides of the opening in accordance with the resiliency of the conducting material of which the terminal is constructed, and said terminal having its ends twisted axially to form a partial spiral, and a wire connector sleeve adapted for the connection of a wire at one end and having a rectangular opening at the other end, said opening being large enough to receive either end of said terminal but being small enough to at least partially untwist said spiral within said terminal to a limited extent.

5. A terminal and wire connector comprising, a terminal of resilient flat electrical conducting material, a terminal board having a receptacle opening therein, said terminal having a central portion formed to be received by and held within said receptacle opening, the resiliency of said terminal permitting it to be forced and sprung into said receptacle opening wherein it is mounted under bias and held against longitudinal movement, said terminal having end portions each provided with a partial spiral twist and a slot, a sleeve connector of resilient electrical conducting material having a tongue portion biased inwardly and formed to be received by said slot within said terminal, said sleeve connector being longitudinally receivable on said terminal end portion by slightly untwisting the spiral twist therein, whereby said spiral twist provides a biased connection between said terminal and said sleeve connector, and said tongue portion locks within said slot.

6. A terminal wire connector comprising, a terminal of resilient flat electrical conducting material, a terminal

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board having a receptacle opening therein, said terminal having a central portion formed with saw tooth serrations and a shoulder on each side edge thereof, said central portion being dished arcuate shape so that its width across the saw tooth serration portion is slightly greater than the length of said receptacle opening, the presence of said arcuate shaped portion and the resiliency of said terminal permitting it to be forced and sprung into said receptacle opening wherein it is mounted under bias and held against longitudinal movement in one direction by said saw tooth serrations and in the other direction by said shoulders, said terminal having tapered end portions each provided with a spiral twist and a longitudinal slot, a connector of resilient electrical conducting material of substantially rectangular sleeve formation at one end and having wire receiving clips at its other end, said sleeve portion having a through slot on one side and a biased inward tongue portion on its opposite side, said connector being receivable on either of said terminal end portions and acting to partially untwist the spiral twist of that end of said terminal, whereby said spiral twist of said terminal is confined under

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tension within said rectangular sleeve portion and said tongue portion of said connector interlocks with said longitudinal slot of said terminal.

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