

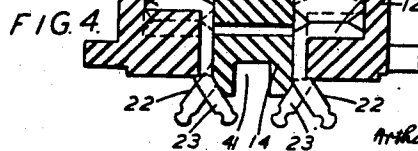
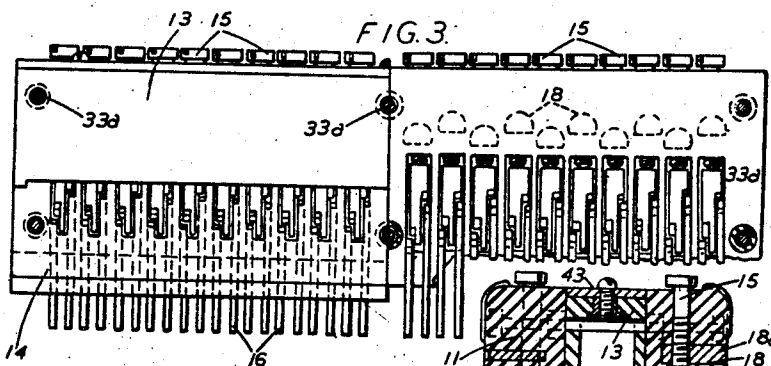
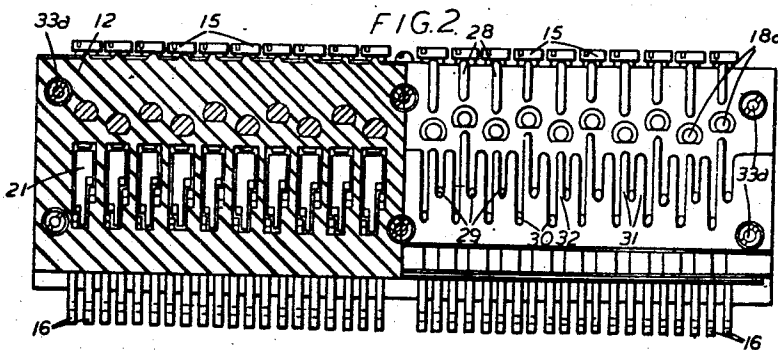
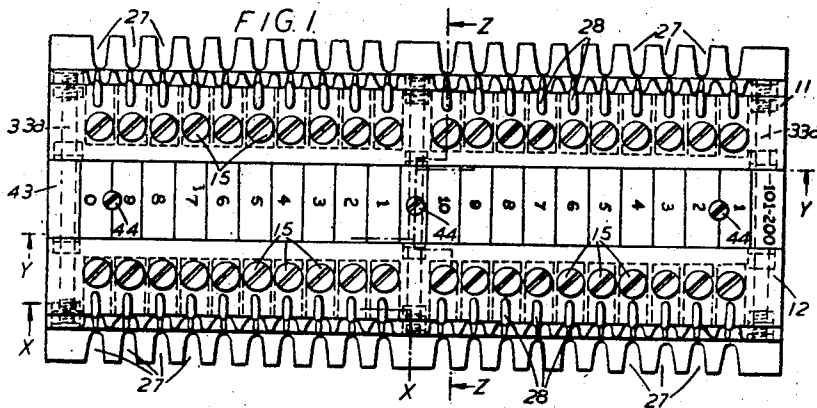
Sept. 28, 1948.

A. J. HUMPHRIES
CROSS CONNECTION STRIP AS USED IN
TELEPHONE AND LIKE SYSTEMS

2,450,001

Filed May 9, 1946

3 Sheets-Sheet 1



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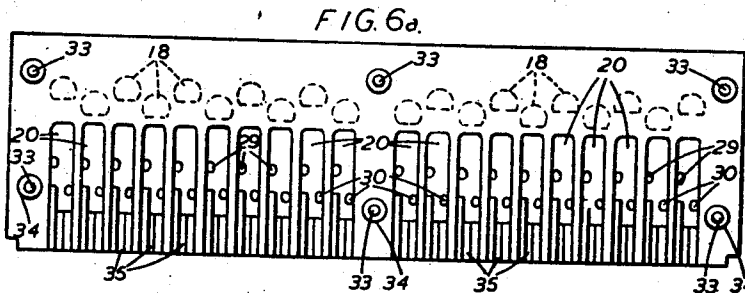
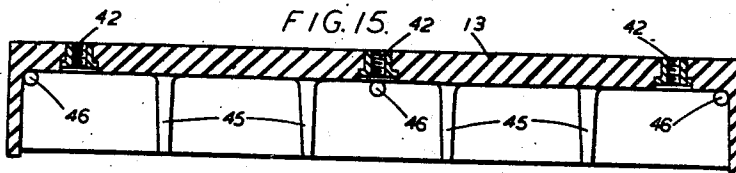
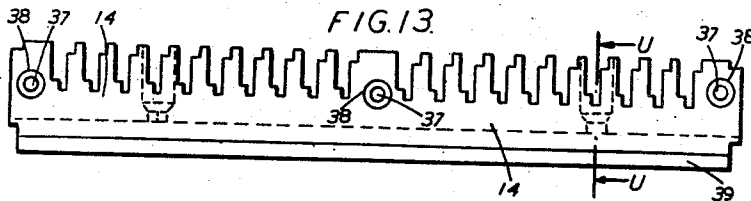
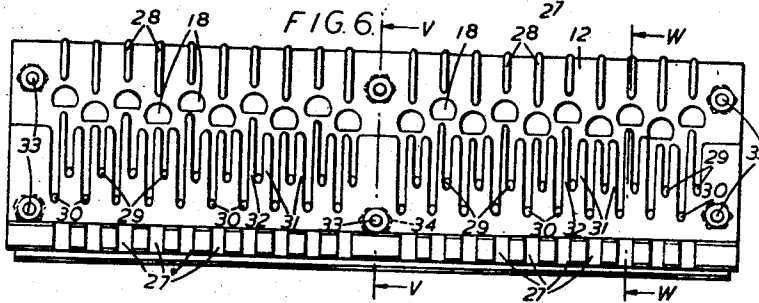
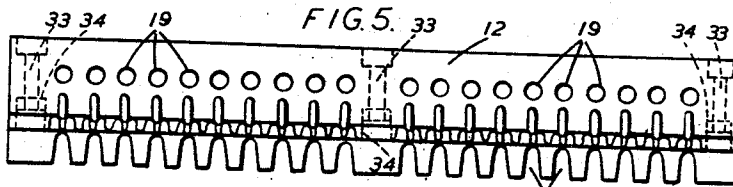
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3 Sheets-Sheet 2



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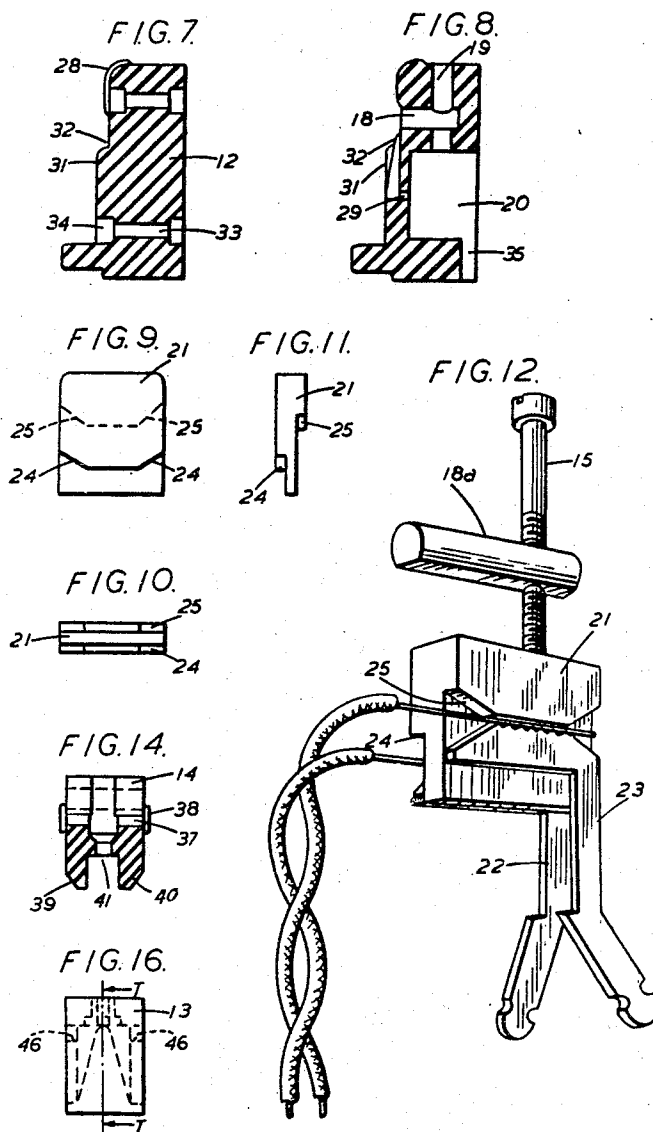
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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CROSS CONNECTION STRIP AS USED IN
TELEPHONE AND LIKE SYSTEMS

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3 Claims. (Cl. 173—324)

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The present invention concerns improvements in or relating to connection strips as used in telephone and like systems and more particularly although not exclusively concerns the construction of a cross connection strip which is used in a distribution cabinet or street pillar for connecting conductors in a cable extending from an exchange to other conductors in a cable extending eventually to subscriber's premises. It will be understood that connection strips can be used at two or more points between the exchange and the subscribers' cable and in other situations if required or desired.

Distribution cabinets have to be located in convenient positions with regard to the locality they serve and must be readily accessible for the connection of new subscribers and the disconnection of subscribers whose service is terminated. Consequently consideration has to be given to the following features. Firstly the contact members must be satisfactorily insulated even under adverse conditions as regards ingress of moisture and dust and at the same time the contacts must be reliable in service and free from any tendency to disconnection due to vibration or other external disturbances. Secondly the jumper field should be neat and orderly and maintained in this manner throughout the full period during which the installation is in use. Thirdly the cabinet in which the cross connected strips are mounted must be of such appearance and dimensions as to be suitable for the position in which they require to be located so as to facilitate the granting of the necessary way leaves and it is an object of the present invention to provide a cross connecting strip capable of meeting the above conditions in a most satisfactory way.

According to one feature of the invention the contacting surfaces are so located within the insulation of the connecting strip that ingress of dust or moisture therein is substantially eliminated or at least reduced to a minimum in the most adverse conditions.

According to another feature of the invention use is made of straight bare bridging wires, the connection strip being arranged to permit easy and positive insertion of bridging wires as far as possible. The cross connecting strip consists of two rows of terminals to one of which rows the conductors of the exchange lines are connected and to the other of which rows the outgoing connections to the individual subscribers' lines are connected, two or more terminals being provided for each line. It is found in practice that the majority of the connections can be made directly

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across as between corresponding terminals in the two rows and that only a comparatively small number of the connections need to be made by means of jumper wires, that is to say by connections between terminals which are not immediately opposite to each other.

According to a third feature of the invention the connection to two or more wires is effected through the medium of a single screw, termed the contact screw, the necessary pressure being transmitted to the contact surfaces through a pressure block which consists of a shaped insulated and guided block designed to press the individual wires against their respective contact members.

The invention will be better understood by reference to the accompanying drawings which illustrate by way of example a cross connection strip for pairs of wires in accordance with the invention.

In the drawings:

Fig. 1 is a plan view of a cross connection strip.

Fig. 2 is a part elevation and part sectional elevation of the strip on line XX of Fig. 1.

Fig. 3 is a sectional elevation on the staggered line YY of Fig. 1.

Fig. 4 is a sectional side view on the staggered line ZZ of Fig. 1.

Fig. 5 is a plan view of a terminal block.

Figs. 6 and 6a are front and rear views respectively of a terminal block.

Fig. 7 is a section on the line VV of Fig. 6.

Fig. 8 is a section on the staggered line WW of Fig. 6.

Fig. 9 is a side view, Fig. 10 a plan from below and Fig. 11 a front view of the pressure block.

Fig. 12 is a perspective view of the components of a contact-making element for a single pair of wires.

Figs. 13 and 14 show respectively front view and cross section on line UU (Fig. 13) of guide block.

Figs. 15 and 16 show respectively section on line TT (Fig. 16) and end view of label block.

The connection strip conveniently consists of two similar rectangular blocks 11 (left-hand) and 12 (right-hand) of insulating material. The rectangular blocks, which will be termed terminal blocks, are similar in construction and it will be sufficient to describe the construction of one only. These terminal blocks are mounted opposite each other and are suitably spaced apart by insulating blocks 13 and 14 so that corresponding terminals in each strip lie immediately opposite each other. It will be appreciated that one of the dimen-

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sions of the terminal block, which will be termed the length, will depend upon the number of terminals to be accommodated. This number is governed by manufacturing considerations and may be varied as convenient. In the drawings 20 pairs are provided for. The individual terminals of a pair are conveniently spaced about one-eighth of an inch apart, while the individual pairs have their centres about a quarter of an inch apart.

The other two dimensions will be referred to as the breadth, which is the dimension transverse to the length of the terminal block, and is conveniently about $\frac{1}{2}$ " to $\frac{3}{4}$ " while the third dimension extending from the contact screws 15 to where the contact tags 16 emerge will be referred to as the depth and is approximately $1\frac{1}{2}$ ". It will be understood that these dimensions can be readily varied without departing from the spirit of the invention and that their choice is dependent upon a number of considerations, particularly the desirability of having the containing distributing box as small as possible consistent with adequate spacing of the terminals for handling insulation and like considerations.

Each terminal block as will be best seen from Figs. 5 to 8, has internal portions cut away which are similar for each pair of terminals, that is to say vertical sections transverse to the length could be cut away which are the same for each pair of terminals. These cutaway portions consist of a hole 18 shaped so as to have a part circular section to take a brass insert 18a of similar cross section, and having a threaded hole crossing the axis with which hole a contact screw 15 engages. The hole and the brass insert have a length of about three-quarters of the terminal block. A circular hole 19 is provided for the contact screw itself and a recess 20 is provided for the pressure block 21 and contact plates 22 and 23. The recess does not extend right through the block. The pressure block 21 is conveniently formed of insulating material, either by moulding or otherwise and is illustrated in Figs. 9, 10 and 11. It will be noted that it consists of a block cut away to different heights on opposite sides, the under sides of the cuts being chamfered at their ends as at 24 and 25. The width of the pressure block 21 is such as to fit neatly with little play in the recess 20 while the breadth of the pressure block is about equal to the breadth of the recess 20. The contact plates 22 and 23 are complementary and their shape will be best seen in Fig. 4. They each have a tag portion to which connecting wires may be soldered, a vertical shank and a horizontal extending contact-making element, and are conveniently formed by a simple blanking tool. The contact-making element is chamfered to facilitate insertion of a conductor.

The recess 20 is provided with a shelf at one side on which the contact-making element of plate 23 may rest while the contact-making element of plate 22 rests on the base of recess 20 as clearly shown at the left-hand side of Fig. 2.

In operation wires inserted between the serrated surfaces of the contact members 22 and 23 and the underside of the cut-away portions on each side of the pressure block 21 are secured in position by a single screw 15 which on being turned presses at its end on the pressure block 21 due to its engagement with the threaded hole of insert 18a causing the wires to be gripped tightly between the serrated surfaces of the contact plates 22 and 23 and the upper parts of the cut-away portions on each side of pressure block 21.

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To allow for manufacturing tolerances in the wires and in the components of the strip, the contact plates 22 and 23 are serrated on their upper faces. The serrations which by penetration of the wire or by themselves becoming deformed under pressure permits these tolerances to be taken up and subsequently equal pressure maintained.

The perspective view illustrated in Fig. 12 shows clearly the component parts which go to make up a contact-making element for a single pair of wires and their general arrangement from which the method of operation described above can be easily followed.

In the complete cross-connecting strip as illustrated in Figs. 1, 2, 3 and 4, there are two identical terminal blocks 11 and 12 conveniently formed by moulding a phenol condensation product, the construction of these blocks being fully disclosed in Figs. 5, 6, 6a, 7 and 8, a guide block 14 similarly formed, the construction of which is illustrated in Figs. 13 and 14, and a label block 13 which is also similarly formed and the construction of which is illustrated in Figs. 15 and 16. The general arrangement of these blocks is best illustrated in Fig. 4 which also shows long contact plates 23 and short contact plates 22 in position.

The blocks are secured together by clamping rods 33a which are shorter at the top than at the bottom. The clamping rods are threaded at their ends and pass through holes in the terminal blocks and an intermediate block which may be either the label block or the guide block according as to whether the upper or lower clamping rods are referred to.

Nuts engaging with the threaded ends secure the blocks together.

The construction of the blocks will now be described in greater detail. Referring first of all to the terminal block illustrated in Figs. 5, 6, 6a, 7 or 8, it will be noted that along the top there are two sets of ten holes 19 for the contact screws 15, along the base but visible in the plan are two sets of ten grooves 27 which serve as guides for the interconnecting pairs of wires.

Embossments 28 which extend round the outer corners of the top of the terminal block and down one side serve as guides to define the position of a cable pair and are alternatively long and short as will be best seen when viewed in Fig. 6.

Looking at Fig. 6 it will be noted that there are two sets of ten pairs of holes 29, 30 for the admission of the ends of the wires to be connected, the holes are oval in shape to permit, when necessary, for two wires to be inserted together. The holes 29 and 30 are displaced diagonally to increase the clearance between wires when inserted.

Dividing the holes are embossed ridges 31 and 32. Embossed ridges 31 which are substantially rectangular with a curved corner serve to divide the various pairs of connecting wires or terminals while embossed ridges 32 which are actually a continuation of 28 divide the individual pairs of connecting wires or terminals. These embossed ridges extend from a protruding part of the terminal block and where they join such part they provide semi-circular bases round the holes 29 and 30 whereby the connecting wires may be readily guided for entry therein.

Ten pairs of holes 18 are provided for the brass inserts 18a which are staggered in height to permit of their horizontal separation being increased, the embossments 28 and 32 varying in length in accordance with the position in heights of the holes 18 with which they are associated.

Six holes 33 with hexagonal recesses in the left-

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hand terminal block 11 and circular recesses in the right-hand terminal block 12 are provided for the clamping rods 33a with their associated nuts.

By referring to Fig. 8 and Fig. 6a it will be noted that recesses 20 of rectangular section are provided, extending to the inside of the wall containing the holes 29 and 30, which recesses serve to accommodate the pressure blocks 21 and contact plates 22 and 23. Slots 35 in the inside of the terminal block serve to accommodate the vertical shanks of such contact plates so that their outer edge lies flush with the inner side of the block. It will be noted that the successive pairs of contact plates are effectively insulated from each other by the side walls of the recesses while the contact plates of a pair are insulated within the recesses by the central portion of the pressure block.

The guide block 14 which is illustrated in Figs. 13 and 14 is provided with two pairs of ten grooves extending across the block, each groove having three different depths the lowest depth being in the middle while the side depths corresponding approximately to the heights of the holes 29 and 30 respectively serve as guides for straight bridging wires passing through said holes. Three holes 37 corresponding with the lower holes 33 are provided each having a boss 38 at each end having a diameter such as to be a neat fit in the circular recesses 34.

On the lower part of the guide block 14 are two projecting ridges 39 and 40 forming between them a longitudinal groove 41 extending the full length of the block and serving as a channel for a mounting bar to which several strips may be fixed preparatory to soldering wires of the cable to the tags of contact members.

The label block 13 illustrated in Figs. 15 and 16 is a substantially hollow rectangular block having moulded in its upper part three metal inserts 42, having threaded holes to enable a label plate 43 (see Fig. 1) of celastoid or like material to be secured in position by screws 44. It will be noted that the hollow in the block is open on the underside and has ribs 45 to strengthen the somewhat thin side walls of the block.

Holes 46 are provided for aligning with the upper holes 33 in the terminal blocks. It will also be noted that the end pieces of the label block extend beyond the plane of the base. This enables the label block to seat in the cut-away portions at the upper corners of the guide block.

The manner of assembly of the cross connecting strip in the form illustrated in Figs. 1 to 4 will be readily appreciated from the foregoing description.

The method of use will now be described.

From a cable for instance extending from an exchange and a cable for instance extending eventually to subscribers' premises and each having 20 pairs of conductors, the pairs of conductors of one cable are connected to corresponding tags of pairs of contact plates on one side of the cross connecting strip and the pair of conductors of the other cable are connected to corresponding tags of pairs of contact plates on the other side of the cross connecting strip.

To connect one pair of conductors of one cable to a pair of conductors of the other cable, two different methods of connection are possible with the cross connecting strip according to the invention.

One method of connection concerns pairs of contact plates directly opposite each other in the cross connecting strip. For this kind of con-

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nection all that is necessary are bare wires preferably with insulating heads of a suitable plastic or other material. Alternatively two such bare wires may be joined by a common insulating head to form a pair. The wires are inserted through the holes 29 and 30 of one of the pairs of contact plates to be connected up after the contact screws 15 of the two pairs of contact plates to be connected together have been unscrewed. As the wires are pushed home due to the chamfered surfaces on the contact plates and the pressure block the pressure block rises permitting the wires to pass through. The ledges on the guide block ensure the wires passing straight towards the chamfered surfaces on the second pair of contact plates and the pressure block where the pressure block is raised to permit the ends of the wires entering between the serrated surfaces of the contact plates, and the horizontal surfaces between the chamfered surfaces of the pressure block. All that remains is to screw the contact screws home when good electrical connection is made between the wires and the contact plates and in consequence between the two pairs of wires it is desired to connect together.

The other method of connection concerns pairs of contact plates which are not directly opposite to each other in the cross connecting strip.

It is estimated in practice that the majority of connections may be made between contact plates directly opposite each other and that therefore only a limited number of connections will require to be made in the manner to be described.

Instead of bare wires it will be desirable if not essential to employ insulated-covered wires conveniently in twisted pairs with wires sufficiently stiff to pass readily through the holes 29 and 30 and to raise the pressure block substantially as previously described.

To connect two pairs of contact plates not directly opposite the bared ends of a pair of insulated wires as described above are inserted through the holes 29 and 30 sufficiently to raise the pressure block and pass on to the serrated surfaces of the contact plates, the contact screw 15 associated therewith is then screwed home to secure the ends and establish a good electrical connection with the contact plates. The pair of wires are then bent over and passed through the groove 27 immediately below the pair of contact plates. They are then crossed over to pass through the groove 27 immediately below the pair of contact plates with which contact is to be established and the wires cut and ends cleared of insulation sufficiently to permit the cleared ends passing through the holes 29 and 30 of the latter pair of contact plates and on to the knurled surfaces thereof. The contact screw 15 associated with this pair of contact plates is then screwed home and a secure electrical connection between the two pairs of conductors made.

It will be appreciated that by this construction all parts where contact is made are enclosed in insulating materials so that deleterious effects of the ingress of moisture and dust are minimised. If a jumper connection is to be made the jumpers may conveniently be insulated with a polyvinyl-chloride covering. This provides a very neat construction and furthermore the entrances to the connecting contacts being only just sufficient for the wires to pass through protects the contact surfaces from the ingress of moisture and dust.

It will be appreciated that the invention is not strictly limited to the construction described. For instance, the mechanical arrangement of op-

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erating the pressure block and its shape may be varied, i. e. a milled headed securing screw may be employed or instead of the metal piece being above the pressure block it may be arranged below it, the screw then passing through the pressure block may be arranged to lift it so that the contacts are accessible from the top. The shape of the contact plates may also be varied. The object of providing different sizes of contact plates for each pair of conductors enables the contacts to be located nearer together while permitting of easy manual operations.

I claim:

1. In a strip for cross connecting the wires of two cables, two parallel terminal blocks of insulating material each having a front, a back, a top and a bottom, a plurality of groups of tags projecting through the bottoms of the two terminal blocks and to which groups of wires of the two cables may be attached, each tag having a contact surface within a recess in the corresponding terminal block, each recess being open to the back of its block and having a shelf for each contact surface, a pressure block of insulating material within each recess, movably positioned between and separating the shelves and the contact surfaces lying thereon, each pressure block having a ledge for engaging each contact surface, each cooperating ledge and contact surface being aligned with a perforation in the front of the terminal block through which wires may be pushed from the front of one terminal block to the aligned perforation in the front of the other block, each wire passing between contact surfaces and the cooperating ledges, and means projecting through the tops of the terminal blocks, one for each pressure block to force it towards the cooperating contact surfaces.

2. In a trip for crossconnecting the wires of two cables, two terminal blocks of insulating material each having a front, a back, a top and a bottom, a plurality of pairs of tags projecting through the bottoms of the two terminal blocks and to which pairs of wires of the two cables may be fastened, the tags of each pair being staggered, each tag having a contact surface formed at right angles to the shank of the tag and positioned within a recess in the corresponding terminal block, each recess being open to the back of its block and having two staggered shelves, one for the contact surface of one and the other for the contact surface of the other tag of a pair, a pressure block of insulating material within each recess, movably positioned between and separating the two shelves and the contact surfaces lying thereon, each pressure block having on one side a ledge parallel with and engaging one contact surface and on the opposite side a ledge parallel with and engaging the second contact surface positioned within the same recess, staggered perforations in the front of each terminal block aligned with the contact surfaces and cooperating ledges on the pressure blocks affording open channels through which wires may be pushed from the perforations in the front on one terminal block to the aligned perforation in the front of the other block, each wire passing between cooperating contact surfaces and ledges, and a plurality of screws projecting through the tops

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of the terminal blocks, one for each pressure block and arranged to force it towards the cooperating contact surfaces.

3. In a strip for cross connecting the wires of two cables, two parallel terminal blocks of insulating material each having a front, a back, a top and a bottom, an upper and a lower strip of insulating material clamped between the blocks of the two terminal blocks, identification cards on the upper strip, a plurality of pairs of tags projecting through the bottoms of the two terminal blocks and to which pairs of wires of the two cables may be soldered, the tags of each pair being staggered, each tag having a serrated contact surface chamfered at two ends and formed at right angles to the shank of the tag within a recess in the corresponding terminal block, each recess being open to the back of its block and having two staggered shelves, one for supporting the contact surface of one and the other for supporting the contact surface of the other tag of a pair, a pressure block of insulating material within each recess, movably positioned between and separating the two shelves and the contact surfaces lying thereon, each pressure block having on one side a ledge parallel with and engaging one serrated contact surface and on the opposite side a ledge parallel with and engaging the second serrated contact surface within the same recess, said ledges being chamfered at two ends to form with the chamfered ends of the contact surfaces guide holes opening towards the back and front, respectively, of the terminal block, the front guide holes being aligned with staggered perforations in the front of each terminal block, and the rear holes being aligned with staggered grooves formed in the lower insulating strip affording channels between aligned recesses of the two terminal blocks through which wires may be pushed from the perforations in the front of one terminal block to the aligned perforations in the front of the other block, each wire passing between and being engaged by two serrated contact surfaces and the cooperating ledges, projections of insulating material on the front of each terminal block aligned with the perforations therein, a plurality of screws projecting through the tops of the terminal blocks, one for each pressure block and arranged to force it towards the cooperating contact surfaces, and metal inserts in the terminal blocks, one for each screw and in threaded engagement therewith.

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