

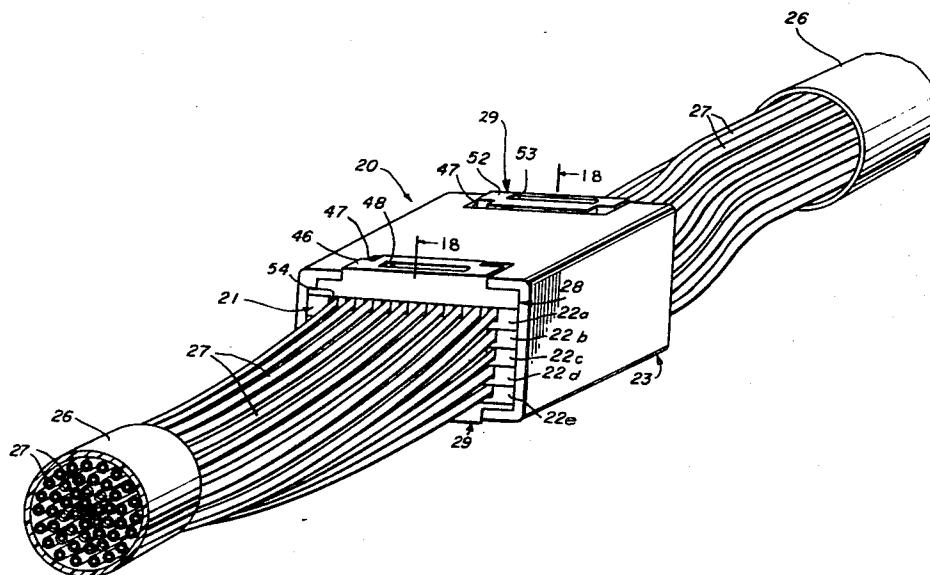
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[21] Appl. No. **817,866**
[22] Filed **Apr. 21, 1969**
[45] Patented **Sept. 14, 1971**
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New York, N.Y.
Continuation-in-part of application Ser. No. 418,995, Dec. 17, 1964, now Patent No. 3,457,640.

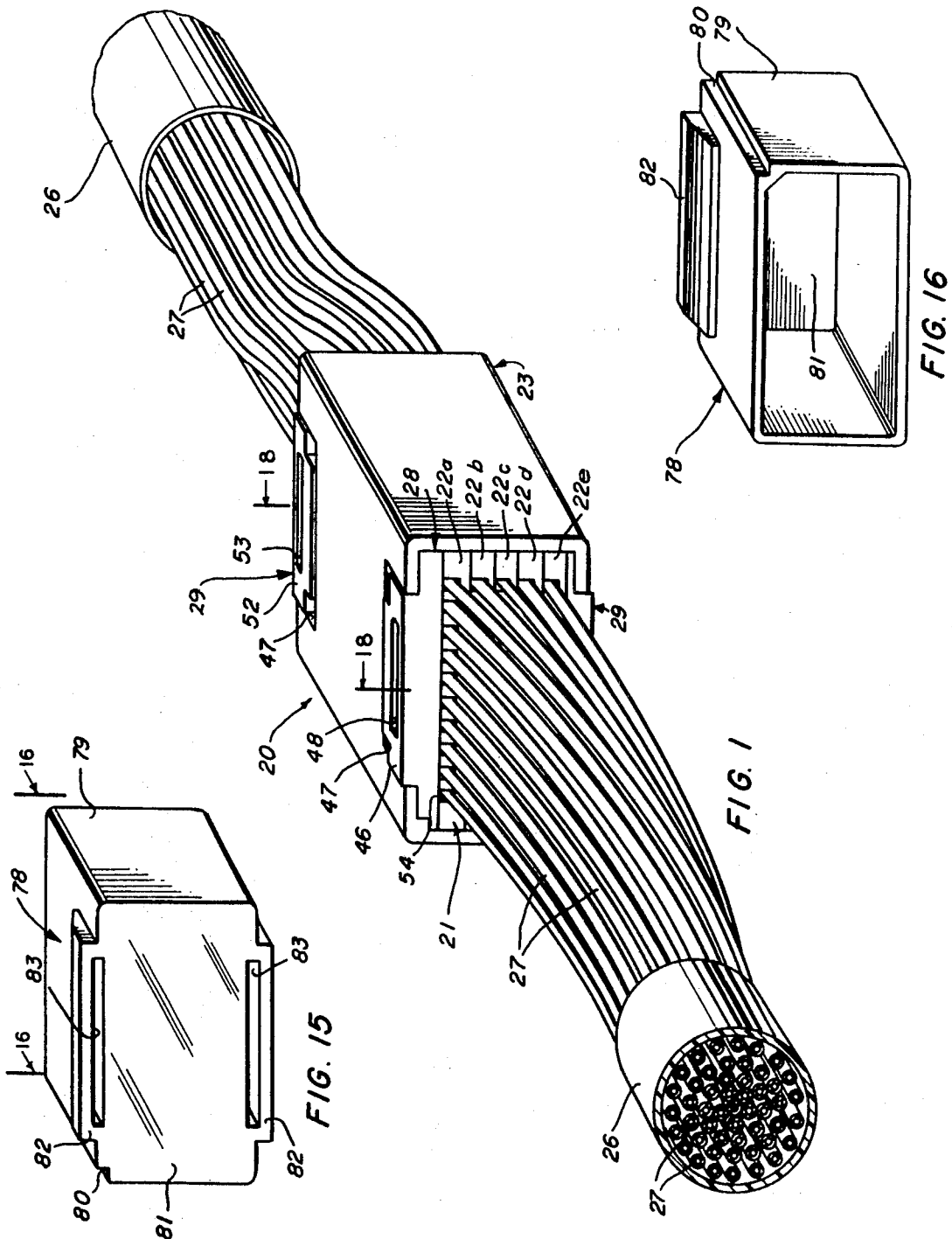
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[54] **ELECTRIC COUPLER**
30 Claims, 28 Drawing Figs.
[52] U.S. Cl. **339/49,**
339/113, 339/176, 339/198, 339/217
[51] Int. Cl. **H01r 25/00**
[50] Field of Search. **339/49,**
113, 176, 176 M, 191, 192, 195, 196, 198, 210,
211, 217

ABSTRACT: An electrical coupler unit includes a plurality of wafers which are stacked so that open slots of each of the wafers form contactor-receiving cells with associated portions of flat surfaces of adjacent wafers. A plurality of contactors are inserted into and locked within the cells formed by the stacked wafers and are formed with pockets for supporting the ends of associated conductors which are soldered thereto. Mating coupler units are assembled within supporting bands to facilitate the connecting of mating contactors of the units to form an electrical coupler.



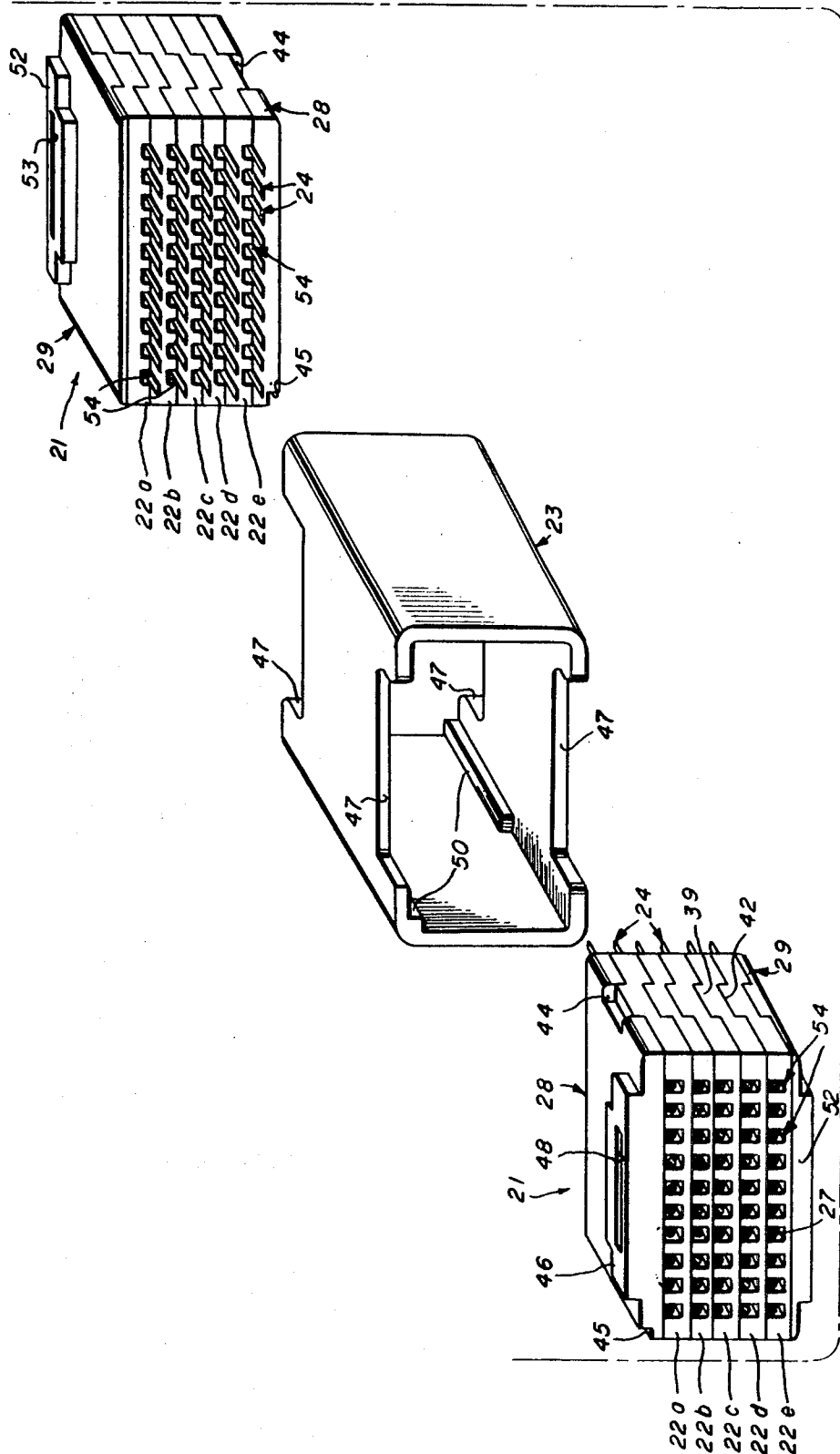


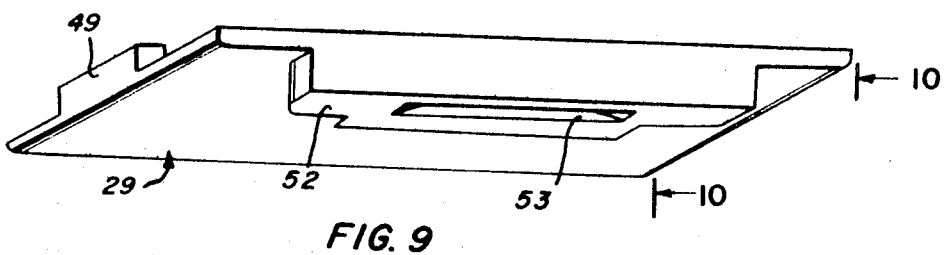
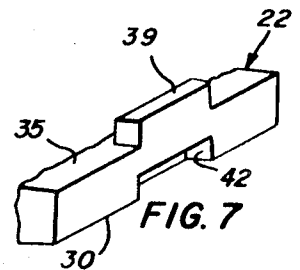
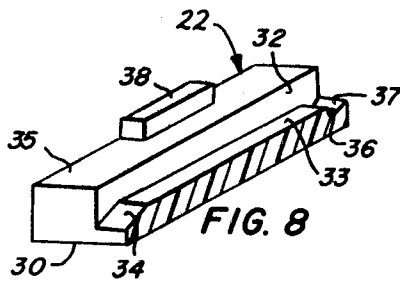
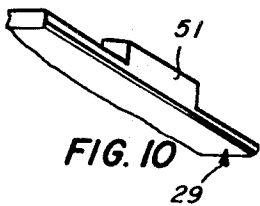
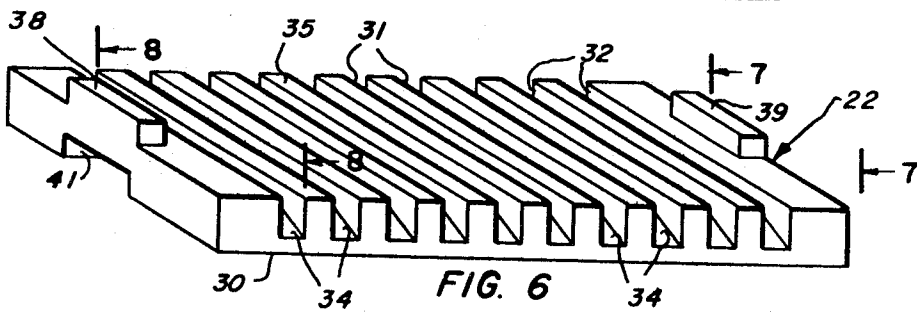
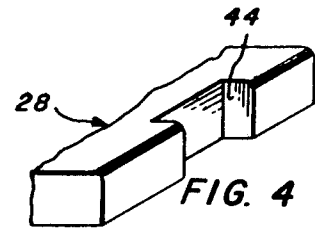
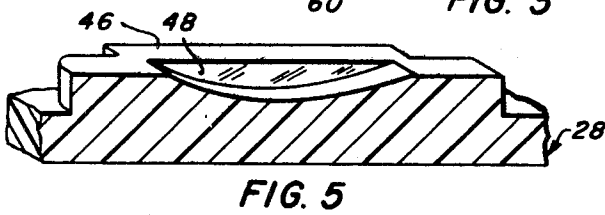
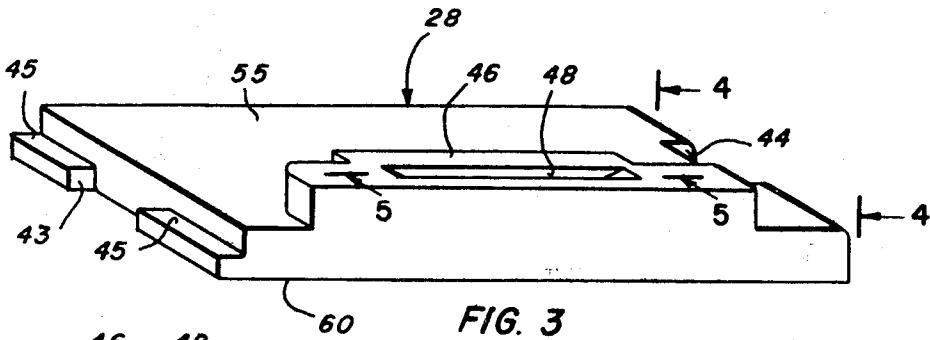
INVENTOR

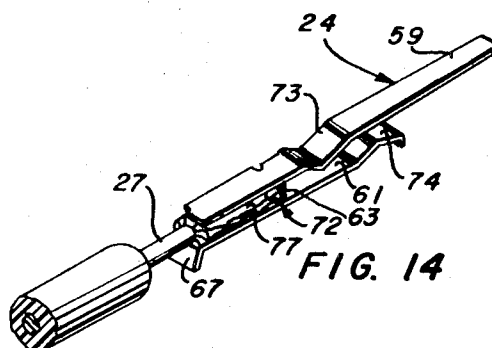
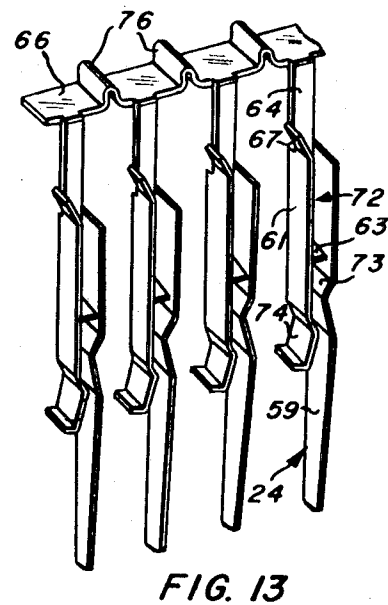
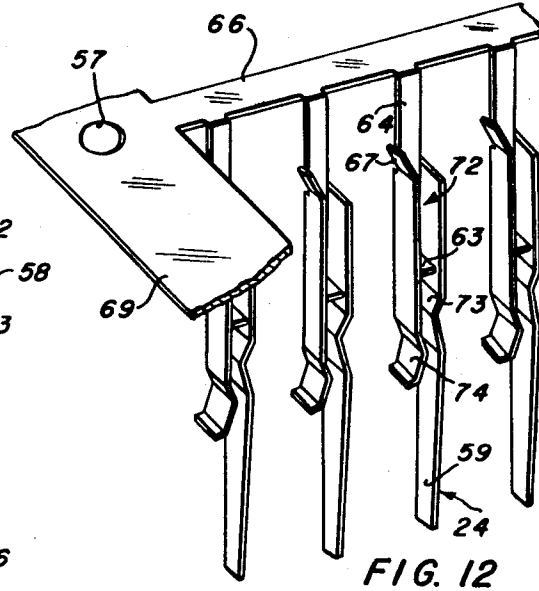
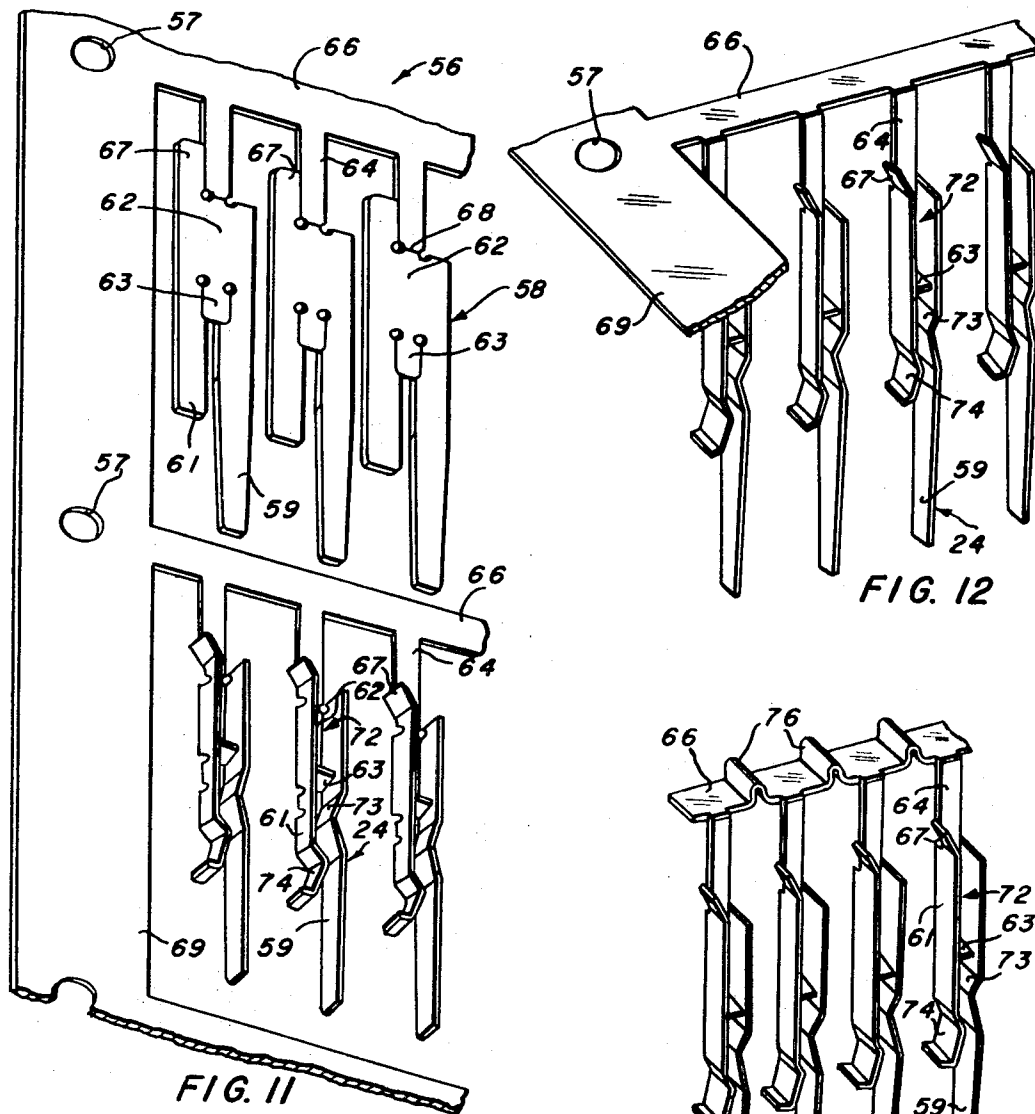
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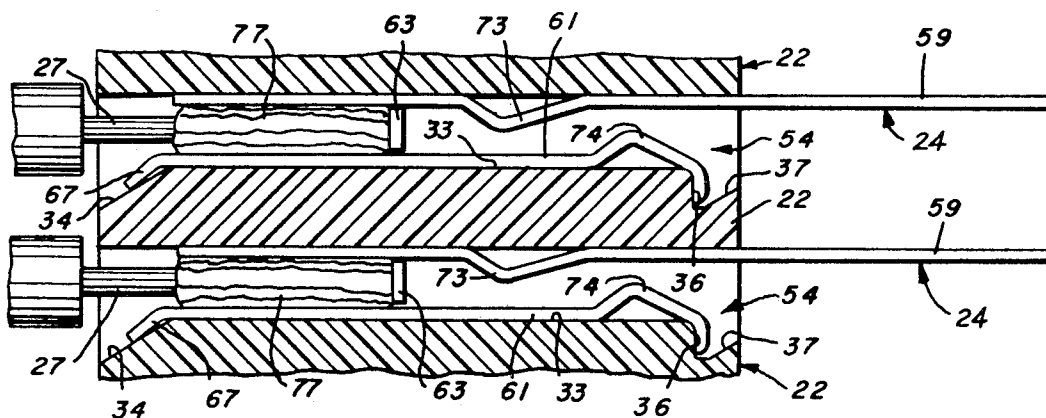


FIG. 17

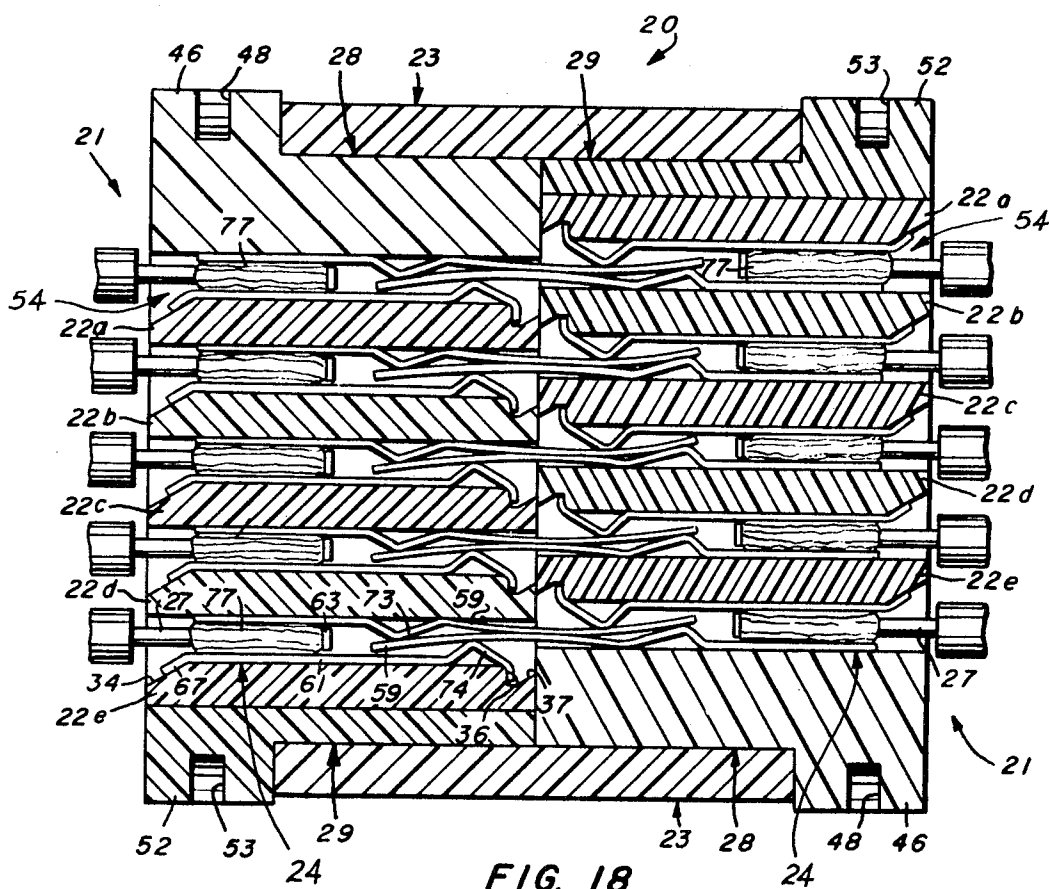


FIG. 18

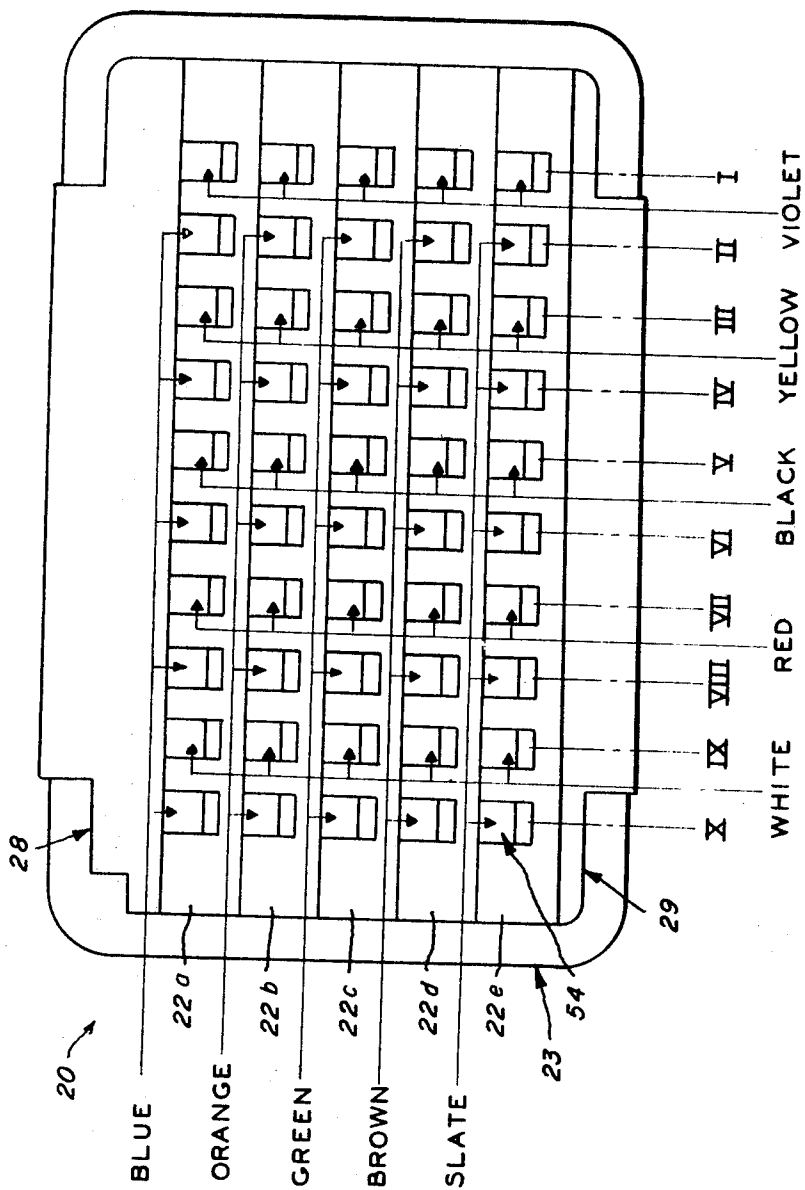
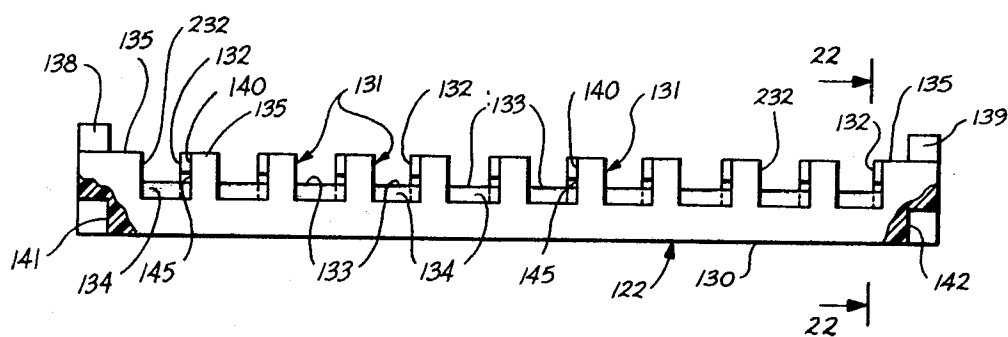
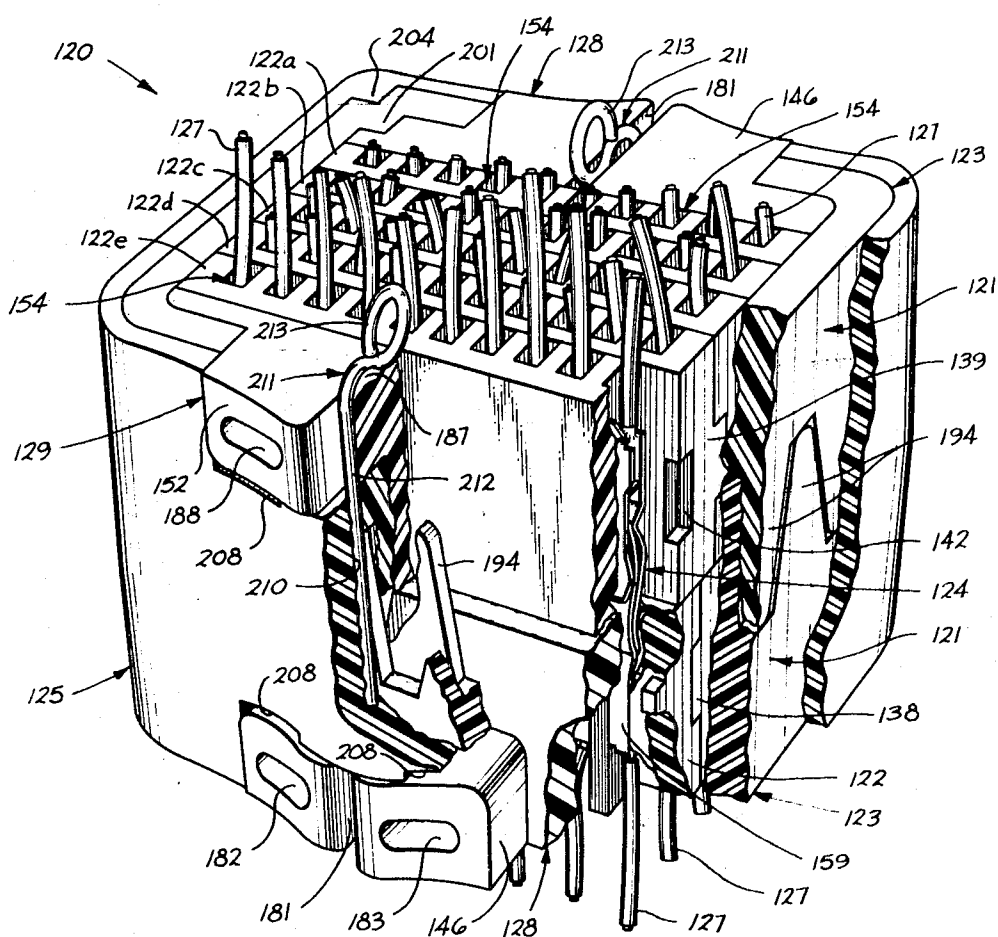


FIG. 19



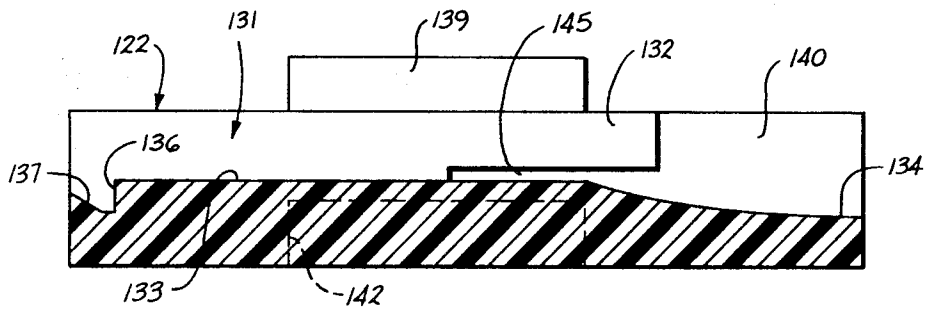


FIG. 22

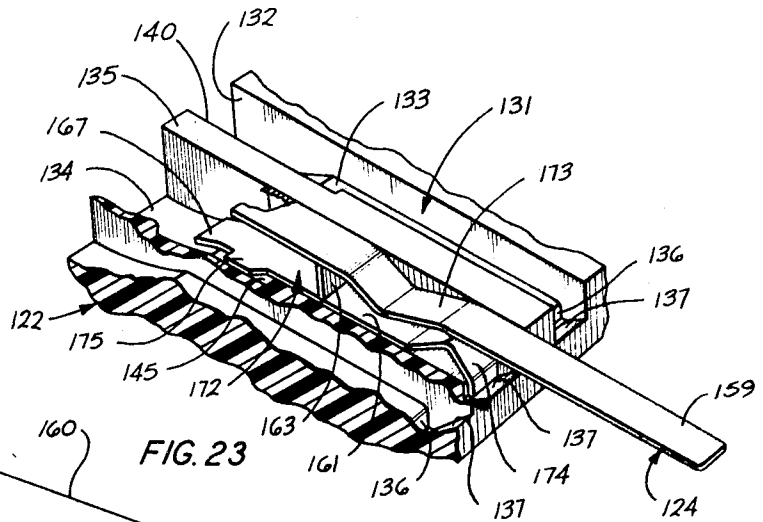


FIG. 23

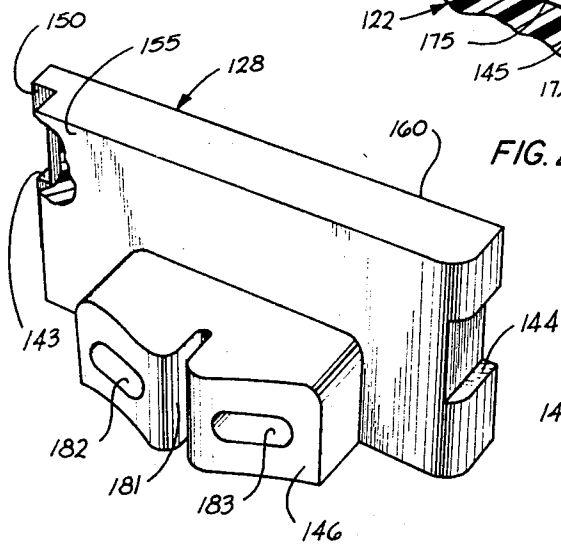


FIG. 24

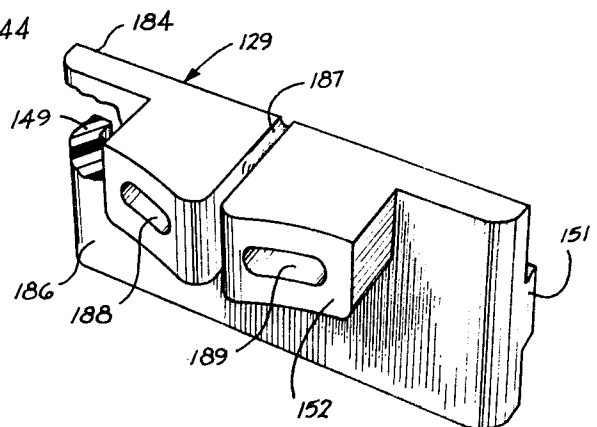
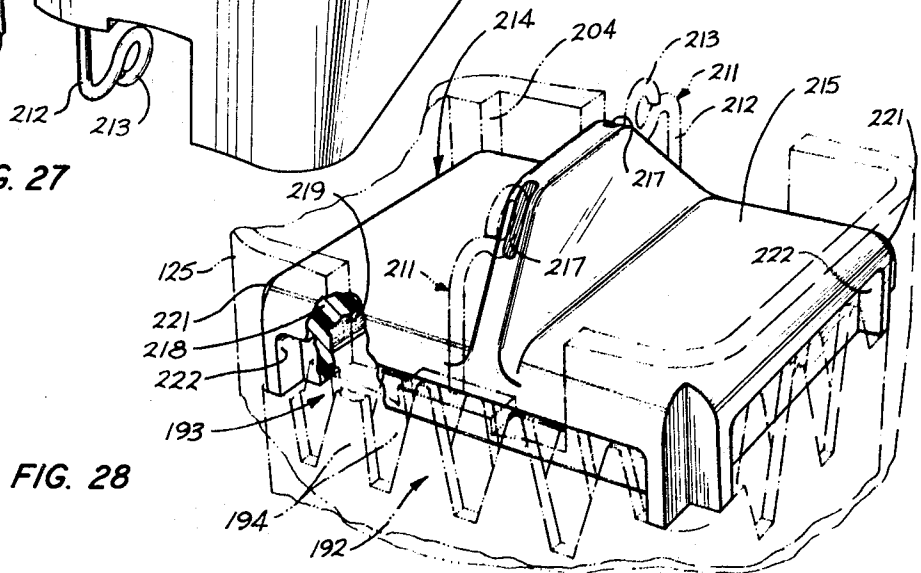
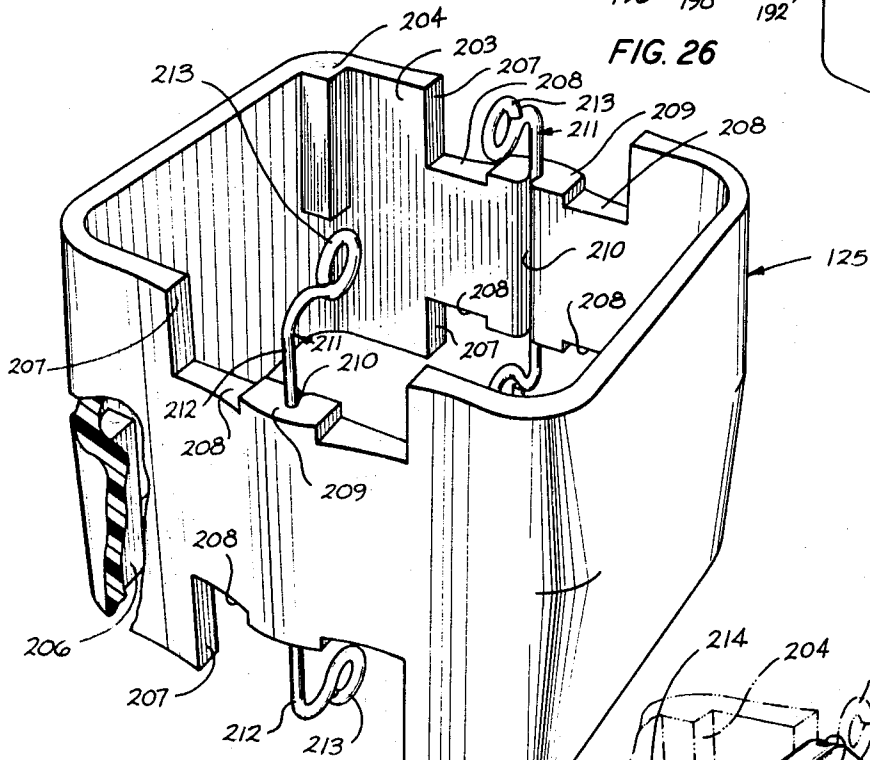
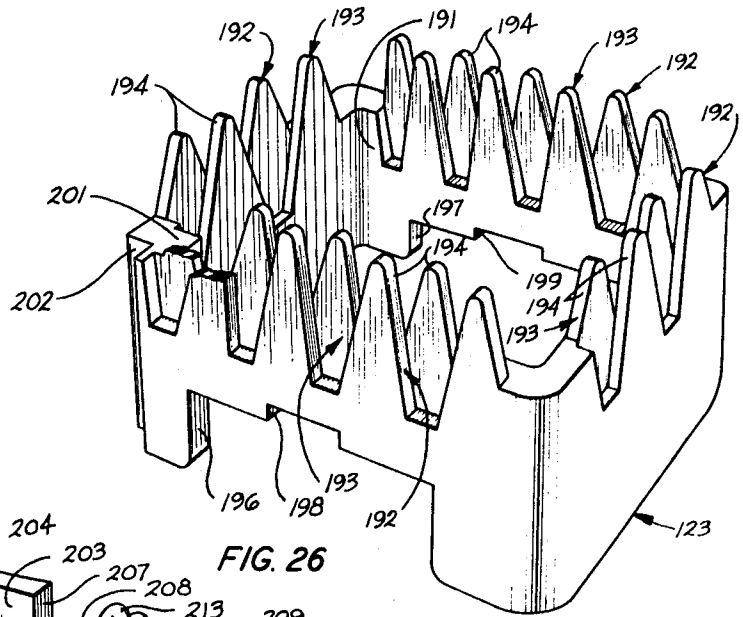


FIG. 25



ELECTRIC COUPLER

This is a continuation-in-part of application Ser. No. 418,995, filed Dec. 17, 1964, now U.S. Pat. No. 3,457,640, issued July 29, 1969.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

This invention relates to an electrical coupler and particularly to a symmetrical, laminate, color-coded coupler.

2. Description of the Prior Art

A standard color-coded telephone cable is described in U.S. Pat. No. 3,031,524, issued in the name of W. T. Hicks on Apr. 24, 1962, and discloses in one embodiment a single unit cable consisting of 25 distinctive pairs of conductors. In many instances, multiples of such unit cables are combined to form a multiple unit group, wherein each unit cable is lashed with a pair of different colored binder tapes. In addition, the color-code combination of each pair of binder tapes for respective unit cables are formed from a different color combination relative to the remaining pairs of color-coded binder tapes wrapped about the remaining unit cables. In this manner, the respective unit cables of a multiple unit group are clearly distinguishable from the remaining unit cables of the group. The unit cables and the multiple unit groups are thereafter utilized for interconnecting a plurality of subscriber sets with central office facilities. Presently, the cable is manufactured and delivered to an installation group for installing the cable in either aerial or underground conduits and for hand splicing individual cables or other types of terminations.

With the increasing volume of subscriber service in the telephony field, considerable time and effort is required by an installation group to hand splice the conductors of the cables for connection with other cables or terminations. Additional effort is necessitated to insure proper connection between similarly color-coded twisted pairs of unit cables being connected together as well as to insure the connecting of unit cables having the same color-coded binder tapes wherein the unit cables form portions of separate multiple unit groups. Hence, a need for simplifying and hastening cable connecting and terminating operations is apparent, wherein the color coding must be retained.

Additionally, where the cable is installed in conduits, coupling facilities must be sufficiently compact to permit pulling them through such conduits.

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a new and improved compact multiple-contact coupler for simplifying and hastening cable connecting and terminating operations.

Another object of the invention is the provision of a new and improved multiple-contact, color-coded, laminated coupler for connecting corresponding unit cables while maintaining color identification throughout.

Still another object of the invention is the provision of a new and improved multiple-contact, laminated, color-coded coupler having different colored wafers corresponding to a color code used with a cable to facilitate interconnecting color-coded cables.

A further object of the invention is the provision of a new and improved multiple-contact, laminated coupler having wafers supported within a band with contactor protecting structure.

A still further object of the invention is the provision of a new and improved multiple-contact, laminated coupler having wafers and contactors which cooperate structurally to lock the contactors with associated wafers.

An electrical coupler illustrating certain principles of the invention may include a pair of identical coupler units each having a plurality of wafers held in a laminated stack for supporting a plurality of contactors assembled therewith. The wafers

can be of different colors and can be assembled in a coded array to match a color code scheme of insulation of conductors which are assembled with contactors supported in similarly colored wafers.

The wafers may be supported in a resilient band and are formed with structure which complements the formed structure of the contactors so that the contactors are attached securely with the associated wafers to preclude undesirable disassembly of the contactors from the wafers when the wafers are not assembled in the laminated stack. The complementary structure of the contactors and the wafers also facilitates the retaining of the contactors in a desired orientation when the associated wafers are assembled in the laminated stack to form the coupler unit.

Other objects and advantages of the invention may be readily understood from the following detailed description of a specific embodiment thereof when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing a coupler which forms one embodiment of the invention and which includes a pair of symmetrical coupler units assembled with a band for aligning and holding the coupler units in mating engagement;

FIG. 2 is an exploded perspective view showing the relationship between the pair of mating coupler units of the coupler and the aligning and locking band;

FIG. 3 is a perspective view showing structural features of one of a pair of side wafers of the laminated coupler unit;

FIG. 4 is a partial end view, taken along line 4—4 of FIG. 3, showing a keeper notch formed in the side wafer;

FIG. 5 is a partial sectional view, taken along line 5—5 of FIG. 3, showing a structural recess formed in the side wafer to provide a grip for facilitating manual removal of the laminated coupler unit from within the band and for further reducing the effects of heat sink during plastic molding of the side wafer;

FIG. 6 is a perspective view showing an intermediate wafer of the laminated coupler unit;

FIG. 7 is a partial end view, taken along line 7—7 of FIG. 6, showing a keeper notch formed in the intermediate wafer, and further showing a keeper lug which cooperates with the notch of the adjacent intermediate wafer for facilitating cooperative positioning, aligning and locking of the wafers in a stacked, laminated configuration;

FIG. 8 is a sectional view, taken along line 8—8 of FIG. 6, showing structural recesses of the intermediate wafer;

FIG. 9 is a perspective view showing the structural features of a second of the pair of side wafers of the laminated coupling unit;

FIG. 10 is a partial end view, taken along line 10—10 of FIG. 9, showing a keeper lug of the side wafer shown in FIG. 9;

FIG. 11 is a partial perspective view of a metal strip showing the major steps of blanking and forming a contactor from the strip;

FIG. 12 is a partial perspective view of a plurality of formed contactors bent downwardly and held in a spaced relation by a backbone strip supported by a skeleton rib;

FIG. 13 is a partial perspective view showing the contactors held in a spaced relation by the crimped backbone strip to facilitate a more closely aligned spacing between adjacent contactors;

FIG. 14 is a perspective view showing a single insulated conductor secured with a contactor;

FIG. 15 is a closed end view of a disposable dust cover which is inserted into one end of a band having a coupler unit inserted into the other end and is used to protect tines of coupler contactors during shipment;

FIG. 16 is a perspective view taken along line 16—16 of FIG. 15 showing an open end view of the dust covers;

FIG. 17 is a partial sectional view of the contactors assembled in cells of the coupler unit;

FIG. 18 is a partial sectional view taken along line 18—18 of FIG. 1 showing opposed coupler units of a coupler in mating arrangement, whereby a five-point contact is established between each of the mating pairs of contactors;

FIG. 19 is a diagrammatical view showing the location of color-coded twisted pairs of conductors relative to associated contactor-receiving cells of the coupler unit as viewed from the contact side of the unit;

FIG. 20 is a perspective view showing an alternative embodiment of the coupler which includes a pair of symmetrical coupler units each assembled within an associated inner band and further assembled within an outer band for aligning and holding the coupler units in mating engagement;

FIG. 21 is a side view showing an intermediate wafer of the laminated coupler unit shown in FIG. 20;

FIG. 22 is a sectional view taken along line 22—22, of FIG. 21, showing structural recesses and a contactor locking slot of the intermediate wafer shown in FIG. 21;

FIG. 23 is a perspective view showing one of the contactors assembled in an associated slot of the intermediate wafer shown in FIG. 21;

FIG. 24 is a perspective view showing structural features of one of a pair of side wafers of the laminated coupler unit shown in FIG. 20;

FIG. 25 is a perspective view showing structural features of a second of the pair of side wafers of the laminated coupler units shown in FIG. 20;

FIG. 26 is a perspective view showing the inner band for supporting the wafers in a laminated stack and showing structural features for protecting exposed portions of contactors extending from the stacked wafers;

FIG. 27 is a perspective view showing the outer band for supporting mating coupler units therein in the forming of the coupler shown in FIG. 20, and

FIG. 28 is a perspective view showing a shipping cover inserted into one end of the outer band of FIG. 27 and onto portions of the inner band of FIG. 26 with portions of the inner and outer bands shown in phantom view.

DETAILED DESCRIPTION

Referring to FIGS. 1 and 2, there is illustrated a coupler, designated generally by the numeral 20, which forms an exemplary embodiment of the invention. The coupler 20 includes a pair of identical, laminated, universally color-coded coupler units, designated generally by the numeral 21, which are interlocked and subsequently held together by a resilient, plastic band, designated generally by the numeral 23. Each coupler unit 21 includes a plurality of different colored, plastic, intermediate wafers, designated generally by the numeral 22, (FIG. 2) which are numbered 22a through 22e to designate that each wafer is composed of a different color relative to the other wafers such as blue, orange, green, brown and slate, respectively. Each of the coupler units 21—21 is provided with a plurality of contactors, designated generally by the numeral 24, (FIG. 2) which are positioned for mating engagement with the contactors of the opposing coupler unit. The coupler unit 21 may be used in connecting the ends of cables, such as unit cables 26—26, wherein each cable is composed of a plurality of twisted pairs of conductors 27—27 and is substantially similar to the unit cable described in U.S. Pat. No. 3,031,524, issued to W. T. Hicks.

An example of the unit cable 26 would include 25 twisted pairs of conductors 27—27, wherein each of the conductors is individually insulated with a colored insulation material. Ten different pairing colors of insulation material are utilized with two groups of five base colors each, thereby composing 25 pairs of 50 conductors 27—27 which form the unit cable 26. The base code colors to be utilized include a first group of colors such as white, red, black, yellow and violet; and a second group of colors such as blue, orange, green, brown and slate.

TABLE I

Pair Number	Conductor	
	A	B
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Slate
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Slate
11	Black	Blue
12	Black	Orange
13	Black	Green
14	Black	Brown
15	Black	Slate
16	Yellow	blue
17	Yellow	Orange
18	Yellow	Green
19 Yellow		Brown
20	Yellow	Slate
21	Violet	Blue
22	Violet	Orange
23	Violet	Green
24	Violet	Brown
25	Violet	Slate

In accordance with a pattern as shown in table 1, a pair identification system is utilized wherein conductors A and B of each of the 25 pairs are insulated with different colored insulation, with each pair having a color combination different from any other color combination of the remaining pairs. In addition, it is to be noted that the base code colors of the first group are utilized on the insulation of the conductors A and the base code colors of the second group are utilized on the insulation of the conductors B.

Further, a pair of different-colored binder tapes (not shown) is wrapped helically about each unit cable 26 which forms a portion of a multiple unit group comprising a plurality of unit cables. Hence, a given unit cable of 25 pairs of conductors 27—27 is distinguishable from the remaining unit cables of the group by having a different color combination of pairs of colored binder tapes wrapped helically around respective unit cables of the group. The coupler units 21—21 are composed of the different colored, intermediate wafers 22—22 preassembled between a pair of different colored, plastic, side wafers, designated generally by the numerals 28 and 29, wherein the colors utilized in the intermediate wafers 22a through 22e conform to the colors used in the insulation of the second group of base code colors such as blue, orange, green, brown and slate, respectively, and the colors of the side wafers conform to the colors of the pair of colored binder tapes wrapped helically around the unit cable 26. In this manner, one unit cable 26 of 25 pairs of conductors 27—27 is readily distinguishable from an adjacent unit cable of 25 pairs by observing the different color combination of the side wafers 28 and 29 of the coupler unit 21.

As viewed in FIGS. 6 through 8, 17 and 18, each of the individual, intermediate wafers 22—22 is generally of a flat and rectangular configuration and is formed with a flat face 30 on one major surface thereof and on the opposite major surface 35 with spaced, parallel slots 31 which transverse the short dimension of the rectangular wafer. Each slot 31 is formed with opposed, spaced sidewalls 32—32 with a flat bed 33 contiguous with and extending between the walls for receiving the contactor 24. A common end of each of the beds 33—33 of the wafer 22 is formed with a downwardly sloped surface 34.

The opposite common ends of each of the beds 33—33 of the wafer 22 is formed with a transverse undercut 36 with an upwardly sloped surface 37 extending outwardly therefrom. It is noted that the sloped surface 34 and the undercut 36 facilitate the self-securing of the contactor 24 lengthwise within the slot 31 of the coupler unit 21. In addition, the

sloped surface 37 strengthens the walls of the slots 31—31 at the entry end and provides an insulator barrier between adjacent pairs of contactors 24—24 as well as a guide for an entering, mating connector. Keeper lugs 38 and 39 extend upwardly from opposite ends of the flat, slotted surface 35 of the wafer 22, and conforming keeper notches 41 and 42 are formed in the opposite ends of the other flat surface of the wafer 22 wherein the lugs cooperate with the conforming notches of an adjacent wafer 22 for locking the wafers together to preclude relative lateral sliding movement in any direction.

As further viewed in FIGS. 3, 4 and 5, the side wafer 28 is substantially flat and rectangular with two major flat surfaces 55 and 60. The wafer 28 is formed with through-notches 43 and 44 on opposite ends thereof to facilitate the reception of the keeper lugs 38 and 39 of the adjacent, intermediate wafer 22 to preclude relative lateral sliding movement in any direction. In addition, the flat surface 55 of the side wafer 28 is formed with a projection 46, which fits into a cutaway 47 (FIGS. 1 and 2) of the band 23. The projection 46 of the side wafer 28 is formed with a recess 48 to facilitate a grip for manual handling of the coupler unit 21 relative to the band 23 and also reduce undesirable strain effects resulting from heat sink during the molding of the wafers.

The side wafer 28 is formed with a corner keyway 45 along the edge which is provided with the through-notch 43 and cooperates with one of a pair of corner keys 50—50 (FIG. 2) formed along diagonally opposed corners of a common inner wall of the band 23. It is noted that each of the keys 50—50 extend into the band 23 from respective open ends of the band approximately one-half of the distance between the open ends of the band. Hence, as shown in FIG. 2, proper orientation of the mating coupler units 21—21 prior to mating engagement is assured by the cooperation of the corner keys 50—50 on the inner wall of the band 23 and the complementary keyways 45—45 of the side wafers 28—28. Proper alignment of the mating couplers 21—21 is accomplished by the close sliding fit of the coupler units 21—21 with the band 23.

As viewed in FIGS. 9 and 10, the side wafer 29 is substantially flat, and is formed at opposite ends of one flat surface with projecting keeper lugs 49 and 51 which are positioned within keeper notches 41 and 42, respectively, of the adjacent, intermediate wafer 22, whereby the side wafer is assembled with the adjacent, intermediate wafer to preclude relative lateral sliding movement in any direction. The side wafer 29 is also formed with a projection 52 extending from the opposite flat surface, wherein the projection is formed with a recess 53 for facilitating handling of the coupler unit 21 relative to the band 23 and to reduce undesirable heat sink effects.

As the intermediate wafers 22a—22e and side wafers 28 and 29 are assembled in a laminated stack, the flat face 30 of one wafer is positioned adjacent the slotted surface 35 of the adjacent wafer, whereby the slots 31—31 are enclosed to define contactor-receiving cells, designated generally by the numeral 54, as shown in FIGS. 2, 17 and 18. In addition, the flat surface 60 of the side wafer 28 cooperates with the adjacent, intermediate wafer 22 to enclose the slots 31—31 of the intermediate wafer, thereby forming contactor-receiving cells 54—54 with predetermined spacing between adjacent cells. Further, the cells 54—54 are displayed in individual rows formed by each wafer 22 as well as perpendicularly disposed columns formed by the combination of wafers where the columns are denoted by Roman Numerals I through X as shown in FIG. 19.

Thus, by forming the wafers 22—22 of the laminated stack with the keeper lugs 38 and 39 and the keeper notches 41 and 42, each wafer of the laminated assembly is precluded from lateral sliding movement relative to the remaining wafers. The projection 46 formed on the outer surface of the side wafer 28 and the projection 52 formed on the outer surface of the opposite side wafer 29 provide hand grips to facilitate manual movement of the mating coupler units 21—21 relative to the band 23. The outer end walls of the projections 46 and 52 are

rounded and arranged for interference engagement with the inner end walls of the cutaways 47—47, thus providing friction fits to hold the mating coupler units together within the band 23.

Generally the miniature contactors 24—24 are stamped from a stock strip in transverse multiples held on backbone cross strips supported by continuous stock side strips to facilitate handling of the miniature parts through subsequent necessary operations. Without this supported handling, the contactors 24—24 would tangle and mat together so that later separation would be tedious, time-consuming, injurious to the contactors and prohibitively expensive.

The backbone cross strips and the continuous stock side strips cooperate to provide means for holding the contactors 24—24 in suspended, parallel, spaced relationship while tines of the contactors are tin or gold plated. The backbone strips and continuous side strips provide an electrical path for the plating operation, and plate metal is conserved by plating only the contact end of the contactors.

The securing of the conductors 27—27 to the contactors 24—24 is facilitated by a soldering operation which is greatly facilitated with multiple contactors held in spaced relation on the backbone strip. Placement of the contactors 24—24 in a soldering device is much faster and more precise while layup of the color-coded conductors 27—27 of the unit cable 26 is simplified, and a plurality of the contactors held by a single backbone strip can be soldered simultaneously to respective cable conductors.

A coupler unit 21 embodying the features of the invention may be easily connected to conductors 27—27 at the extremities of a unit cable 26 at the manufacturing location, wherein the cable is wound on a reel and subsequently delivered to an installation group in the field for installing the cable in telephone distribution networks. With the aid of such a color-coded coupler unit 21, an installer need only insert the coupler unit connected to the trailing end of a cable 26 of a depleted supply reel to the mating coupler unit connected to the leading end of a cable of a new supply reel in accordance with the aligned colors of the colored, laminated wafers 22—22. This procedure obviates the time-consuming task of hand-splicing the individual conductors of one cable to the individual conductors of another cable.

Where unit cables 26—26 are combined to form a multiple unit group, side wafers 28 and 29, which are positioned at the opposite sides of the laminated wafer stack of the coupler unit 21, connected to a given unit cable, are composed of a colored material corresponding to the colors of the respective pair of binder tapes wound helically around the given unit cable. In addition, the method of fabricating and inserting the contactors 24—24 into the coupler units 21—21 at the manufacturing location requires considerably less time than is required for the hand-splicing operation by the installer in the field. Thus, the overall time required for the connecting operation is greatly reduced by the utilization of the coupler 20 and the method of fabrication of the coupler and effectively reduces associated time delays to customer service.

Specifically, the contactors 24—24 (FIG. 2), which are utilized in the coupler unit 21 are stamped from an elongated metal strip 56, as shown in FIG. 11, wherein the strip is provided with a series of perforations 57—57 along the border edges thereof to receive means for moving and aligning the strip during subsequent blanking and forming steps. As the strip 56 is guided through a punching press (not shown), the strip is punched transversely into a plurality of patterned blanks, generally designated by the reference numeral 58. Each blank 58 is formed with a long tine 59 and a short tine 61 bridged at their heel ends by a central web section 62 which holds the tines in parallel, cantilever relationship. A tab 63 extends from the central web section 62 spatially between the tines 59 and 61.

At the opposite end of the web section 62, a rib strip 64 connects the patterned blank 58 to a commonly supporting, transverse backbone strip 66. Further, a tab 67 extends rearwardly

from the short tine 61 spatially adjacent the rib strip 64. The rib strip 64 is scored at 68 near the web 62 for subsequent removal of the individual contactors 24—24 from the rib strip and the backbone strip 66. A plurality of backbone strips 66—66, each supporting a plurality of spaced patterned blanks 58—58, are spatially formed from the strip 56 and are supported by and extend transversely between spaced skeleton side strips 69—69 (one shown).

The side strips 69—69 with the blanks 58—58 and the backbone strips 66—66 are subsequently fed into forming dies (not shown), wherein the long tine 59, the tab 63 and the short tine 61 with the tab 67 of each contactor 24 are bent upwardly, as shown in FIG. 11, to form a pocket, designated generally by the numeral 72, in the area of the web section 62 for reception of an exposed end of one of the conductors 27—27. Thus, the long and short tines 59 and 61 extend integrally from sidewalls of the pocket 72. In addition, each of the long tines 59—59 is crimped slightly to form an intermediate ramp 73, while each of the short tines 61—61 is formed at the free end thereof with a hooked ramp 74. The rearward tab 67 is bent outwardly away from the neck portion 64 and angularly extends from the pocket sidewall which is integral with the short tine 61.

Subsequently, as viewed in FIG. 12, the side strips 69—69 with the formed contactors 24—24 and the backbone strips 66—66 are positioned within a bending die (not shown), wherein the rib strips 64—64 supporting the formed contactors are bent downwardly at a right angle relative to the backbone strips. The side strips 69—69 are moved into a plurality of stations (not shown) whereat the backbone-held contactors 24—24 are degreased and cleaned, heat treated, pickled and gold-plated, and washed and dried to greatly increase the resiliency and fatigue life of the contactors and improve electrical contact.

The side strips 69—69 with the formed, downwardly suspended contactors 24—24 are then passed into a crimping and cutting press (not shown), wherein the backbone strip 66 is crimped, as shown in FIG. 13, in areas 76 between each of the spatially supported contactors, thereby reducing the spacing between adjacent contactors. The reducing of the spacing between the contactors 24—24 is necessary to facilitate a subsequent soldering operation and insertion of the contactors into the precisely spaced cells 54—54 of the coupler unit 21. The backbone strips 66—66 are sequentially severed from the skeleton side strips 69—69 and the free backbone strips are successively and automatically directed into a compartmented container (not shown) to facilitate handling and transporting of the backbone-supported, miniature, fragile contactors 24—24 into a soldering station where the cable conductors 27—27 are assembled and secured with the contactors. The magazing of the backbone-supported contactors 24—24 into containers minimizes damage to, or mutilation of, the miniature contactors during the handling and transportation thereof.

The backbone-held contactors 24—24 are positioned and held in a soldering and cutting apparatus (not shown), such as that disclosed in a copending application in the name of H. E. Brent, Ser. No. 419,132, which was filed on Dec. 17, 1964, now U.S. Pat. No. 3,252,644 and issued on May 24, 1966, wherein a plurality of the conductors 27—27 of the unit cable 26 are assembled and held in the pockets 72—72 formed by the tines 49 and 51 and the tab 53. Thereafter, the pockets 72—72 are heated and individual solder strands (not shown) are inserted into each respective, heated pocket 72, whereby the solder melts upon engagement with the pocket. Upon cooling of the solder, the conductors 27—27 are secured within the respective contactor pockets 72—72 by a solidified solder 77 (FIGS. 14, 17 and 18). By depositing the cold solder directly into the heated pockets 72—72, the solder is prevented from forming on the outer surfaces of the pockets which could subsequently interfere with the close fit of the contactor 24 within the cells 54—54 of the coupler units 21—21 and also undesirably bridge adjacent contactors.

Subsequent to the soldering operation, the apparatus automatically and transversely severs the backbone strip 66 into selected segments with each segment supporting five contactors 24—24. Hence, a unit cable 26 of 25 conductor pairs would be secured with 10 backbone segments with each segment supporting five contactors 24—24 having five respective conductors 27—27 secured therewith.

The conductors 27—27 are soldered to the contactors 24—24 in accordance with the previously discussed color-code arrangement, whereby each of the conductors which form a twisted pair is soldered to contactors which are subsequently secured in adjacent cells 54—54 of the contactor-supporting coupler unit 21. Thereafter, the backbone-held contactors 24—24, having the paired conductors 27—27 of the unit cable 26 secured thereto, are inserted into and self-secured within the cells 54—54 of the contactor-supporting coupler unit 21 where the hooked ramp 74 initially engages the sloped surface 34 to facilitate flexing of the short tine 61 during the insertion procedure.

The spacing between adjacent cells 54—54 of the coupler unit 21 is determined by the spacing of the wafer slots 31—31 which is small due to the miniature size of the coupler unit. In the formation of the contactors 24—24, sufficient material must be provided between adjacent contactor blanks 58—58 (FIG. 11) to facilitate the formation of the contactor elements. However, the necessary spacing between adjacent blanks 58—58 is greater than the critical spacing between adjacent cells 54—54. Hence, the necessity for crimping the backbone strip 66 in the areas 76 (FIG. 13) is to reduce the spacing between the formed contactors so that the contactor spacing coincides with the cell spacing to facilitate the gang insertion of the contactors into the coupler unit cells 54—54.

TABLE 2

Contactor Number	Conductor Color	Segment Number
1	Blue	
2	Orange	
3	Green	
4	Brown	
5	Slate	
6	White	
7	White	
8	White	IX
9	White	
10	White	
11	Blue	
12	Orange	
13	Green	
14	Brown	
15	Slate	
16	Red	
17	Red	
18	Red	VII
19	Red	
20	Red	
21	Blue	
22	Orange	
23	Green	VI
24	Brown	
25	Slate	

TABLE 3

Contactor Number	Conductor Color	Segment Number
50	Violet	
49	Violet	
48	Violet	I
47	Violet	
46	Violet	
	Slate	
44	Brown	
43	Green	
42	Orange	
41	Blue	
40	Yellow	
39	Yellow	
38	Yellow	III
37	Yellow	
36	Yellow	
35	Slate	

TABLE 3—Continued

34	Brown	IV
33	Green	
32	Orange	
31	Blue	
30	Black	V
29	Black	
28	Black	
27	Black	
26	Black	

The backbone strip 66 supports, for example, 25 contactors 24—24 in the manner as shown in FIG. 13. A method of assembling the conductors 27—27 of the 25 color coded, twisted pairs of the unit cable 2 with the contactors 24—24 includes holding the backbone strip 66 to facilitate assembly and soldering of the individual conductors within the pockets 72—72 of the contactors. As displayed in table No. 2, numbers 1 through 25 have been assigned to the 25 successive contactors 24—24, held by the common backbone strip 66, which are assembled with a first group of 25 respective conductors 27—27 of the 50-conductor unit cable 26 in accordance with the pattern as outlined in the table No. 2.

In this manner, the five contactors 24—24 of each of three groups having contactors which are numbered 1 through 5, 11 through 15 and 21 through 25 are assembled with conductors having colored insulation of the second group of colors; namely, blue, orange, green brown and slate, respectively. The five contactors 24—24 numbered 6 through 10 are assembled, respectively, with the five conductors 27—27 having white colored insulation. The remaining five contactors 24—24 numbered 16 through 20 are assembled, respectively, with the five conductors having the red colored insulation. A second group of 25 conductors 27—27 of the 50-conductor unit cable 26 are assembled with the contactors 24—24 held by another backbone strip 66 in accordance with the pattern as shown in table No. 3 wherein the number assignment and color scheme follows a similar pattern as that described for table No. 2.

Subsequent to the assembly of the first 25 conductors 27—27 with the contactors 24—24 in accordance with the pattern shown in table No. 2, the conductors are secured within the individual pockets 72—72 of the respective contactors. It is noted that contactors 24—24, which are numbered 1 and 6, are assembled with the conductors 27—27 which form the blue-white conductor pair; the contactors numbered two and seven are assembled with the orange-white conductor pair; the contactors numbered three and eight are assembled with the green-white conductor pair and so on. Further, the contactors 24—24, which are numbered 11 and 16, are assembled with the blue-red conductor pair; the contactors numbered twelve and seventeen are assembled with the orange-red conductor pair and so on.

As previously discussed, another backbone strip 66 supports the second group of 25 contactors 24—24 wherein the contactors are numbered 26 through 50 and are assembled with the remaining 25 conductors 27—27 of the 50-conductor unit cable 26 in the manner as set forth in table No. 3. It is noted that the conductors 27—27, which are assembled with the contactors 24—24 numbered 21 and 26 in tables 2 and 3, respectively, form the blue-black pair; the conductors assembled with the contactors numbered 22 and 27 form the orange-black pair and so on. Further, the conductors 27—27 assembled with the contactors 24—24 numbered 31 and 36 in table No. 3 form the blue-yellow pair, and so on; while the conductors assembled with the contactors numbered 41 and 46 in table No. 3 form the blue-violet pair, and so on.

Subsequent to the assembly of the 50 conductors 27—27 of the unit cable 26 with the contactors 24—24 numbered 1 through 50 in accordance with the pattern shown in tables 2 and 3, the backbone strips 66—66 supporting the two groups of 25 contactors are each transversely severed along four spaced planes to provide ten backbone supported segments designated by Roman numerals I through X in tables 2 and 3 wherein each segment supports five contactors with the conductors assembled and secured therewith. For example, the segment I of five assembled conductors 27—27 and con-

tors 24—24 includes the contactors numbered 46 through 50 having the conductors with violet colored insulation secured therewith. As a further example, the segment II of five backbone-supported, assembled conductors 27—27 and contactors 24—24 includes the contactors numbered 41 through 45 assembled and secured with conductors having blue, orange, green, brown and slate colored insulation, respectively. This segment pattern is continued as shown in tables 2 and 3.

Referring to tables No. 2 and 3, the backbone-supported segment I, supporting the five contactors 24—24 numbered 46 through 50 which are secured with the conductors having the violet colored insulation, is aligned with the column I of cells 54—54 which is the first column from the right of the coupler unit 21 as viewed in FIG. 19. The segment I is moved toward the coupler unit 21 so that the contactors 24—24 are inserted into the cells 54—54 of the column I in such a manner that the backbone strip of the segment projects to the left as viewed in FIG. 19 and is substantially parallel with the face of the conductor side of the coupler unit. Subsequent to the insertion of the contactors 24—24 of the segment I into the cells 54—54 of the column I, the backbone strip of the segment I is flexed to separate the rib strips 64—64 from the respective contactors along the scored lines 68—68.

The five contactors numbered 41 through 45 assembled with conductors 27—27 having blue, orange, green, brown and slate colored insulation, respectively, and which are supported by the backbone segment II, are inserted into the column II of cells 54—54 which is the second column from the right of the coupler unit 21 as viewed in FIG. 19. The contactors 24—24 of segment II are assembled in the cells 54—54 of the column II in such a manner that the backbone strip of the segment projects to the left, as viewed in FIG. 19, parallel to the face of the conductor side of the coupler unit 21. By assembling the contactors 24—24 of the segment II in this manner, the backbone of the segment projects away from the previously assembled segment I rather than projecting between the assembled segments I and II. Assembly of the segments in this manner facilitates easy gripping and flexing of the segment backbone to separate the rib strip 64 from the contactors 24—24 along the scored lines 68—68. This assembly procedure precludes the necessity of flexing the backbone of the segments between assembled segments which could be cumbersome and difficult. In this manner, the five contactors 24—24 of segment II, which are assembled with conductors having blue, orange, green, brown and slate colored insulation, are inserted into the cells 54—54 of the column II formed by the intermediate wafers 22a through 22e which are composed of the colors blue, orange, green, brown and slate, respectively.

Thus, the contactor 24, which is numbered 41 in table No. 3, and which is secured with the conductor having the blue insulation, is inserted into the cell 54 which is coincident with the row of cells formed by the blue intermediate wafer 22a, and the cells formed by column II; the contactor numbered 42 which is secured with the conductor having the orange colored insulation is inserted into the cell which is coincident with the row of cells formed by the orange intermediate wafer 22b and the cells formed by Column II; the contactor numbered 43, is secured with the conductor having the green insulation, is inserted into the cell which is coincident with the row of cells formed by the green intermediate wafer 22c and the cells formed by Column II, and so on.

Further the contactors 24—24 of the segments I and II are assembled in the respective cells 54—54 of the columns I and II in such a manner that the blue-violet pair of conductors 27—27, which are secured to contactors numbered 41 and 46 (table No. 3), respectively, occupy adjacent cells of the row of cells formed by the intermediate blue wafer 22a. The orange-violet pair of conductors 27—27 are secured to contactors 24—24, numbered 42 and 47 (table No. 3), respectively, which occupy adjacent cells 54—54 of the row of cells formed by the intermediate orange wafer 22b. This pattern of assembly is followed with the remaining violet colored conduc-

tor pairs. Further, the remaining segments III through X are assembled with the coupler unit 21 in a similar pattern, whereby pairs of the contactors 24—24 secured with the respective paired conductors 27—27 occupy adjacent coupler cells 54—54 of the rows of cells formed by the respective, individual wafers 22—22 as shown in FIG. 19.

In addition, it is noted that the pairs of conductors 27—27, having one conductor with blue insulation, are secured with contactors 24—24 which are inserted into and occupy the cells 54—54 of the row of cells formed by the blue wafer 22a; the pairs of conductors having one conductor with orange insulation are secured with contactors which are inserted into and occupy alternate cells of the row of cells formed by the orange wafer 22b, and so on. Further, each group of five conductors 27—27 each, having insulation of the second group, namely, white, red, black, yellow and violet, respectively, are secured with contactors 24—24 which occupy cells 54—54 in alternate columns of cells formed by the stacked rows of cells not occupied by contactors secured to conductors having colored insulation of the first group.

Referring to FIG. 17, as each contactor 24 is inserted into one of the cells 54—54 of the coupler unit 21, the long tine 59 is moved through and protrudes from the cell in a cantilever fashion. In addition, the hooked ramp 74 is flexed in the cell 54 and moves along the bed 33 of the cell until the free end of the hooked ramp engages and locks against the transverse undercut 36, thereby preventing rearward movement of the contactor 24 within the cell. Further, the rearward tab 67 engages the sloped surface 34 to limit continued forward movement of the contactor 24 within the cell 54. Thus, the contactors 24—24 are positioned within the cells 54—54 and are prevented from slideable movement within the cells due to cooperative structural features of the contactors and the coupler cells, whereby the contactors are located within the coupler unit 21 in a self-secured fashion.

As further shown in FIG. 17, the intermediate ramp 73 of the long tine 59, urges the long tine upwardly against the wall of the cell 54 formed by the flat surface 30 of the adjacent wafer 22, thereby providing resiliency in the extended end of the tine which protrudes from the coupler unit 21. This resilient feature aids in the subsequent flexing of the extend end of the tines 59—59 when the coupler unit 21 is mated with another identical coupler unit.

It is noted that each of the contactors 24—24 can be removed from within the respective cell 54 by inserting a needlelike implement (not shown) into the contactor end of the cell, engaging the free end of the hooked ramp 74 and thereafter lifting the ramp over the transverse undercut 36. The contactor 24 is thereafter withdrawn from the conductor end of the cell 54 by sliding the flexed tines 59 and 61 from within the cell and appears as shown in FIG. 14. This feature facilitates interchangeability of the contactors 24—24 necessitated by circuit changes and can be effected at any location, for example, at the manufacturing facility or in the field.

Referring to FIG. 18, one of the contactor-supporting, assembled coupler units 21—21 is inserted into one end of the band 23, whereby the close fit of the wafers 22—22 within the band facilitates alignment of the contactors 24—24 of the coupler unit for subsequent mating engagement with the contactors of the mating coupler unit. In addition, the coupler unit keyway 45 and the complementary band key 50 assure proper orientation of the wafered coupler unit 21 as the unit is inserted into the band 23 to mate with the identical coupler unit inserted from the opposite side of the band. The key 50 and keyway 45 precludes the possibility of the coupler units 21—21 being inserted into the band 23 in an incorrect orientation which could result in matting and tangling of the mating contactors 24—24 possibly resulting in permanent damage.

As the pair of coupler units 21—21 are inserted into the band 23, the cantilevered long tines 59—59 of each contactor 24 of one coupler unit are inserted into the contactor end of opposing cells 54—54 between the spaced long and short tines 59 and 61 of the mating coupler unit and subsequently engage

and are flexed by the ramps 73 and 74 of the contactors of the mating coupler unit. The engagement of the cantilevered ties 59—59 with the ramps 73 and 74 of the mating contactor 24 flexes each of the tines into a substantially bow shape, whereby the tines 59—59 of one coupler unit engage the tines 59—59 of the mating coupler unit at an intermediate portion thereof, thereby establishing a five-point contact between each pair of mating contactors of the coupler units. In this manner, the contacting surfaces of the contactors 24—24 establish a plurality of areas for contact, thereby insuring a good electrical connection.

Thus, the connecting of color-coded pairs of conductors 27—27 of one cable 26 with identically color-coded pairs of conductors of another cable is readily accomplished by stacking the colored laminate wafers 22—22 in a selected color-coded pattern to form the coupler units 21—21, inserting the conductor-supporting contactors 24—24 into cells 54—54 of the coupler unit in accordance with the previously discussed color-code arrangement, and thereafter mating the contactor-supporting coupler units in such a manner that the colored wafers of one unit are aligned with the mating unit wafers of the same colors.

Further, in the event the hooked ramp 74 of the short tine 61 is not completely resting within the undercut 36, the pressure exerted upon the ramp by the long tine 59 of the entering mating contactor 24 is sufficient to urge the ramp completely into the undercut as shown in FIG. 18. As the mating coupler units 21—21 engage, the coupler units are frictionally held within the plastic band 23 (FIGS. 1 and 18) whereby the laminated, intermediate wafers 22—22 and the side wafers 28 and 29 are precluded from individual movement in any direction. It is noted that the cantilevered end of each of the tines 59—59 is tapered inwardly to facilitate the alignment of the contactors 24—24 as the contactors enter into the cells 54—54 of the mating coupler unit 21.

Subsequent to the assembly of the contactors 24—24 within the coupler unit 21 and the further insertion of the coupler unit into one end of the band 23, the unit cable 26 and the respective coupler unit are prepared for shipment whereby a disposable dust cover, designated generally by the numeral 78, as shown in FIGS. 15 and 16, is inserted into the open end of the band 23. The cover 78 has a containerlike shape such as a plastic shell 79 with a closed end 81 where the outer shell conforms substantially to the outer configuration of the assembled, laminated coupler unit 21. The dust cover 78 is further formed with projections 82—82 which protrude from opposite sides of the shell 79 adjacent the closed end 81. Recesses 83—83 are formed in the outer portion of the closed end 81 where the projections join the shell 79, thereby facilitating resilient gripping of the dust cover 78 and further reducing the effects of heat sink during molding of the cover. In addition, the dust cover 78 is formed with a keyway 80 which is complementary with the band key 50 to facilitate insertion of the cover into the band.

As the dust cover 78 is inserted into the open end of the band 23, the open end of the shell 79 is guided about the cantilevered tines 59—59 extending from the coupler unit 21 which is positioned in the opposite open end of the band, thereby protecting the tines from accidental bending and damage during transportation of the assembled unit. The arrangement of the dust cover 78 within the band 23 also provides a substantially dust-free enclosure for the coupler unit elements, thereby preventing damage to and an accumulation of dust on the contactors 24—24.

As noted, each coupler unit 21 is assembled within one end of the band 23 with a dust cover 78 inserted into the other end. When the coupler 20 is to be assembled in the field, an installer removes and discards the dust cover 78 from within the band 23 which supports the coupler unit 21 assembled with the end of one of the cables 26—26. Thereafter, the installer removes from another band 23 the coupler unit 21 assembled with the end of another cable 26 and inserts this coupler unit into the open end of the first band for mating assembly with

the coupler unit in the opposite end of the band, thereby completing the coupling procedure.

While the conductor-supporting contactors 24—24 are assembled with the wafered coupler units 21—21 in the manner previously discussed, poling frequently occurs wherein the colored wafers 22a—22e of one coupler unit do not align with the corresponding colored wafers of the mating coupler unit when the coupler units are inserted into the band 23. This is an indication to the installer that the wafers 22a—22e of the coupler units 21—21 are not properly oriented for accomplishing the desired coupling and that poling has resulted. In the event such poling occurs, the installer merely removes one of the coupler units 21—21 from within the band 23 and restacks the individual wafers 22a—22e relative to the side wafers 28 and 29 to obtain the required wafer color alignment and thereafter inserts the reoriented coupler unit into the band 23 to facilitate the desired coupling.

To facilitate reorientation of the wafers 22a—22e for obtaining proper color alignment, the installer selects one of the coupler units 21—21 and separates the side wafer 29 from the remaining wafers. Thereafter, the installer carefully separates the first wafer 22, which was adjacent the removed side wafer 29, and assembles the removed wafer 22 with a spare side wafer 28. It is noted that the contactors 24—24, which are assembled within the cells 54—54 formed by the removed wafer 22, will remain with the wafer, thereby retaining the desired contactor assembly for that row of cells. The next succeeding wafer 22 is removed from the original stack and is assembled with the first removed wafer with the assembled contactors 24—24 remaining with the transferred wafer. This pattern is continued until the wafers 22—22 of the removed coupler unit 21 have been reoriented to facilitate proper color alignment of the wafers 22a—22e for proper mating with the other coupler unit 21 within the band 23. Hence, the wafer structure of the coupler units 21—21 readily facilitates reorientation of the colored wafers 22a—22e where such reorientation is necessary to accomplish the desired coupling.

It is to be noted that the color-code arrangement and related numerical designations disclosed herein is merely representative of one of many colors and numerical schemes which could be incorporated into such a color-code system. Further, the coupler unit 21 can be easily modified to facilitate the reception of other combinations and numbers of terminals and is thereby not limited to the arrangement disclosed herein.

Referring to FIG. 20, there is illustrated a coupler, designated generally by the numeral 120, which forms an alternative embodiment of the invention. The coupler 120 includes a pair of identical, laminated, universally color-coded coupler units, designated generally by the numeral 121. Each of the coupler units 121—121 includes a plurality of different colored, plastic, intermediate wafers, designated generally by the numeral 122. For the purposes of explanation, the wafers 122—122, which are shown in FIG. 20, have been numbered units 122a through 122e to indicate that the wafers are colored blue, orange, green, brown and slate, respectively. The wafers 122a through 122e of each coupler unit 121 are assembled with plastic side wafers, designated generally by the numerals 128 and 129. The assembled wafers 122—122 and side wafers 128 and 129 are then inserted into an associated, resilient plastic, inner band, designated generally by the numeral 123, which retains the wafers in compact, laminated arrangement. The coupler 120 can be utilized in the same manner and has all of the previously described advantages of the coupler 20 (FIG. 1) including all of the various color schemes, the preassembly of the coupler units at the manufacturing locations and protection of coupler elements during shipment.

Each coupler unit 121 is provided with a plurality of contactor-receiving cells, designated generally by the numeral 154, for supporting a plurality of contactors, designated generally by the numeral 124, for mating engagement with a corresponding plurality of contactors of a mating coupler unit.

Each of the contactors 124—124 may be connected to an associated one of a plurality of conductors 127—127 which form a portion of a cable, such as the unit cable 26 (FIG. 1). The mating coupler units 121—121 are assembled within a resilient, plastic, outer band, designated generally by the numeral 125, which retains the mating coupler units in the assembled relation. The conductors 127—127 may form twisted pairs within the unit cable 26 and have insulation in a color code scheme such as that previously described with respect to U.S. Pat. No. 3,031,524. The insulated conductors 127—127 would then be assembled with associated contactors 124—124 of the coupler units 121—121 formed by the colored wafers 122a—122e in accordance with the previously described color code scheme.

In addition, the side wafers 128 and 129 can be used in a color code scheme similar to that previously described wherein pairs of different colored binder types, which are wrapped helically about associated ones of a plurality of unit cables 26—26 of a multiple unit group, correspond to the colors of the side wafers 28 (FIG. 3) and 29 (FIG. 9) to identify the unit cable to which a particular coupler unit 21 (FIG. 2) is connected.

Referring to FIG. 21, there is illustrated one of the wafers 122—122 which are similar to the wafers 22—22 (FIGS. 6, 7 and 8). Each of the wafers 122—122 is formed with two major surfaces 130 and 135. A plurality of spaced, parallel slots, designated generally by the numeral 131, are formed in the surface 135. Each of the slots 131—131 includes a pair of spaced sidewalls 132 and 232 and a flat bed 133 which extends between the base of the sidewalls.

As illustrated in FIG. 22, one end of the flat bed 133 of each of the slots 131—131 is formed with a sloped trailing surface 134. The other end of the flat bed 133 of each of the slots 131—131 is formed with a transverse undercut 136 and a sloped forward surface 137. Referring again to FIG. 21, each of the wafers 122—122 is formed with keeper lugs 138 and 139 which project outwardly from opposite ends of the surface 135. In addition, a pair of conforming keeper notches 141 and 142 are formed in opposite ends of the surface 130 of each of the wafers 122—122. When the wafers 122—122 are assembled in a laminated stack to form the coupler unit 121, the keeper lugs 138 and 139 of each wafer fit into the conforming keeper notches 141 and 142, respectively, of the adjacent wafer to prevent relative shifting of the stacked wafers in any lateral direction.

Referring again to FIG. 22, a portion of the wall 132 of each of the slots 131—131 is formed with a cutaway 140 adjacent to the associated sloped surface 134. A contactor-locking groove 145 is also formed in each of the walls 132—132 adjacent to a portion of the flat bed 133 and is contiguous with the cutaway 140.

Referring now to FIG. 23, there is illustrated one of the contactors 124—124 which is formed in a manner similar to the forming of the contactors 24—24 (FIG. 14), as previously described. Each of the contactors 124—124 is formed with a long tine 159 and a short tine 161 and with a web section 162 which is integral with and extends between rearward, adjacent portions of the long and short tines. A tab 163, which is integral with and extends from the forward end of the web section 162, is folded to a position transversely between intermediate, spaced portions of the long and short tines 159 and 161, respectively. The web section 162, the tab 163 and the rearward, spaced adjacent portions of the long and short tines 159 and 161, respectively, which are contiguous with the web section, form a pocket, designated generally by the numeral 172, for receiving the bared end of an associated one of the conductors 127—127 (FIG. 20) which is subsequently soldered therewith.

Each of the contactors 124—124 are formed with a rearward, angled tab 167 which is contiguous with and extends rearwardly from the short tine 161. An intermediate portion of the long tine 159 of each of the contactors 124—124 is formed with an intermediate ramp 173 and the forward end of

the short time 161 is formed with a hooked ramp 174. Each of the contactors 124—124 are formed with a locking tab 175 which extends outwardly from a portion of the edge of the short time 161 adjacent to the pocket 172.

When the contactors 124—124 are assembled within the associated cells 154—154 (FIG. 20) of the stacked wafers 122—122, the hooked ramp 174 of each of the contactors is biased into a depression formed by the transverse undercut 136 and the upwardly sloped surface 137 which precludes rearward movement of the contactors unless the hooked ramp is biased upwardly out of the depression by some external means such as the needlelike implement previously mentioned. In addition, the rearward tab 167 of each of the contactors 124—124 engages the sloped surface 134 of the associated cells 154—154 to preclude continued forward movement of the contactors into the associated cells. As the contactors 124—124 are moved into the associated cells 154—154, the locking tab 175 of each of the contactors is moved into the contactor-locking groove 145 of each of the associated cells to prevent movement of the contactors out of the longitudinal opening of the associated slot 131 during periods when the wafers 122—122 are unstacked. In this manner, the contactors 124—124 are precluded from moving out of the associated cells 154—154 in any direction regardless of whether the wafers 122—122 are stacked or unstacked.

Referring to FIG. 24, there is illustrated the side wafer 128 which is formed at opposite ends thereof with through-notches 143 and 144. A keyway 150 is formed along one edge of one flat surface 155 of the side wafer 128 adjacent to the through-notch 143. A projection 146 extends outwardly from the flat surface 155 of the side wafer 128. A L-shaped slot 181 is formed centrally in two contiguous edges of the projection 146 of the side wafer 128. The projection 146 of the side wafer 128 is further formed with a pair of openings 182 and 183 which facilitate handling of the stacked wafers 122—122 and the side wafers 128 and 129 during assembly and disassembly of the coupler unit 121 with the outer band 125 and also reduces undesirable heat sink effects. The side wafer 128 is assembled with one side of the stack of laminated wafers 122—122 so that the keeper lugs 138 and 139 (FIG. 21) of the adjacent wafer fit into the keeper notches 143 and 144, respectively, of the side wafer. In addition, a flat surface 160 of the wafer 128 is positioned over the slots 131—131 (FIG. 20) of the adjacent wafer 122 to form the contactor-receiver cells 154—154.

Referring to FIG. 25, there is illustrated the side wafer 128 having a pair of projecting keeper lugs 149 and 151 which extend from opposite ends of a flat surface 184 of the side wafer. A projection 152 extends from another flat surface 186 of the side wafer 129 and is formed centrally with a L-shaped slot 187 in two contiguous edges thereof. The projection 152 of the side wafer 129 is also formed with a pair of openings 188 and 189 to reduce undesirable heat sink effects and to facilitate handling of the side wafer and the coupling unit 121 as previously described. The side wafer 129 is assembled with one side of the stack of laminated wafers 122—122 (FIG. 20) so that the keeper lugs 149 and 151 fit into the keeper notches 141 and 142, respectively, of the adjacent wafer.

Referring now to FIG. 26, there is illustrated the inner band 123 which is composed of a sleeve-like, four-sided structure having a central opening 191. One edge of each side of the inner band 123 is formed with two adjacent rows, designated generally by the numerals 192 and 193, of tapered teeth 194—194 which extend from associated edges of the band and generally in the plane of the edge. The teeth 194—194 of each of the rows 192 and 193 are spaced from the adjacent teeth in the same row and the teeth of one row are aligned with the space between the teeth of the adjacent row. Cutaways 196 and 197 are formed in edges of two opposite sides of the band 123 with separation notches 198 and 199, respectively, formed centrally in the cutaways. The inner band 123 is formed with a key 201 in one inner corner thereof and is formed with a keyway 202 in an outer corner thereof adjacent to the key.

The wafers 122—122 and the side wafers 128 and 129 are assembled in a stack, for example, in the same manner as the coupler unit 21 (FIG. 2) is assembled, to form the contactor-receiving cells 154—154. Thereafter, the contactors 124—124, with associated conductors 127—127 assembled therewith, may be inserted into the associated cells 154—154. However, the conductors 127—127 could be inserted into the associated cells 154—154 after the assembled, stacked wafers 122—122 and side wafers 128 and 129 have been inserted into the inner band 123.

The stacked wafers 122—122 and side wafers 128 and 129 are inserted snugly into the opening 191 of the inner band 123 so that the long time 159 of each of the contactors 124—124, which are assembled within the associated cells 154—154, are parallel with and project in the same general direction as the teeth 194—194 of the inner band. In addition, the keyway 150 of the side wafer 128 slides over and is guided by the key 210 formed in one inner corner of the inner band 123.

As illustrated in FIG. 20, base portions of the projections 146 and 152 of the side wafers 128 and 129, respectively, are positioned in, and the remaining portions of the projections extend from, the cutaways 196 and 197, respectively, of the inner band 123. The tip ends of the teeth 194—194 extend slightly beyond the tip ends of the long times 159—159 of the contactors 124—124 to provide protection for the contactors from any extraneous lateral forces.

As further illustrated in FIG. 20, when one coupler unit 121 is assembled with a mating coupler unit, the tapered, spaced teeth 194—194 of one of the inner bands 123—123 mesh into the associated spaces between the teeth of the mating inner band. Thus, the rows 192—192 and 193—193 of the teeth 194—194 of the mating coupler units 121—121 intermesh and overlay to absorb the inadvertent side pressures and safeguard the contactors 124—124 of the mating coupler units during closure of the mating units.

When the stacked wafers 122—122 and side wafers 128 and 129 are assembled within the inner band 123, base portions of the projections 146 and 152, which are positioned in the cutaways 196 and 197, respectively, of the inner band, cover the open side of each of the separation notches 198 and 199, respectively. If the stacked wafers 122—122 and side wafers 128 and 129, which are fitted tightly within the inner band 123, are to be removed from within the inner band, flat implements (not shown) are placed into the slots 198 and 199. The flat implements are then turned to separate the projections 146 and 152 from the slots 198 and 199, respectively, and thereby move the stacked wafers 122—122 and side wafers 128 and 129 partially out of the inner band 123. The projections 146 and 152 of the side wafers 128 and 129, respectively, of each coupler unit 121 can then be gripped manually in the areas of the side wafer openings 182, 183 and 188, 189, respectively, to withdraw the wafers 122—122 and side wafers completely from within the inner band 123.

Referring to FIG. 27, there is illustrated the outer band 125 consisting of a rectangular, tubular structure having a central opening 203. A key 204 is formed in a portion of one inner corner of the outer band 125 and extends from one edge of the band to an intermediate portion thereof. Another key 206 is formed in an adjacent inner corner of the outer band 125 and extends from the opposite edge of the band to an intermediate portion thereof. Cutaways 207—207 are formed in opposite edges of opposed walls of the outer band 125. Each of the cutaways 207—207 are formed with a pair of separation notches 208—208 which are spaced apart by a raised surface 209.

The outer band 125 is formed with a pair of slots 210—210 for receiving and supporting for rotation therein a pair of keeper springs, designated generally by the numeral 211. Each of the keeper springs 211—211 is formed with a shank portion 212 and eyeletted ends 213—213. Intermediate portions of the shank portions 212—212 of the keeper springs 211—211 can be inserted into the associated slots 210—210 of the outer band 125 by moving the walls of the band, which include the slots, inwardly toward each other so that the mouth of each of the slots is opened substantially. The shank portions 212—212

of the keeper springs 211—211 are then inserted into the associated open slots 210—210 and the outer band 125 is released so that the keeper springs are captured within the associated slots but are free to rotate and slide therewithin. The eyeletted ends 213—213 of each of the keeper springs 211—211 extend outwardly from associated raised surfaces 209—209 of the outer band 125.

As an alternative, the keeper springs 211—211 can be molded with the outer band 125 but should be pretreated with a cadmium plating and a mold release compound so that the keeper springs are permitted to rotate and slide freely within their molded confinement.

After the coupler units 121—121 have been formed, mating coupler units, including the associated bands 123—123, can be inserted into opposite sides of the outer band 125 as shown in FIG. 20. However, prior to the inserting of the coupler units 121—121 into the outer band 125, the keeper springs 211—211 of the outer bands 125—125 must be turned partially so that the associated eyeletted ends 213—213 extend outwardly from the side of the band and clear of the path of the coupler units during the inserting of the units into the outer band. The coupler units 121—121 are then inserted snugly into the associated outer band 125 but not so snugly as the fit of the wafers 122—122 and side wafers 128 and 129 within the associated inner band 123. As the mating coupler units 121—121 are inserted into the outer band 125, the keyway 202 of the inner band 123 of one coupler unit slides over the key 204 of the outer band and the keyway of the inner band of the mating coupler unit slides over the key 206 of the outer band. As the two mating coupler units 121—121 are moved together within the outer band 125, the teeth 194—194 of the inner bands 123—123 of the mating coupler units intermesh and absorb the forces being exerted upon the coupler units during the mating assembly thereof. As the teeth 194—194 of the associated inner bands 123—123 of the mating coupler units 121—121 intermesh, the contactors 124—124 of the mating coupler units are moved into contacting engagement as shown in FIG. 20 and as previously described with respect to FIG. 18.

As the mating coupler units 121—121 are moved into the assembled relation within the outer band 125, end portions of the projections 146—146 and 152—152 of the side wafers 128—128 and 129—129, respectively, are moved into associated ones of the cutaways 207—207 formed in the outer band. In addition, the slots 181—181 and 187—187 of the wafers 128—128 and 129—129, respectively, move over adjacent portions of the shank portions 212—212 of the associated keeper springs 211—211 until one end of each of the projections engages an associated one of the raised surfaces 209—209 in the cutaways 207—207 of the outer band 125. The end portion of the mating coupler units 121—121 having the associated conductors 127—127 extending therefrom is then flush with the associated edge portions of the outer band 125.

In addition, a small opening is formed where the projections 146—146 and 152—152 of the side wafers 128—128 and 129—129, respectively are positioned adjacent to associated ones of the separation notches 208—208 of the outer band 125. Thereafter, the keeper springs 211—211 are rotated partially so that the eyeletted ends 213—213 of the rods are biased into associated keeper recess portions of the slots 181—181 and 187—187 of the side wafers 128—128 and 129—129, respectively, to latch the mating assembled coupler units 121—121 within the outer band 125 to form the coupler 120 as shown in FIG. 20.

Referring to FIG. 28, there is illustrated a shipping cover, designated generally by the numeral 214, which is composed of an insulating material and has a substantially flat portion 215 with a centrally upstanding finger grip and latching wall 216. The latching wall 216 is formed with a pair of keeper depressions 217—217 along the edge of opposite, outer corner portions thereof. Side portions 218—218 extend downwardly from the edges of the flat portion 214 to form an inner enclosure 219 with the underside of the flat portion 215.

Keyways 221—221 are formed in each of the four outer corners of the side portions 218—218. Cutaway portions 222—222 are formed in the sides of each of the side portions 218—218 of the shipping cover 213 and are cut away at a depth which is equal to twice the thickness of one of the teeth 194—194 of the inner band 123.

Prior to shipping the cable 26 (FIG. 1), and after the coupler units 121—121, which are assembled with the cable, have been inserted into one end of associated ones of the outer bands 125—125, one of the shipping covers 214—214 is then inserted into the other end of each of the outer bands which is shown partially in phantom view in FIG. 28. Depending upon which end of the outer band 125 the associated coupler unit 121 is inserted into, one of the corner keyways 221—221 of the shipping cover 214 moves over the key 204 or the key 206 of the associated outer band when the cover is inserted into the band. In addition, the cutaway portions 222—222 of the side portions 218—218 of the shipping cover 214 are positioned over the extended ends of the plurality of teeth 194—194 of the rows 192 and 193 of the teeth of the associated inner band 123 which is also shown partially in phantom view in FIG. 28.

The inner enclosure 219 of the cover 214 is positioned protectively over and spaced from the extended ends of the long ties 159—159 of the contactors 124—124. The free-end edges of the side portions 218—218 of the covers 214—214 rest on the flush outer surface of the associated coupler unit 121 to facilitate the complete enclosure of the extended end portions of the long ties 159—159 of the contactors 124—124.

When the shipping covers 214—214 have been properly inserted into the open end of the associated ones of the outer bands 125—125, the latching wall 216 of each cover is positioned so that the keeper depressions 217—217 are positioned adjacent to the eyeletted ends 213—213 of the associated keeper springs 211—211. The keeper springs 211—211 are then rotated partially to position one of the eyeletted ends 213—213 of each of the keeper springs into an associated one of the keeper depressions 217—217 formed in the latching wall 216 of the shipping cover 214. In addition, as the keeper springs 211—211 are rotated partially, the eyeletted ends 213—213 at the opposite ends of the rods are moved into the associated slots 181 and 187 of the side wafers 128 and 129, respectively, of the coupler unit 121 as shown in the upper portion of FIG. 20. Each of the shipping covers 214—214 is now latched with the associated coupler unit 121 and the associated outer band 125 and protects the contactors 124—124 of the associated coupler unit during shipment of the assembly to another location.

What is claimed is:

1. An electrical coupler for connecting color-coded conductors, which comprises:
 - a pair of mating, identical coupler units,
 - each unit including a plurality of different colored, laminate wafers stacked in a selected color-coded pattern having colors corresponding to the colors of insulation of the conductors, the stacked wafers forming contactor-receiving cells within each wafer, and
 - a plurality of contactors within the respective cells, the contactors having a corresponding plurality of the color-coded conductors secured therewith, each color-coded conductor having insulation of a given color secured to a contactor occupying the cell formed by the wafer of the same given color, so that when the coupler units are brought together, the colored wafers of one unit are aligned with the mating wafers of the same colors and the color-coded conductor groups secured to one coupler unit are connected to corresponding color-coded conductor groups secured to the mating coupler unit.
2. An electrical coupler as set forth in claim 1 which includes:
 - each wafer being formed with at least one slot having opposed spaced sidewalls,
 - the slots of the stacked wafers forming the contactor-receiving cells,

one sidewall of each slot of the wafers being formed with a contactor-locking groove, and

a tab formed on each contactor and positioned so that the tab is inserted into the contactor-locking groove when the contactor is inserted into the associated cell of the coupler unit to preclude movement of the contactor out of the longitudinal opening of the associated slot during a period when the wafers are unstacked.

3. The electrical coupler as set forth in the claim 1 which includes:

a pair of resilient inner bands for receiving therewithin associated stacks of the laminated wafers which are keyed and supported in an assembled relation.

4. The electrical coupler as set forth in claim 3 which includes:

each of the contactors being formed with long tines which extend from associated cells of the associated coupler unit, and

the resilient inner bands being formed with means for protecting end portions of the long tines of the contactors which extend from associated cells.

5. The electrical coupler as set forth in claim 4 wherein the means for protecting the long tines of the contactors includes:

at least a pair of rows of spaced teeth which extend from one edge of the resilient inner bands in a direction parallel with the direction of extension of the long tines of the contactors with the ends of the teeth extending a distance beyond the ends of the long tines so that the contactor ends of the long tines are protected from lateral forces and so that the spaced teeth of the inner bands of each coupler unit intermesh with the spaced teeth of the mating coupler unit and absorb pressures exerted upon the coupler unit when the units are assembled together.

6. The electrical coupler as set forth in claim 3 which includes:

a resilient outer band for receiving within opposite ends the mating identical coupler units including the stacked wafers and the associated inner bands which are keyed in a position so that the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

7. The electrical coupler unit as set forth in claim 6 wherein the resilient outer band includes latching means for locking the assembled mating coupler units within the outer band.

8. The electrical coupler as set forth in claim 7 wherein the means for latching the coupler units within the outer band includes:

a pair of springs having shank portions attached to the outer band for movement relative to the band, and
the ends of the springs being deformed structurally to fit into associated complementary portions of the coupler units after the coupler units have been assembled within the outer band so that the coupler units are locked within the outer band.

9. An electrical coupler for connecting color-coded conductors, which comprises:

a pair of identical mating coupler units,
each unit including a plurality of different colored, laminate wafers having colors corresponding to the colors of insulation of the conductors, the wafers being stacked in a selected color-coded pattern and having contactor-receiving cells therein, and

a plurality of contactors within the respective cells, pairs of the contactors having color-coded pairs of conductors secured therewith, at least one conductor of each conductor pair having colored insulation of color corresponding to one of the wafer colors, each of the conductors having insulation of a wafer color being secured to the contactor which occupies one of the cells formed by the wafer of the same color, the other conductor of the conductor pair being secured with a contactor which occupies the adjacent cell formed by the same wafer, so that when the coupler units are brought together the colored wafers of one unit are aligned with the mating wafers of

the same colors and the color coded pairs of conductors of one coupler unit are connected to the identically color-coded pairs of the mating coupler unit.

10. An electrical coupler for connecting color-coded conductors, which comprises:

a pair of mating, identical coupler units,
each unit including a plurality of stacked laminate wafers of different colors corresponding to the colors of insulation of the conductors, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers being assembled in a predetermined color-code arrangement, whereby the grooves of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,

a plurality of contactors within the cells of each coupler unit, the contactors formed with tines which extend from the assembly and are received by cells of the mating identical coupler unit, the contactors provided with a pocket for receiving conductors having different colored insulation thereon, whereby the colors of the insulation correspond to the different colors of the laminate sections of the coupler unit so that the conductors having a given colored insulation may be attached to contactors inserted into one of the cells formed by the laminate wafer of the same color,

a resilient band for receiving within opposite ends the mating, identical coupler units, and

means formed in the band for keying the coupler units in an assembled relation within the band so that the colored wafers of one unit are aligned with the mating wafers of the same colors and the color-coded conductors of one coupler unit are connected to corresponding color-coded conductors of the mating coupler unit.

11. An electrical coupler for connecting color-coded conductors, which comprises:

a pair of identical, mating coupler units,
each unit including a plurality of different colored wafers formed from a first group of colors, the wafers being stacked in a selected color-coded pattern and having a row of contactor-receiving cells within each wafer, and
a plurality of contactors within the respective cells of the coupler unit, a plurality of pairs of the contactors secured with a plurality of pairs of conductors, one conductor of each pair having colored insulation with a color of the first group, the other conductor of each pair having colored insulation with a color of the second group, the conductors having insulation color of the first group secured with contactors occupying cells formed by the wafer of the same color, the conductors having insulation color of the second group secured with contactors occupying the adjacent cells formed by the same wafer, so that when the coupler units are brought together the colored wafers of one unit are aligned with the mating wafers of the same colors and the color-coded pairs of conductors of one coupler unit are connected to the identically color-coded pairs of the other coupler unit.

12. An electrical coupler for connecting color-coded conductors, which comprises:

a pair of identical, mating coupler units,
each unit including a plurality of different colored wafers formed from a first group of colors which corresponds to a first of two groups of colors of insulation of the conductors, the wafers being stacked in a selected color-coded pattern, each of the stacked wafers forming a row of contactor-receiving cells, the cells of the stacked wafers forming columns of cells perpendicularly disposed from the rows of cells, and

a plurality of contactors within the respective cells, a plurality of pairs of the contactors secured with a plurality of color-coded pairs of conductors, a first conductor of each

conductor pair having an insulation color of the first of the two groups of colors, a second conductor of each conductor pair having an insulation color of the second of the two groups of colors, the first conductor of the pairs of conductors having insulation color of the first group secured with contactors occupying alternate cells of the row of cells formed by the wafer of the same color, the second conductor of the pairs of conductors having insulation color of the second group of colors secured with contactors occupying alternate columns of cells formed by cells not occupied by the first contactors of each pair, so that when the coupler units are brought together the colored wafers of one unit are aligned with the mating wafers of the same colors and the color-coded pairs of conductors of one coupler unit are connected to the identically color-coded pairs of the other coupler unit.

13. An electrical coupler for connecting color-coded conductors, which comprises:

- a pair of mating, identical coupler units,
- each unit including a plurality of stacked laminate wafers of different colors, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, the laminate wafers being formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers being assembled in a predetermined color-code arrangement so that the slots of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,
- each unit including a pair of different colored side wafers assembled on each stacked side of the stacked, laminate wafers,
- a plurality of contactors within the cells of each coupler unit, the contactors formed with tines which extend from the assembly and are received by cells of the mating, identical coupler unit, the contactors provided with a pocket for receiving conductors of a unit cable of a multiple unit group, the conductors having different colored insulation thereon which corresponds to the different colors of the laminate sections of the coupler unit, the conductors having a given colored insulation being secured with the contactors inserted into the cells formed by the wafer of the same color, the conductors of each unit cable being bound by a pair of different colored tapes having the same colors as the colors of the side wafers, the colored tapes of each cable of the multiple group being a different color combination relative to the tapes of the other cables of the group, so that the coupler unit of the color-coded conductors of one unit cable are distinguishable from the coupler unit of the conductors of another unit cable within the multiple unit group, and
- a resilient band for receiving within opposite ends the mating, identical coupler units, whereby the laminate wafers of each coupler unit are held in an assembled relation within the band and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

14. An electrical coupler, which comprises:

- a pair of mating, identical coupler units,
- each unit including a plurality of stacked laminate wafers, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers assembled so that the slots of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,
- a plurality of interchangeable contactors self-secured within the cells of each contactor-supporting coupler unit, the contactors formed with tines which extend from the unit and are received by cells of the mating, identical coupler unit,

means formed on the contactors for receiving conductors secured therewith,

means formed on each contactor for facilitating the removal of the contactor from within the cell of the supporting coupler unit so that the contactors and conductors secured therewith may be interchanged relative to the coupler unit, and

a resilient band for receiving within opposite ends the mating, identical coupler units whereby the laminate wafers of each coupler unit are keyed in an assembled relation and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

15. An electrical coupler, which comprises:

- a pair of mating, identical coupler units,
- each unit including a plurality of stacked laminate wafers, each wafer having a series of parallel, spaced slots formed on a first major surface thereof and a flat face formed on an opposite major surface thereof, each wafer formed with keeper lugs at opposite ends of the first major surface and keeper notches at opposite ends of the opposite major surface, the wafers stacked so that the keeper lugs of each wafer fit into the keeper notches of the adjacent wafer to preclude relative lateral movement, the stacked laminate wafers assembled so that the slots of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,

a plurality of contactors self-secured within the cells of each coupler unit, the contactors formed with tines which extend from the assembly and are received by cells of the mating, identical coupler unit,

means formed on the contactors for receiving conductors secured therewith, and

a resilient band for receiving within opposite ends the mating, identical coupler units whereby the laminate wafers of each coupler unit are keyed in an assembled relation and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

16. An electrical coupler, which comprises:

- a pair of mating, identical coupler units,
- each unit including a plurality of stacked laminate wafers, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers assembled so that the slots of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,

a plurality of contactors self-secured within the cells of each contactor-supporting coupler unit, each of the contactors formed with a long tine which extends from the unit and is received by one of the cells of the mating, identical coupler, each long tine formed with a ramp intermediate the ends thereof positioned within the cell of the supporting unit, each of the contactors formed with a short time spaced from, and parallel with, the long time, each short time formed with a ramp on the leading end thereof positioned within the cell between the contactor end of the supporting coupler unit and the long time ramp, whereby the long tines of each coupler unit are flexed and engaged by the ramps of the respective short and long tines of the mating coupler unit and are flexed into engagement with an intermediate portion of the respective long tines of the mating coupler unit,

means formed on the contactors for receiving conductors secured therewith, and

a resilient band for receiving within opposite ends the mating, identical coupler units whereby the laminate wafers of each coupler unit are keyed in an assembled relation and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

17. An electrical coupler, which comprises:

a pair of mating, identical coupler units,

each unit including a plurality of stacked laminate wafers, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, each of the slots formed with an undercut at one common end and a sloped surface at the opposite end, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers assembled so that the slots of one wafer are positioned adjacent the flat face of an adjacent wafer to form a plurality of contactor-receiving cells,

a plurality of interchangeable contactors positioned within the cells of each contactor-supporting coupler unit, each of the contactors formed with a contacting end for engaging contactors of the mating coupler unit and a conductor-receiving end for receiving conductors secured therewith, each contactor formed with a locking hook at the contacting end thereof which is flexed into engagement with the slot undercut to preclude contactor movement toward the conductor end of the contactor, each contactor formed with a tab at the conductor end thereof which engages the sloped surface of the slot to preclude contactor movement toward the contacting end of the contactor, whereby the contactors are self-secured within the cells of the coupler unit, each locking hook being accessible from the contacting end of the coupler unit so that the locking hook may be flexed from engagement with the slot undercut and withdrawn from the cell of the stacked wafers to facilitate interchangeability of the contactors and the conductors secured therewith, and

a resilient band for receiving within opposite ends the mating, identical coupler units whereby the laminate wafers of each coupler unit are keyed in an assembled relation and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

18. An electrical coupler, which comprises:

a pair of mating, identical coupler units,

each unit including a plurality of stacked laminate wafers, each wafer having a series of parallel, spaced slots formed on one surface thereof and a flat face formed on the opposite surface thereof, each slot having a bed extending between opposed sidewalls, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers assembled so that the slots of one wafer are positioned adjacent the flat face of the adjacent wafer to form a plurality of contactor-receiving cells,

a plurality of contactors self-secured within the cells of each contactor-supporting coupler unit, each contactor formed with a pocket having opposed sidewalls for receiving conductors secured therewith, each contactor formed with a long tine which integrally extends from one sidewall of the pocket toward a contacting end of the contactor, each contactor formed with a short tine which extends from the opposite sidewall of the pocket toward the contacting end of the contactor, the long tine of each contactor flexed against a wall of the cell formed by the flat face of the adjacent wafer, the short tine of each contactor flexed against the bed of the respective slot, whereby the tines are flexed apart to facilitate the reception and engagement of the contactor end of the long tine of the mating coupler unit with the long and short tines of the supporting coupler unit, and

a resilient band for receiving within opposite ends the mating, identical coupler units whereby the laminate wafers of each coupler unit are keyed in an assembled relation and the contactors of each coupler unit are held in contacting engagement with the contactors of the mating coupler unit.

19. An electrical coupler as set forth in claim 18, wherein:

each of the long tines is formed with a ramp intermediate the ends thereof which is positioned within the cell of the supporting coupler unit, each of the short tines is formed with a ramp at the contactor end thereof which is positioned within the cell of the supporting coupler, whereby the long tine of the mating coupler unit is flexed between, and engages, the ramps and is flexed into engagement with an intermediate portions of the long tine of the supporting coupler unit thereby facilitating multiple contacting engagement between mating contactors of the mating coupler units.

20. An electrical coupler as set forth in claim 18, wherein:

the slot beds of each wafer are formed with an undercut at one common end thereof and a sloped surface at the opposite end thereof, the contactor end of each short tine formed with a locking hook, and a tab angularly extending from the conductor end of the pocket wall which is integral with the short tine, the locking hook flexed into the slot undercut to preclude contactor movement toward the conductor end of the coupler unit and the angularly disposed tab being in engagement with the sloped surface to preclude contactor movement toward the contactor end of the coupler unit, whereby each contactor is removably self-secured within one of the coupler unit cells.

21. An electrical coupler unit for assembly with a mating coupler unit, which comprises:

a plurality of stacked laminate wafers, each wafer having at least one slot formed on one surface thereof, each slot having a bed extending between opposed sidewalls, the laminated wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked wafers assembled so that the slot of each wafer is positioned adjacent to an associated portion of a flat face of the adjacent wafer to form a conductor-receiving cell,

a plurality of contactors self-secured within the cells of the coupler unit, each contactor formed with a pocket having opposed sidewalls for receiving conductors secured therewith, each contactor formed with a long tine which extends integrally from one sidewall of the pocket toward a contacting end of the contactor, each contactor formed with a short tine which extends integrally from the opposite sidewall of the pocket toward the contacting end of the contactor, the long tine of each contactor flexed against a wall of the associated cell formed by the flat face of the adjacent wafer, the short tine of each contactor flexed against the bed of the associated slot so that the tines are flexed apart to facilitate the reception and engagement of the contactor end of the long tine extending from the mating coupler unit, and

a resilient band for receiving the stacked, laminate wafers within one end thereof with the wafers being keyed in an assembled relation and the contactors of the coupler unit held in a position so that the long tines of the contactors can engage associated contactors of the mating coupler unit.

22. An electrical coupler unit as set forth in claim 21, which includes:

one sidewall of each slot of the wafers being formed with a contactor-locking groove, and

a tab formed on each contactor and positioned so that the tab is inserted into the contactor-locking groove when the contactor is inserted into the associated cell of the coupler unit to preclude movement of the contactor out of the longitudinal opening of the associated slot during a period when the wafers are unstacked.

23. The electrical coupler unit as set forth in claim 21 wherein the resilient band includes:

means for protecting the contactor end portions of the long tines of the contactors which extend from associated cells.

24. The electrical coupler unit as set forth in claim 23 wherein the means for protecting the long tines of the contactors includes:

at least a pair of rows of spaced teeth which extend from one edge of the resilient band in a direction parallel with the direction of extension of the long tines of the contactors with the ends of the teeth extending a distance beyond the ends of the long tines and the teeth of each row being positioned adjacent to an associated one of the spaces between the teeth of the adjacent row so that the contactor ends of the long ties are protected from lateral forces.

25. An electrical coupler, which comprises:

a pair of mating, identical coupler units,

each unit including a plurality of stacked laminate wafers, each wafer having at least one slot formed on one surface thereof, each slot having a bed extending between opposed sidewalls, the laminate wafers formed with complementary interlocking structure to preclude relative lateral movement, the stacked laminate wafers assembled so that the slot of each wafer is positioned adjacent to a flat face of the adjacent wafer to form a contactor-receiving cell,

a plurality of contactors self-secured within the cells of each contactor-supporting coupler unit, each contactor formed with a pocket having opposed sidewalls for receiving conductors secured therewith, each contactor formed with a long tine which extends integrally from one sidewall of the pocket toward a contacting end of the contactor, each contactor formed with a short tine which extends integrally from the opposite sidewall of the pocket toward the contacting end of the contactor, the long tine of each contactor flexed against a wall of the cell formed by the flat face of the adjacent wafer, the short tine of each contactor flexed against the bed of the respective slot, whereby the ties are flexed apart to facilitate the reception and engagement of the contactor end of the long tine extending from the mating coupler unit,

a pair of resilient inner bands for receiving therewithin associated stacks of the laminated wafers which are keyed in an assembled relation, and

a resilient outer band for receiving within opposite ends the mating identical coupler units including the stacked wafers and the associated inner bands which are keyed in a position so that the contactors of each coupler unit are

held in contacting engagement with the contactors of the mating coupler unit.

26. An electrical coupler as set forth in claim 25 which includes:

one sidewall of each slot of the wafers being formed with a contactor-locking groove, and

a tab formed on each contactor and positioned so that the tab is inserted into the contactor-locking groove when the contactor is inserted into the associated cell of the coupler unit to preclude movement of the contactor out of the longitudinal opening of the associated slot during a period when the wafers are unstacked.

27. The electrical coupler as set forth in claim 25 wherein each of the resilient inner bands includes:

means for protecting the contactor end portions of the long tines of the contactors which extend from associated cells.

28. The electrical coupler as set forth in claim 27 wherein the means for protecting the long tines of the contactors includes:

at least a pair of rows of spaced teeth which extend from one edge of each of the resilient inner bands in a direction parallel with the direction of extension of the long tines of the contactors with the ends of the teeth extending a distance beyond the ends of the long tines so that the contactor ends of the long tines are protected from lateral forces and so that the spaced teeth of the inner bands of each coupler unit intermesh with the spaced teeth of the mating coupler unit and absorb pressures exerted upon the coupler unit when assembled within the outer band.

29. The electrical coupler as set forth in claim 25 wherein the resilient outer band includes latching means for locking the assembled mating coupler units within the outer band.

30. The electrical coupler as set forth in claim 29 wherein the means for latching the coupler units within the outer band includes:

a pair of keeper springs having shank portions attached for movement to the outer band, and

the ends of the springs being deformed structurally to fit into associated complementary portions of the coupler units after the coupler units have been assembled within the outer band so that the coupler units are locked within the outer band.

UNITED STATES PATENT OFFICE CERTIFICATE OF CORRECTION

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Inventor(s) VINCENT A. RAYBURN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the specification, Column 3, line 53, "2" should read --6--.
Column 7, line 23, "he" should read --the--. Column 8, line 35 opposite "Contactor Number 3" under "Segment Number" should read --X--. Column 8, line 45, opposite "Contactor Number 13" under "Segment Number" should read --VIII--. Column 8, line 65 opposite "Contactor Number 43" under "Segment Number" should read --II--. Column 8, line 65, under "Contactor Number" should read --45-- following Number 46. Column 9, line 14, "2" should read --26--. Column 9, line 71, "f" should read --of--. Column 12, line 2 "ties" should read --tines--. Column 14, line 17, "types" should read --tapes--. Column 14, line 28, "he" should read --the--. Column 15, line 21, "he" should read --the--. Column 15, line 47, "128" should read --129--. Column 16, line 17, "210" should read --201--. Column 16, line 61, "he" should read --the--. Column 16, line 67, "nd" should read --and--. Column 16, line 69, "sank" should read --shank--. Column 17, line 24, "s" should read --as--. Column 17, line 46, "nd" should read --and--. Column 18, line 25, "ties" should read --tines--. Column 23, line 63, of Claim 18, "he" should read --the--. Column 24, line 36, of Claim 21 "o" should read --to--. Column 25, line 11 of Claim 24, "ties" should read --tines--. Column 25, line 35 of Claim 25, "ties" should read --tines--.

Signed and sealed this 11th day of February 1975.

(SEAL)

Attest:

RUTH C. MASON
Attesting Officer

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Commissioner of Patents
and Trademarks