FLAT CABLE CONNECTOR

Inventor: Robert F. Dorrell, Des Plaines, Ill.

Assignee: Bunker Ramo Corporation, Oak Brook, Ill.

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This invention provides a connector for flat multiconductor cable. Cables to be connected are inserted into slots on opposite sides of a housing, there being an upper and a lower contact adjacent the slot for each cable conductor to be mated. Each upper and lower contact has a pointed projection for each cable to be joined which projections pierce the insulation of the cable when the upper and lower contacts are driven together, thereby pinching the conductor of the cable therewith to assure good physical and electrical contact of the cable connector with the connector contacts. If there is a metallic ground shield on the cable, an extra pair of contacts is provided adjacent the slot which contacts have teeth for engaging the shielding. In first embodiments of a connector in accordance with the invention, the upper and lower contacts are driven together by commonly actuated eccentrically mounted cams. In second embodiments of a connector in accordance with the invention, the upper and lower contacts are driven together by a heat activatable memory driving member made of a specially chosen memory alloy, such as 55-Nitinol. This memory driving member is provided with original and intermediate shapes chosen so that the upper and lower contacts will be driven together upon the application of moderate amounts of heat.

Primary Examiner—Roy D. Frazier
Assistant Examiner—Terrell P. Lewis
Attorney, Agent, or Firm—William Lohff, F. M. Arbuckle

23 Claims, 16 Drawing Figures
FLAT CABLE CONNECTOR

RELATION TO OTHER APPLICATIONS

This patent application is a continuation-in-part of my commonly assigned copending patent application Ser. No. 310,059, filed on Nov. 28, 1972, now U.S. Pat. No. 3,824,529.

BACKGROUND OF THE INVENTION

This invention relates to a connector for flat multi-conductor cable. Existing flat cable connectors are of two general types. Most of these connectors require that the cable insulation be removed from at least a portion of the cable to expose the cable conductors. Exposed conductors are then mounted in the connector in contact with exposed conductors of the cable to be connected to or with electrical contacts of the connector. While these connectors may be relatively simple and inexpensive in construction, they have the disadvantage of requiring prestripping of the cable. Since this prestripping must frequently be done with fairly high precision in order to prevent damage to the conductors and for the cable to fit properly into the connector, prestripping of the cable is a difficult, time consuming, and therefore expensive operation.

In order to overcome the need for prestripping cable, insulation piercing flat cable connectors have been developed. These connectors, however, have generally been bulky, expensive and complicated to use, frequently requiring the use of specialized tools in order to secure the cable in the connector. Additional connection operations are also frequently required in order to electrically connect cable shielding, where this exists, to ground contacts of the connector.

From the above it is clear that a need exists for an insulation piercing flat cable connector which is (1) quick and simple to operate, (2) relatively simple in design and thus inexpensive to manufacture, and (3) which permits electrical connection to be made to ground shield of a cable as part of the same operation during which electrical connection is made to the conductors of the cable.

SUMMARY OF THE INVENTION

In accordance with the above, this invention provides a connector for flat cables which cables each have at least one insulation covered conductor. The connector includes a housing having at least one cable receiving slot. A moveable contact is mounted in the housing adjacent the slot, a separate moveable contact being provided for each conductor of the cable. There is a pointed projection on each contact for each of the cables to be joined, the projections being on the side of the contact adjacent the slot.

In first preferred embodiments of the invention, a cam follower surface is provided on the opposite side of each contact for cooperative action with a cam eccentrically mounted in the housing for each of the moveable contacts, each cam being rotatable between an inoperative and an operative position. When in its operative position, each cam coacts with the cam follower surface of the corresponding moveable contact to drive the contact against cable positioned in the slot. When this occurs, the projections on the contacts pierce the cable insulation to make physical and electrical contact with the corresponding conductors of the cable. A second fixed contact is preferably provided on the opposite side of the slot from each moveable contact, with the conductor of the cable being pinched between projections on the fixed and moveable contacts when the cam is in its operative position. The cams for all the contacts are joined together and are operated by a single means, such as, for example, a common shaft. An additional moveable contact may be provided having projections adapted to engage the cable shield. This additional contact is operated by a cam mounted on the same shaft as the other cams.

In second preferred embodiments of the invention, a heat-activatable memory driving member made of a material having controllable memory properties is employed for driving the contacts together instead of the camming structure used in the first preferred embodiments. This memory driving member is made of a specially chosen metallic alloy, such as 55-Nitinol, having the property that, after being set to an original shape at a predetermined elevated temperature, the alloy can then be deformed at a lower temperature into a desired intermediate shape. By application of moderate amounts of heat, the alloy can be returned to the original shape while exerting considerable force. In these second preferred embodiments of the invention, the memory member is incorporated in the connector in a particularly advantageous manner with original and intermediate shapes of the memory driving member being chosen so as to permit reliably providing the desired electrical connections between the respective conductors using a simple and economical overall connector construction. A disconnection feature may also advantageously be provided by choosing the alloy employed for the memory driving member so that by the application of appropriate cooling, sufficient relaxation of the memory driving member may be obtained to permit removal of the inserted cables.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a pair of stacked connectors of this invention.

FIG. 2 is a partially broken away view along line 2—2 of FIG. 1.

FIGS. 3, 4 and 5 are sectional views along the line 3—3 of FIG. 2 showing respectively the connector before cable is inserted therein, after cable is inserted therein but before the cam is operated, and with the cable in the connector and the cam operated.

FIG. 6 is a front sectional view of a slightly modified embodiment of the invention.

FIG. 7 is a sectional view along the line 7—7 of FIG. 6 showing the modified form of the invention with a shielded cable in the connector and the cam operated.

FIG. 8 is a view similar to FIG. 2 illustrating another preferred embodiment of the invention employing a memory driving member instead of the camming structure used in the embodiments of FIGS. 1—8.

FIGS. 9—12 are sectional views along the line 9—9 of FIG. 8 showing respectively the connector before cable is inserted therein, after cable is inserted therein but before the memory driving member is activated, and
with the cable in the connector and the driving member activated.

FIGS. 13 and 14 are sectional views respectively similar to FIGS. 10 and 12 illustrating another embodiment of a connector employing a modified form of memory driving members.

FIGS. 15 and 16 are fragmentary front sectional views with FIG. 16 being exploded, illustrating a further modification of the invention.

**DETAILED DESCRIPTION**

The first preferred embodiments of the invention illustrated in FIGS. 1–7 which employ camming driving means will now be considered.

Referring initially to FIGS. 1, 2, and 3, it is seen that the connector 10 consists of a housing of dielectric material which is divided into an upper housing section 12A and a lower housing section 12B. Sections 12A and 12B may be snap-fitted together with projections 14 on section 12B fitting into grooves 16 or section 12A. In the alternative, the sections may be bolted together, glued together, fused together by the application of heat and pressure after assembly, or held together by any other suitable means. Grooves formed in each of the sections form a cable receiving slots 18 which extend into the center of the connector housing from each end. Flat cables 20 having conductors 22 surrounded by insulation 24 are inserted into the slots 18, with the two cables to be connected being inserted into the slots on opposite sides of the housing.

As may be best seen in FIGS. 2 and 3, there is a cavity 26 formed in housing 12B adjacent slot 18 for each conductor 22 of the cable. Aa lower contact 28 having at each of its ends an angled leading surface 31 terminating in pointed projection 30 is positioned in each of the cavities 26. There is also a cavity 32 formed in upper housing 12A for each conductor 22. An upper contact 34 is positioned in each cavity 32 and is free to move laterally therein. Referring to FIG. 3 it is seen that each contact 34 has an upper cam surface 36, the function of which will be described shortly, and angled leading surfaces 38 at each of its ends, each of which angled surfaces terminates in a pointed projection 40. Projections 40 normally extend through a slot 18 into partial engagement with the corresponding projections 30 and contact 28.

Extending through upper housing section 12A is a channel 41 having enlarged portions 43 adjacent each of the slots 32. Channel 41 extend above and perpendicular to slot 18. A shaft 46 is positioned in channel 41. Cams 42, eccentrically mounted on shaft 46, are positioned in each extended portion 43. Cams 42 and shaft 46 are preferably of a metallic material with a dielectric coating 44, the metallic material providing strength and the dielectric coating electrical insulation. However, cams of a hard dielectric material may also be utilized. Attached to one end of shaft 46 is a square-shaped knob 48 having affixed thereto a circular flange 50. Grooves 52 spaced 180° apart are formed in flange 50. Attached to housing 12A is a spring 54 having resilient detenting projections 56 at either end and an opening at its center through which shaft 46 projects. At least one wall of slot 52 is chamfered or angled so as to provide a camming surface to remove projection 56 from slot 52 when knob 48 is turned to rotate shaft 46. Slots 52 and spring 54 provide two stable, easily recognized positions, 180° apart, in which cams 42, shaft 46 and knob 48 may be positioned and held.

To assemble the connector shown in the figures, contacts 28 are first placed into cavities 26 of lower housing 12B. Contacts 34 are then positioned and nested on top of contacts 28. Next, upper housing 12A is placed over the projecting surfaces of contacts 28, projections 14 fitting into openings 16 to assure proper orientation between the two housing sections. As indicated previously, the two housings are secured together by snap-fitting, bonding, fusing, or other suitable means.

When the housings have been secured together, eccentric shaft 46 with cams 42 positioned thereon and coating 44 deposited thereon, is inserted into channel 41 with the cams each resting in an enlarged portion 43 of the channel. The ends of shaft 46 rest on curved surfaces 47 formed in housing 12A at each end of channel 41. Cap 61 is then placed into an opening formed in the top of housing 12A over channel 41 and bonded or fused to the top surface of housing 12A. Cap 61 has end portions 49 with curved surfaces 51 that engage shaft 46 entrapping the entire camming assembly in the connector. Finally, detent spring 54 is mounted on the shaft and secured to housing 12A, and knob 48 is secured to shaft 46.

In operation, knob 48 and shaft 46 are initially positioned so that cams 42 are shown in FIG. 3 with their low dwells adjacent cam follower surfaces 36 of contacts 34. Since contacts 34 are not initially biased, they rest, under the influence of gravity, on the corresponding contacts 28 as shown in FIG. 3. When cable 20 is inserted into slot 18 of the connector, the leading edge of the cable bears against angled surface 38 at the end of contact 34 and rides along this surface and the angled leading surface of pointed projections 40 to cam contact 34 in an upward direction. Once contact 34 has been cammed out of the way, the cable may be fully inserted into the slot 18 as shown in FIG. 4. The exact amount of cable which is inserted into the connector at each end is not critical. However, sufficient cable should be inserted into the slot so that projections 40 engage the cable well behind its leading edge. The amount of cable inserted cannot, however, cause the cable to extend beyond the end of the slot which is substantially even with projection 60 on contact 34. The cables may both be inserted at the same time as shown in FIG. 3, or the two cables to be connected may be inserted in the slot 18 separately.

When both cables are properly positioned in the connector as shown in FIG. 4, knob 48 is rotated, for example counterclockwise, causing spring projections 56 to be cammed out of slot 52. When knob 48 has been rotated a full 180°, causing cams 42 to be positioned as shown in FIG. 5, with their high dwells adjacent cam follower surfaces 36 of contacts 34, slots 52 are again adjacent projections 56, permitting the projections to spring back into the slots to lock the knob 48, shaft 46 and cams 42 in their new position. As each cam 42 is rotated, its high dwell contacts with the corresponding cam follower surface 36 of contact 34, forcing the contact downward against cables 20. As this is done, pointed projections 40 pierce insulation 24 adjacent the corresponding conductor 22 and make electrical contact with the conductors. The cable is distorted in the area of projections 30 and 40 with the conductor being pushed through the bottom insulation and effect-
3,877,774

5

Vely pinched between the two projections to assure good physical and electrical contact between the conductor 22 and both contacts. Contacts 28 and 34 provide a low resistance electrical path between the cable conductors.

When a cable 20 is to be removed from connector 10, knob 48 is again rotated 180° until slots 52 are again adjacent projections 56 of spring 54. With shaft 46 in this position, a low dwell of each cam 42 is adjacent cam follower surface 36 of the corresponding contact 34. The contacts are thus free to move away from engagement with cables 20, but remain in the position shown in FIG. 5 under the influence of gravity. However, with the holding force removed from contacts 34, cable 20 may be pulled out of the connector by exerting pressure thereon. The force applied to the cable causes the conductor of the cable to exert force on the inclined trailing surface of projection 40 effectively camming the contact out of the way to permit the conductor to be removed.

It should be noted that, while in the discussion above the force of the cable on inclined leading surface 38 and on the inclined leading and trailing surfaces of projection 40 have been considered adequate to raise contact 34 out of the way of the cable when the cable is inserted or removed from the connector, a bias spring or other biasing means may, if desired, be provided to normally hold contacts 34 in a raised position. With such a biasing means, the contacts would always return to this position when cams 42 are in a position with the low dwell of the cam adjacent surface 36. While such a biasing means does simplify cable insertion and withdrawal, it also increases the cost of and the force required to actuate the connector.

A connector for flat multiconductor cable has thus been provided which permits connection to be made to the cable by easily hand-inserting the cable therein without and prestripping of the or the requirement of any special tools. Insulation piercing and electrical connection to all conductors of the cable is effected through the 180° rotation of a single knob. A simple, easily fabricated, easily utilized connector for flat coaxial cable is thus provided.

Referring in particular to FIGS. 1 and 3, it is seen that a cap 61, which covers the channel 41 and enlarged channel portions 43 in which cams 42 and shaft 46 are positioned project above the surface of housing section 12A. There is a mating groove 62 in the bottom of housing section 12B for the projecting portion of cap 61 which permits the connectors 10 to be easily stacked as shown in FIG. 1. Suitable flanges may also be provided on housings 12 for wall mounting or otherwise mounting one or more of the connectors.

FIGS. 6 and 7 illustrate an embodiment of the invention which differs from that shown in FIGS. 1–5 only in that cable 20 has a metallic ground shield 70 around it and in the provision of a pair of ground shield contacts 72 and 74 in place of the contacts 28 and 34 respectively for the right-most conductor position. Contact 72 has an angled leading surface 76 at each end which terminates in a row of shield-engaging teeth 78. Upper contact 74 has an angled leading surface 80 at each end which terminates in a row of shield-engaging teeth 82. Upper contact 74 also has a cam follower surface 84 along its upper edge.

In operation, shield 70 is cut-back slightly before the cable is inserted in slot 18. Then, when knob 48 is rotated to move the high dwells of cams 42 into engagement with cam follower surfaces 36 of upper contacts 34, the rotation of shaft 46 also brings the high dwell of the cam 42 adjacent contact 74 into engagement with cam follower surface 84, forcing contact 74 into engagement with the cut-back shielding 70 on each of the cables 20. With the cam in a fully operated position as shown in FIG. 7, the shielding is pinched between contacts 72 and 74 with the teeth 78 and 82 of the contacts digging into the shielding to assure good physical and electrical contact with the shielding. Thus, electrical contact is established and connection effected with both the conductors 22 of cables 20 and the shielding 70 of the cable as a result of a single 180° of a knob. It should be noted that, while the shield engaging contacts are shown in FIG. 6 as being in the right-most conductor position, this is by way of example only, and these contacts may, in fact be in any of the conductor positions.

Next to be described in connection with FIGS. 8–14 are second preferred embodiments of the invention which employ a memory driving member in place of the camming member employed in the first preferred embodiments. As pointed out previously herein, this memory driving member is made of a material having controllable mechanical memory properties. In the preferred embodiments being considered herein, the memory material is preferably a metallic alloy comprising an equiatomic nickel-titanium intermetallic compound containing approximately 53 to 57 percent by weight of nickel with the balance titanium. This alloy is customarily referred to in the art as 55-Nitinol.

The mechanical memory properties of alloys such as 55-Nitinol are only partially understood in the art, and are believed to be a result of a reversible stress-induced, martensitic transformation. An original memory shape may be set into the alloy at an elevated temperature which is typically about 900°F for 55-Nitinol. This original shape will be retained after the alloy is cooled. The alloy may then be deformed to a desired intermediate shape. Return to the original shape may then be subsequently accomplished when desired by the application of moderate amounts of heat to bring the alloy to a predetermined transitional temperature range which may be varied by appropriate choice of the particular alloy composition. For 55-Nitinol, a transitional temperature range of −60°F to 300°F may be provided by appropriately changing the percentage of nickel and/or substituting cobalt for nickel on an atom-for-atom basis. The shape recovery temperature range is also dependent on the specific processing history of the alloy. During return of the alloy to its original shape, very considerable force can be exerted thereby so that much mechanical work can be accomplished. Further details concerning 55-Nitinol can be obtained from the article "What You Can Do With That 'Memory' Alloy," Materials Engineering, 70, pp. 28–31 (October 1969).

Reference is now directed to FIGS. 8–12 which illustrate how a memory alloy having the properties discussed above may advantageously be employed for providing the driving force required in a flat cable connector of the type previously described in connection with FIGS. 1–5. It will be noted that the embodiments of FIGS. 1–5 and 8–12 contain many basically similar elements. Accordingly, only pertinent ones thereof are designated by reference numerals in FIGS. 8–12. For
ease of understanding, each element designated in FIGS. 8-12 having a like structure and/or function as a corresponding element in FIGS. 1-5 is given the same designation as that used in FIGS. 1-7 followed by a “prime.”

As will readily be evident from a comparison of FIGS. 8 and 9 with the respectively corresponding FIGS. 2 and 3 of the previously described embodiment, the cam and associated operating structure provided for each pair of upper and lower contacts in the embodiments of FIGS. 1-7 are eliminated in the embodiment of FIGS. 8-12 and replaced by a memory driving member 100. As will be seen from FIGS. 9-12, the memory driving member 100 is provided with a driving abutment 102 intermediate its ends which rests against the upper surface of upper contact 34'. The memory driving member 100 also has up wardly depending end portions 104 which extend through apertures 105 in the upper housing 12A' into slots 106 provided in a protective dielectric cover 107. As illustrated by the dashed lines in FIG. 10, the cover 107 is preferably removed during insertion of the cables 20', during which the memory driving member 100 moves upwardly with the contact 34 to permit full insertion of the cables which is accomplished in a like manner that to previously described in connection with the embodiment of FIGS. 1-5.

FIGS. 9 and 10 illustrate the memory driving member 100 when it has the generally linear intermediate shape to which it is de formed for assembly in the connector. FIGS. 11 and 12 illustrate the memory driving member 100 after it has been activated by the application of heat to return to its original shape which is typically in the form of a flattened “V” as shown. As diagrammatically illustrated in FIG. 11, the heat required for activation of the memory driving members 100 may advantageously be provided by temporarily connecting a battery 108 or other appropriate power source across the end portions 104 thereof using the switch 110.

It will be understood from FIGS. 9 and 10 that the intermediate shape of the memory driving members 100 is chosen so that they can readily be assembled and accommodated in the connector without interfering with cable insertion. The original shape of the memory driving members illustrated in FIGS. 11 and 12 is chosen so that the return of an activated driving member 100 to this original shape causes its engagement with the inner surrounding surfaces of the upper cavity 12B in a manner so that its driving abutment 102 will exert sufficient force on the respective upper contact 34' to cause projections 30' and 40' to pierce the cable insulation, thereby providing the desired electrical connections between the cable conductors as previously described in connection with the embodiment of FIGS. 1-5.

Referring next to FIGS. 13 and 14, illustrated therein is a modified embodiment of the invention which is basically similar to that shown in FIGS. 8-12, except that an alternate form of memory driving member 200 is employed having driving abutments 202 provided at the ends thereof for driving the upper contact 34' downward when activated. The intermediate and original shapes of this modified memory driving member are illustrated in FIGS. 13 and 14, respectively.

It is to be understood that provision may be made for removal of the cable 20' in the embodiments of FIGS. 8-15 by choosing the composition and processing history of the alloy used for the memory driving members so that by application of appropriate cooling thereto, sufficient relaxation will be obtained to permit removal of the cables 20'.

The fragmentary sectional views of FIGS. 15 and 16 illustrate a further modification of the invention which may be employed in order to achieve greater rigidity of the resulting connector. As illustrated in the exploded view of FIG. 15, the upper housing section 12A is provided with spaced ribs 212 at locations between the pairs of opposed contacts 28, 34 so as not to interfere therewith. These ribs 212 are shaped to interlock with like-shaped apertures 214 provided at respectively opposed locations in the lower housing section 12B when the housings are secured together, as shown in FIG. 16. It will be understood that the provision of such interlocking of the upper and lower housing sections will be of particular importance to maintaining rigidity of the connector in the event that the camming action provided in the embodiments of FIGS. 1-7 is not maintained, or in the event of a relaxation occurring in the memory driving members in the embodiments of FIGS. 8-14.

Obviously, many modifications and variations of the invention may be possible depending on the particular application involved. For example, it is to be understood with regard to the modification of the invention illustrated in FIGS. 15 and 16 that it is desirable to have a portion of the connector housing removable, as indicated by the dashed line 215 in FIG. 14, in order to permit assembly of the housings 12A' and 12B' by sliding the ribs 212 into their respective apertures 214 from an end of the connector. It will also be understood with regard to the embodiment of FIGS. 15 and 16 that the cables 20' to be inserted therein will typically have appropriate portions of the insulation between conductors sufficiently cut away so that the interlocking ribs and apertures 214 will not interfere with insertion.

The invention is not to be considered as being limited to the construction, arrangement or use exemplified herein, but is to be considered as including all possible modifications and variations coming within the scope of the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connector for flat cables, said cables each having at least one insulation covered conductor comprising:
   a. a housing having at least one cable receiving slot;
   b. a moveable contact mounted in said housing adjacent said slot and moveable in a direction towards said slot, said contact having, on the side thereof adjacent said slot, a pointed projection for each of the cables to be joined;
   c. a second contact having a pointed projection for each cable to be joined, corresponding projections on said moveable and second contacts being relatively positioned so as to pinch the cable conductor therebetween when said driving means are operated;
   d. driving means mounted in said housing adjacent the opposite side of said contact and operable to drive the contact against cables positioned in said slot, said projections piercing the cable insulation to
3,877,774  

9  

make physical and electrical contact with the con-
ductors of the cables, said driving means including a memory driving mem-
ber comprised of a material which changes shape in response to the application of a predetermined amount of heat thereto, the change of shape of said memory driving member being chosen so that the application of said predetermined amount of heat thereto causes said driving member to drive said contact against said cables.  

2. A connector as claimed in claim 1 wherein said second contact is mounted so as to not be movable in said housing.  

3. A connector as claimed in claim 1 including a conductive shield layered on each of said cables; and including an additional moveable contact mounted in said housing adjacent said moveable contact, said additional contact having projections for each cable on the slot side thereof and a cam follower surface on the opposite side thereof; and an additional driving means for driving the projections of the additional contact into physical and electrical contact with the shield of the corresponding cable.  

4. A connector as claimed in claim 3 wherein there are a plurality of conductors for each of the flat cables to be joined; and including a separate moveable contact for each pair of conductors to be connected; and a separate driving means for each of said contacts; and wherein said additional moveable contact is substi-
tuted for one of said separate moveable contacts.  

5. A connector as claimed in claim 4 wherein the shielding on said cables is cut back so as not to be con-
tacted by the projections on said separate moveable contacts and wherein the projections on said additional moveable contacts are positioned so as to engage said shielding.  

6. The invention in accordance with claim 1, wherein said memory driving member is made of a metallic alloy material having the property that after being physically deformed into an intermediate shape is returnable to an original shape by the application of heat, said intermediate and original shapes being chosen so that the return of said driving means to said original shape causes said contact to be driven against said cables.  

7. The invention in accordance with claim 6, wherein said metallic alloy material is chosen so that the application of cooling thereto after return to its original shape will produce sufficient relaxation of said driving means to permit removal of a cable from said connector.  

8. The invention in accordance with claim 6, wherein said metallic alloy material is 55-Nitinol.  

9. The invention in accordance with claim 6, wherein said driving means includes a driving member having at least one driving abutment located adjacent said oppo-
site side of said contact, said intermediate shape of said driving member being chosen to be of generally linear form and said original shape being chosen to cause said driving abutment to drive the contact projections against said cables with sufficient force to pierce the cable insulation to make physical and electrical contact with the conductors of the cables.  

10. The invention in accordance with claim 9, wherein said driving abutment is located between the ends of said driving member.  

11. The invention in accordance with claim 9, wherein a driving abutment is provided on said driving member opposite each of said projections, and wherein said original shape is chosen so as to cause each of said abutments to be driven against said contact.  

12. A connector for flat cables, said cables each hav-
ing at least one insulation covered conductor compris-
ing: a housing having at least one cable receiving slot; a moveable contact mounted in said housing adjacent said slot and moveable in a direction towards said slot, said contact having, on the side thereof adjacent said slot, a pointed projection for each of the cables to be joined; and driving means mounted in said housing adjacent the opposite side of said contact and operable to drive the contact against cables positioned in said slot, said projections piercing the cable insulation to make physical and electrical contact with the conduc-
tors of the cables, said housing comprising first and second sections of insulative material, secured together, and wherein one of said sections is provided with a plurality of spaced ribs at locations between said contacts and the other of said sections is provided with spaced apertures for respectively receiving said ribs, the shapes of said ribs and apertures being chosen to provide interlocking when said first and second sections are secured together.  

13. A connector for flat cables, said cables each hav-
ing at least one insulation covered conductor compris-
ing: a housing having at least one cable receiving slot; a moveable contact mounted in said housing adjacent said slot and moveable in a direction towards said slot, said contact having, on the side thereof adjacent said slot, a pointed projection for each of the cables to be joined; and driving means mounted in said housing adjacent the opposite side of said contact and operable to drive the contact against cables positioned in said slot, said projections piercing the cable insulation to make physical and electrical contact with the conduc-
tors of the cables, said driving means including a memory driving mem-
ber comprised of a material which changes shape in response to the application of a predetermined amount of heat thereto, the change of shape of said memory driving member being chosen so that the application of said predetermined amount of heat thereto causes said driving member to drive said contact against said cables, said housing including a removable portion and being provided with spaced apertures located so as to be exposed when said removable portion is removed, said driving member being shaped to have ends ex-
tending into said apertures.  

14. An electrical connector comprising: a housing having means for receiving at least one conductor; a contact mounted in said housing so as to be move-
able in a direction towards said conductor; and a heat activatable memory driving member mounted in said housing member and made of a metallic
alloy material having the property that after being physically deformed into an intermediate shape is returnable to an original shape by the application of heat;
said intermediate and original shapes being chosen so that the return of said driving means to said original shape causes said contact to be driven into conductive engagement with said conductor, said metallic alloy material further being chosen so that the application of cooling thereto after said driving member has been returned to its original shape produces sufficient relaxation of said driving means to permit removal of said conductor from said housing,
said housing being provided with a plurality of said contacts, said housing comprising first and second sections of insulative material, secured together, one of said sections being provided with a plurality of spaced ribs at locations between said contacts and the other of said sections being provided with spaced apertures for respectively receiving said ribs, the shapes of said ribs and apertures being chosen to provide interlocking when said first and second sections are secured together.

15. An electrical connector comprising:
a housing having means for receiving at least one conductor;
a contact mounted in said housing so as to be moveable in a direction towards said conductor; and
a heat activatable memory driving member mounted in said housing member and made of a metallic alloy material having the property that after being physically deformed into an intermediate shape is returnable to an original shape by the application of heat;
said intermediate and original shapes being chosen so that the return of said driving means to said original shape causes said contact to be driven into conductive engagement with said conductor, said metallic alloy material further being chosen so that the application of cooling thereto after said driving member has been returned to its original shape produces sufficient relaxation of said driving means to permit removal of said conductor from said housing;
said housing including a removable portion, wherein said housing is provided with at least one aperture located so as to be exposed when said removable portion is removed, and wherein said driving member is shaped so that a depending portion thereof extends into said aperture.

16. An electrical connector comprising:
a housing having means for receiving at least one conductor;
a contact mounted in said housing so as to be moveable in a direction towards said conductor; and
a heat activatable memory driving member mounted in said housing member and made of a metallic alloy material having the property that after being physically deformed into an intermediate shape is returnable to an original shape by the application of heat;
said intermediate and original shapes being chosen so that the return of said driving means to said original shape causes said contact to be driven into conductive engagement with said conductor, said metallic alloy material further being chosen so that the application of cooling thereto after said driving member has been returned to its original shape produces sufficient relaxation of said driving means to permit removal of said conductor from said housing;
said housing comprising first and second sections of insulative material, secured together, one of said sections is provided with a plurality of spaced ribs at locations spaced from said contact and the other of said sections is provided with spaced apertures for respectively receiving said ribs, the shapes of said ribs and apertures being chosen to provide interlocking when said first and second sections are secured together.

17. The invention in accordance with claim 16, wherein said housing includes means for receiving a second conductor such that said contact is also driven into conductive engagement with said second conductor when said driving means is returned to its original shape, and wherein said second conductor is also removable in response to cooling of said driving member.

18. A cable connector comprising:
a housing having at least one conductor receiving means;
a movable contact mounted in said housing adjacent said receiving means; said contact being movable in a direction towards said receiving means;
said housing comprising first and second sections of insulative material, secured together, one of said sections being provided with a plurality of spaced ribs and the other of said sections being provided with spaced apertures for respectively receiving said ribs, the shapes of said ribs and apertures being chosen to provide interlocking when said first and second sections are secured together, and driving means mounted in said housing and operable to drive the contact into conductive engagement with a conductor inserted in said receiving means.

19. The invention in accordance with claim 18, wherein said contact has a cam follower surface, and wherein said driving means comprises a cam eccentrically mounted in said housing and being rotatable between operative and inoperative positions, said cam when in said operative position coacting with said cam follower surface to drive said contact against said cables.

20. A connector as claimed in claim 19, wherein there are a plurality of conductors in each of the cables to be joined, and wherein a separate moveable contact is provided for each pair of conductors to be connected; and
an eccentrically mounted cam for each of said contacts.

21. A connector as claimed in claim 20, including a single common means for rotating all of said cams between their operative and inoperative positions.

22. A connector as claimed in claim 21, wherein said cam and cam rotating means are formed as a single element of a conducting material; and
including a coating of a dielectric material on at least the camming surfaces of said element.

23. The invention in accordance with claim 18, wherein said driving means includes a memory driving member comprised of a material which changes shape in response to the application of a predetermined amount of heat thereto, the change of shape of said memory driving member being chosen so that the application of said predetermined amount of heat thereto causes said driving member to drive said contact into conductive engagement with said conductor.

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