Feb. 19, 1963 KARL-HEINZ POHL 3,078,434

PRESSURE PIERCING TERMINAL CONNECTOR

Filed June 8, 1961

FIG. 1

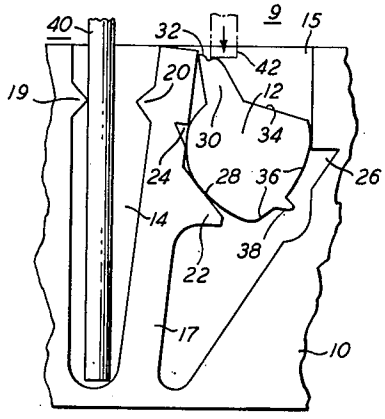


FIG. 2

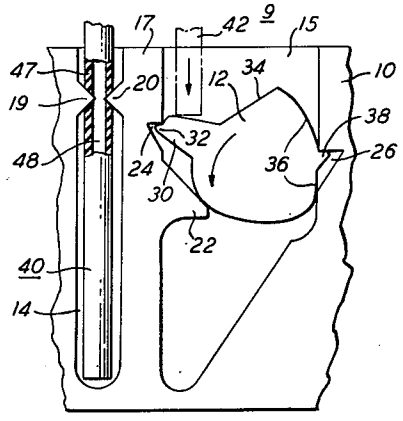


FIG. 3

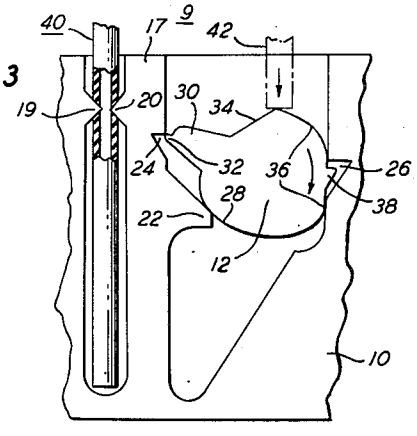
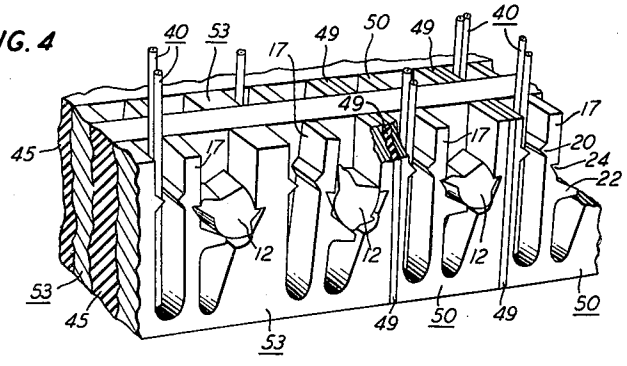


FIG. 4



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PRESSURE PIERCING TERMINAL CONNECTOR

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This invention relates to means for making multiple solderless connections between insulated electrical conductors.

In many applications, such as the newer models of multiple extension supervisory units commercially known as the Call Director, it is necessary to make a multiplicity of interconnections between individual insulated conductors or groups of insulated conductors in a limited space. The conventional terminal strip employing screws is not well suited for use in such applications because it requires prestripping of the conductor ends, involves the tedious chore of mounting and holding the conductors in proper position under the screw head while the connection is being made and requires an intolerable expenditure of space to accommodate the screws and their associated tap mountings.

It is an object of this invention to interconnect a plurality of electrical conductors in a limited space.

It is another object of this invention to interconnect electrical conductors without the necessity of first prestripping insulation from the conductor ends.

Still another object of this invention is to disconnect interconnected conductors without destruction.

Another object of this invention is to make and remove multiple interconnections of unstripped, insulated conductors simultaneously using a standard tool such as a screwdriver.

It is also an object of this invention to provide multiconductor interconnection means which can be inexpensively and easily produced from stamped metal parts.

This invention achieves these objects by use of a connector body made from springy, electrically conductive stamping stock, and an associated cam device; both of which have shapes which are so cooperatively interrelated that upon actuation of the cam structure, parts of the connector body will be caused to penetrate the conductor insulation to electrically connect and retentively contact the conductor and will lock in that attitude until unlocking is selectively accomplished by further activation of the cam.

This device can be better understood by referring to the accompanying drawings in which:

FIGS. 1, 2, and 3 are cross sections of the device in successive stages of operation; and

FIG. 4 is a perspective view of a typical multiple interconnection block.

Referring first to FIG. 1; the connector assembly 9 comprises a connector body 10 made from a springy electrically conductive material such as Phosphor bronze, and a locking cam 12 also made from metal or other strong, readily shapable material which preferably has suitable stamping qualities as well. The connector body has a conductor receiving aperture 14 and a locking cam aperture 15 separated by a deflectable partition 17 which is formed as part of the connector body. When the partition 17 is in the position as shown in FIG. 1, the walls of the conductor receiving aperture 14 taper toward each other at the bottom end. The conductor aperture has insulation penetrating teeth 19, 20 positioned near its open end on the connector body and the partition wall respectively. The locking cam aperture is straight sided near the open end, has a wedge shaped cam seat 22 projecting into it from the partition 17 near its midpoint, a first locking notch 24 positioned in the partition immediately above the wedge shaped cam seat 22, and a second locking notch 26 formed in the connector body wall of the cam aperture opposite the first locking notch. The locking cam aperture extends into the connector body to a depth approximately equal to that of the conductor receiving aperture. The locking cam 12 has a rounded surface 28 bearing on the wedge shaped cam seat 22, a projection 30 having a first protuberance 32 thereon corresponding in shape to the first locking notch 24, a first flat surface 34 adjacent to the projection 30, and a second flat surface 36 which is relieved at that end which is near the point of its juncture with the first flat surface 34 and has positioned near its midpoint a second protuberance 38 corresponding in shape to the second locking notch 26. When the components are in the position illustrated in FIG. 1, an insulated conductor assembly 40 may be inserted into the conductor receiving aperture 14 until it abuts the bottom of the aperture. Vertical pressure may then be exerted on the projection 30 by means of a tool such as a screwdriver blade 42 causing the locking cam to turn counterclockwise until, as shown in FIG. 2, the first protuberance 32 is seated in the first locking notch 24, and the second protuberance 38 is seated in the second locking notch 26. During this operation, the wedging action of the first protuberance 32 against the partition 17, acting in concert with the relieved end of the second flat surface 36 of the locking cam 12 bearing against the connector body 10, causes the top end of the partition 17 to move toward the connector body wall of the conductor receiving aperture 14. The insulation penetrating teeth 19, 20 pierce the insulation wall 47 and establish physical and electrical contact with the conductor 48 of the insulated conductor assembly 40. The inherent springiness of the conductor body material acting through the cantilever beam structure formed by the partition 17 causes the distinctive protuberances 32, 38 on the locking cam 12 to be retained within the corresponding notches 24, 26 of the locking cam aperture 15, thereby locking the connector components in this attitude.

The operation of this device when conductor disconnection and removal is desired is illustrated in FIG. 3. By means of the screwdriver blade 42, vertical pressure is applied to the locking cam 12 near the juncture of the first flat surface 34 and the relieved portion of the second flat surface 36. This causes the second protuberance 38 to unseat from the second locking notch 26 as the cam 12 moves downward. Concurrently, the rounded surface 28 of the cam 12 pressing on the wedge shaped cam seat 22 causes the upper end of the partition 17 to move toward the conductor. When the cam is vertically disposed downward to an extent sufficient for the first protuberance 32 to move free of the first locking notch 24, the inherent springiness of the connector body material causes the partition 17 to press against the first protuberance 32 as the cam is simultaneously lifted by the action of the wedge shaped cam 22 bearing on the rounded surface 28. This causes the locking cam 12 to rotate clockwise as the partition returns to the normal position illustrated in FIG. 1. The conductor receiving aperture 14 is thereby opened and the locking effect of the penetrating teeth 19, 20 on conductor and insulation is removed. When the connector components are in this attitude, the conductors may be removed without destruction to them, and subsequently the same or other conductors may be reinserted for further desired interconnecting.

By making the connector body from thick enough stock, the conductor receiving aperture 14 can be made to accommodate several insulated conductors side by side in the same connector. Since the connector body material is electrically conductive, common electrical interconnections between conductors so positioned may there-

by be perfected. One rapid and inexpensive method by which such connector bodies may be made is by stamping them from material having properties suitable for the purpose.

FIG. 4 illustrates a typical multiple interconnection block. Single connector units 50 may be produced, or several such connectors may be made simultaneously from the same strip of connector body stock forming multiple interconnector units 53. Various desired combinations of single or multiple connectors may be placed in tandem and separated by insulation strips 49 to form interconnector banks. Such tandem banks alone or in combination with other similar banks may be laminated with insulating strips 45 to form terminal blocks of various desired configurations.

Thus it can be seen that many interconnections can be perfected with reliability and ease in a limited physical space by use of this invention.

It should be understood that the device herein described is but one embodiment of this invention and that other embodiments may be made by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrical connector device comprising a connector body having first and second elongated parallel slots extending from the top surface into the interior thereof, said slots being separated from each other by a thin partition affixed only at the bottom end of said slots, insulation penetrating teeth formed as part of said connector body and said partition and projecting into said first slot near its top end; and a locking cam housed within said second slot; said cam and said second slot being so shaped that upon revolution of said cam in a first direction, the upper end of said partition will be caused to move toward the connector body wall of the first slot until rotation of said cam is prevented by the engagement of a first projection on said cam with a first notch in said partition and a second projection on said cam with a second notch in said connector body; said cam and said second slot being so shaped that by application of pressure downward on said cam, said first and said second projections on said cam will disengage from said corresponding first and second notches and said cam will rotate in a second direction, thereby permitting said upper end of said partition to move laterally away from said connector body wall of said first slot.

2. In an insulated conductor terminal connector device a connector body made from electrically conductive springy material having first and second elongated parallel upward facing adjacent slots therein separated by a partition formed as part of the connector body and affixed thereto at its lower end only, and a locking cam positioned in said second slot; said first slot being straight sided and tapered inward toward the bottom when said partition is in the unclamping attitude and having opposing insulation piercing teeth interposed therein near its top end, said teeth being formed as part of said connector body and said partition; said second slot having a triangular projection extending therein from said partition intermediate its top and bottom ends, said partition having a first notch therein facing toward said second slot and slightly above said triangular projection; said connector body having a second notch therein facing toward said second slot at a point opposite said triangular projection; said second slot being straight sided from said first and said second notches upward; said cam being essentially circular having a curved cam surface of about 120 degrees arc, a first chord surface of about 120 degrees arc therefrom, a second chord surface of about 120 degrees arc from said cam surface, said second chord surface being relieved at one end, a first protuberance located near the juncture of the first chord section and said curved surface and corresponding in shape to said first notch in said connector body, and a second protuberance located near the midpoint of said second chord surface corresponding in shape to said second notch in said partition, whereby when said cam is positioned in said second slot with said curved surface resting on said triangular projection, application of pressure downward on said first protuberance will cause rotation of said cam in a first direction and will cause the upper end of said partition to be displace laterally toward the wall of said first slot formed by said connector body until said first protuberance resides in said first notch and said second protuberance resides in said second notch in a locked attitude, and whereby when said cam is in said locked attitude application of pressure downward on said cam near the juncture of said relieved end of said second chord surface with said first chord surface will cause said curved surface of said cam to press on said triangular projection and cause said upper end of said partition to move toward said connector body until said first protuberance moves out of said first notch and said cam rotates in a second direction with corresponding lateral displacement of said upper end of said partition into its normal position.

3. An electrical connector comprising a bichambered connector body, said chambers being separated from each other by a movable wall, the first of said chambers having electrically conductive teeth positioned therein and affixed on said movable wall and the fixed wall opposite said movable wall, the second of said chambers and a cam positioned therein being so correspondingly shaped that said movable wall may be displaced toward said opposite wall of said first chamber by motion of said cam in a first direction, retained in the displaced attitude by interlocking of the surfaces of said cam and the walls of said second chamber, and allowed to move away from said opposite wall of said first chamber by unlocking of the surfaces of said cam and said second chamber and motion of said cam in a second direction.

4. An electrical connector device comprising a connector body having at least one pair of apertures therein, the apertures in each of said pairs of apertures being separated from each other by a leaf spring secured at the bottom end only, one of said apertures in each of said pairs having insulation penetrating teeth made of electrically conductive material projecting therein and affixed to said leaf spring near its movable end and to the wall of said aperture opposite said leaf spring, the other of said apertures in each of said pairs having a cam disposed therein the interaction of whose peripheral surface in concert with the corresponding surfaces of the leaf spring and the connector body provides the sole supporting means for said cam, translates motion of said cam in a first direction into movement of said teeth toward each other, locks said cam in a position whereby said teeth are retained in close juxtaposition to each other, and permits unlocking and motion of said cam in a second direction whereby said teeth move away from each other.

5. An electrical connector module comprising a multiplicity of electrical connectors as described in claim 3 some of which are electrically interconnected to each other to form electrically interconnected connector groups, the balance of the connectors in the module and the interconnected connector groups all being electrically discrete from each other by the interposition of electrical insulation.

6. An electrical connector module comprising electrical connectors as described in claim 4 wherein each of said connector bodies are separated from each other by electrical insulation.

7. A connector for insulated wire comprising a body of resilient metal having a deep notch which is divided into two slots by a deflectable partition extending from the bottom of the notch, one of said slots being a wire receiving slot with juxtaposed insulation piercing teeth on the body and the partition respectively, the other a cam slot housing a rotatable cam for deflecting the partition

to and locking it in wire engaging position, a cam follower projecting from the partition into the cam slot, a cam locking notch in the partition adjacent to a working surface of the follower, and another cam locking notch in the body on the opposite side of the cam slot to the first-named notch, said cam being roughly circular with a projection on its partition side, and cam lock protuberances, one on the projection for cooperation with the notch in the partition and the other on the opposite side of the cam for cooperation with the notch in the body, said cam being

rotatable to locking position by the application of pressure to the cam projection and from locking position by the application of pressure thereto at a point adjacent the body side of the cam slot.

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