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CONNECTOR FOR FLAT CABLES

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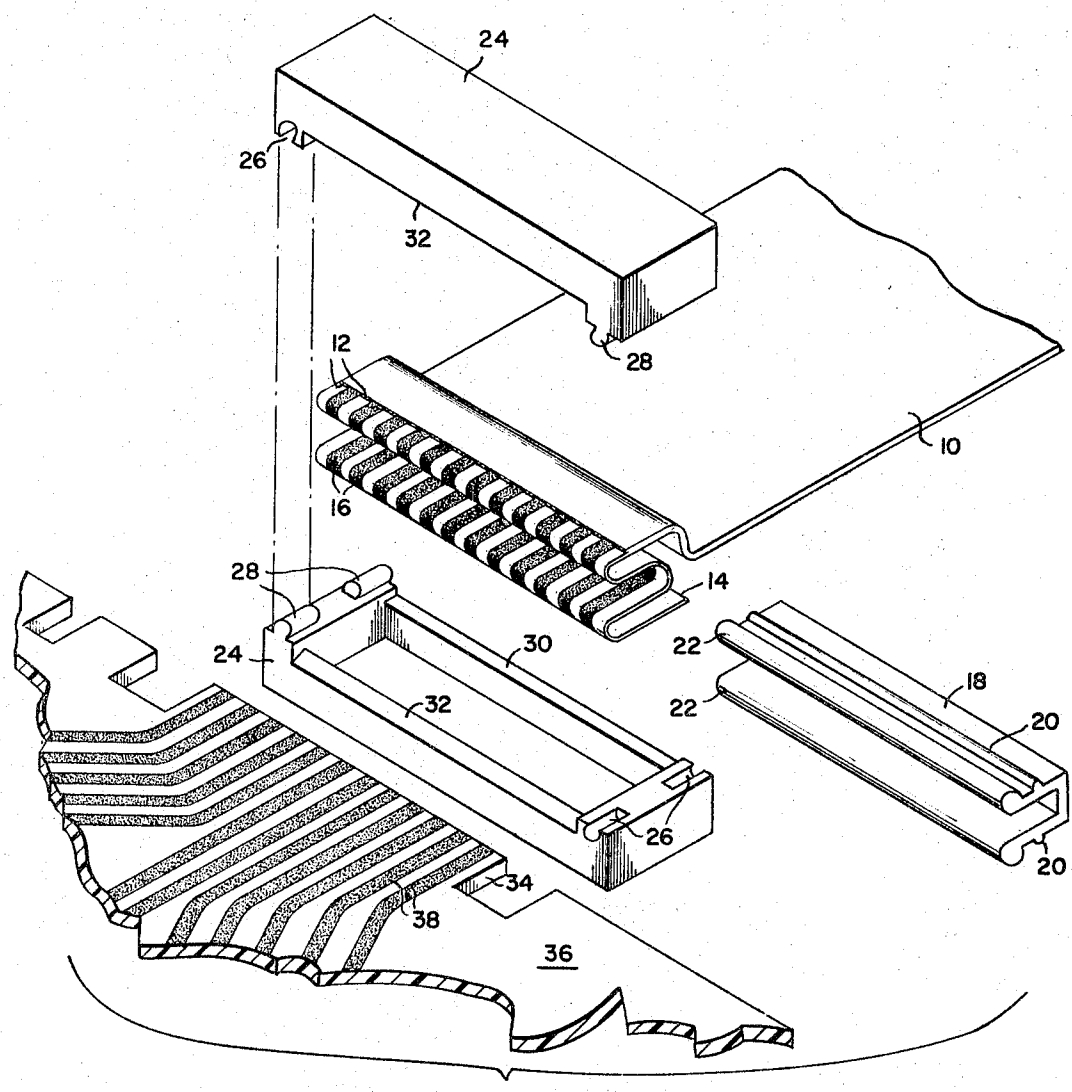

FIG. 1.

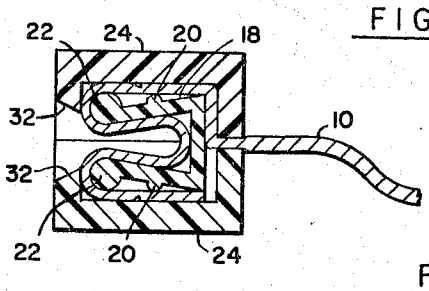

FIG. 2.

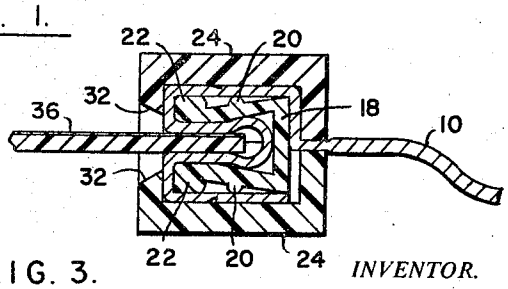

FIG. 3.

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CONNECTOR FOR FLAT CABLES

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This invention relates to cable connectors, and particularly to a connector for use with "tape" type cables having a plurality of parallel conductors.

This invention has particular utility in providing electrical connections to "printed circuit" boards which may be formed in many ways, usually by etching, but which, in any form, comprise conductors carried by one or more faces of an insulating member. In the manufacture of electronic apparatus, it is often desirable to provide multiple interconnections between various separate circuit boards which can be easily removed so that the circuit boards may be easily interchanged or replaced.

In instruments which comprise a chassis within a case, it is often desirable to provide for removal of the chassis from the case while permitting operation to continue for testing purposes. It will be seen that if a flat cable is provided to connect the chassis with a terminal strip on the case, the chassis may be removed from the case while operation of the apparatus continues. The cable takes up little space within the case when the instrument is fully assembled.

The invention contemplates the use of the conducting elements of the flat cable as the contacts of the connector, and great simplicity of construction is thus achieved.

The primary object of this invention is to provide a cable connector having an extremely simple and economical construction.

A further object is to provide a simple means for making multiple electrical connections to a printed circuit board.

Other objects will become apparent from the following description read in conjunction with the accompanying drawing in which:

FIGURE 1 is an exploded view showing the construction of a connection between a flat multiconductor cable and a printed circuit board;

FIGURE 2 is a sectional view of an assembled connector; and

FIGURE 3 is a sectional view of an assembled connector shown in contact with a printed circuit board.

Referring to FIGURE 1, a flexible, flat, multiconductor cable **10** is shown, stripped of insulation on its upper side from a starting edge indicated at **12** to edge **14**. A plurality of parallel conductors **16** are exposed, and the stripped end of the cable is bent into an M-like configuration about a flexible plastic insert **18** having a U-shaped cross-section. Insert **18** is provided with a pair of elongated ribs **20** along its upper and lower sides, and has a pair of lips **22** along its edges. It is desirably an extrusion of an elastic material having the properties of compressibility and flexibility, an example of a suitable material being neoprene.

A pair of identical slightly resilient molded plastic shell halves **24**, formed of an insulating plastic such as polycarbonate is provided. Among other suitable materials are glass filled diallylphthalate and acetal homopolymer. The shell halves are provided with grooved sockets **26** and rounded tongues **28** so that they can be snapped together conveniently (by slight yielding of the walls of the sockets) to form a housing having a hollow inner chamber to contain the assembly comprising insert **18** and the portion of the cable wrapped around it. The sides **30** of members **24** are lowered slightly with respect to the ends of the shell halves to provide an opening through

which cable **10** can pass when the shell halves are assembled.

Edges **32** of the opposed sides of shell halves **24** are oblique, so that, when the shell halves are assembled, a flared opening is provided to facilitate the insertion of a protruding portion **34** of circuit board **36**. Conductors **38**, printed on the circuit board, extend to the edge of protruding portion **34**. It will be apparent that they can be printed on either side of the circuit board or on both sides.

Referring to FIGURE 2, the orientation of the flexible elastic insert within the assembled shell is such that the cable is clamped against the inside of the shell by ribs **20**, insert **18** having been displaced slightly when shell halves **24** were snapped together.

Lips **22**, however, can be moved outwardly with some consequent bending of insert **18** when the connector is mated with the edge of circuit board **36**, as illustrated in FIGURE 3. Lips **22** are compressed in the folds of the cable, and are deformed slightly. The exposed conductors of the cable are then held in contact with the conductors etched on the circuit board by the force resulting from the compression of the lips, and by the elasticity of the opposite sides of insert **18**.

The connector assembly may be slipped off and onto a circuit board, and a good electrical contact is maintained between each cable conductor and its corresponding conductor etched on the circuit board, because of the compression of lips **22** and the slight compression of the insulation backing the stripped portion of the cable. Since the lips are capable of being deformed non-uniformly along their length, the situation will not arise where, for example, the conductors at the edges of the cable are held in contact with their corresponding conductors of the circuit board, while the conductors near the center are not maintained in contact. Ordinary warping of the circuit board therefore has no detrimental effect. Proper alignment between the conductors on the circuit board and the conductors of the cable is accomplished by making the widths of the cable and of protruding portion **34** of the circuit board equal to each other and only slightly less than the openings of which edges **32** of the shell halves form the upper and lower boundaries. Various methods of keying the connector in order to insure that the connector fits onto the circuit board only in the proper direction will be obvious. Ordinarily, the proper direction will be immediately apparent from simple markings on the outside of the connector.

The primary advantage of the connector is its simplicity of construction arising from the fact that it requires no contact members other than the conductors already provided by the cable. Because of the uniform non-indexed pressure exerted by the elastic insert, mating of any combination of conductor widths and spacings are possible with a corresponding combination on the printed circuit board. This feature permits use of an infinite variety of conductor widths within the limits of the cable width, and consequently allows the user considerable freedom to select conductor sizes tailored to the circuit requirements.

The connector is particularly adapted for applications in which connections are to be made to circuit boards which are etched on both sides as where capacitors are formed by leaving conducting areas on opposite sides of the board.

The fact that the connector housing and insert are made entirely of insulating materials reduces hazard to the user and precludes the possibility of failure due to short circuit with the cable conductors.

The connector may be adapted for use as a socket for plug-in circuit boards. It will be apparent that there are

various other uses to which the invention can be put, and that various modifications can be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. For use in making electrical connections between tape-type multiconductor insulated cables and printed circuit boards, the combination comprising a flexible elastic element having substantially a U-shaped transverse cross-section and having a rib spaced from the edges of the oppositely facing sides of said element and extending lengthwise on the outside of each of said oppositely facing sides and having a trough about which a cable with its conductors exposed on one side may be located to present the exposed portions of said conductors facing inwardly within the trough of said element, a hollow housing having a first elongated opening for receiving a protruding portion of a circuit board in electrical connection with said inwardly facing portions of said conductors, and a second elongated opening for receiving said cable, said element being receivable within said hollow housing so that the cable is clamped about said element between each said rib and the adjacent wall of said housing, with the open side of said trough facing said first elongated opening in said housing.

2. For use in making electrical connections between tape-type multiconductor insulated cables and printed circuit boards, the combination comprising a flexible elastic element having a trough about which a cable with its conductors exposed on one side may be located to present the exposed portions of said conductors facing inwardly within the trough of said element, said element having enlarged compressible lips along the edges of its oppositely facing sides, a hollow housing having a first elongated opening for receiving a protruding portion of a circuit board in electrical connection with said inwardly facing portions of said conductors, and a second elongated opening for receiving said cable, said element being receivable within said hollow housing so that the cable is clamped about said element, with the open side of said trough facing said first elongated opening in said housing so that said lips are compressed within folds of said cable between the protruding portion of said circuit board and the adjacent wall of said housing.

3. A connector for flat cables comprising an enclosure having an elongated opening for insertion of a protruding portion of a circuit board and an elongated opening for passage of a flat cable into the interior of said enclosure, a trough-shaped member within said housing formed of a compressible elastic material and having enlarged, compressible lips along the edges of its oppositely facing sides, the open side of said trough-shaped member facing said opening for insertion of a protruding portion of a circuit board, and a flat, multiconductor cable, stripped on at least one side to expose its conductors and having folds about said lips and a fold within said trough shaped member, said lips being compressed within said folds about said lips when the protruding portion of a circuit board is inserted into said fold within said trough-shaped member, and said conductors being exposed to the interior of said fold within said trough-shaped member to make electrical contact with conductors on said circuit board under the force exerted by the compression of said lips.

4. A connector for flat cables comprising an enclosure having an elongated opening for insertion of a protruding portion of a circuit board and an elongated opening for passage of a flat cable into the interior of said enclosure, a trough-shaped member within said housing formed of a compressible elastic material and having a rib extending lengthwise on the outside of each of its oppositely facing sides, said rib being spaced from the edges of said oppositely facing sides, and said trough-shaped member having its open side facing said elongated opening for insertion of a protruding portion of a circuit board, and a flat, multi-conductor cable, stripped on at least one side to expose its conductors and wrapped around said trough-shaped member, and having a fold within said trough-shaped member, said conductor being exposed to the interior of said fold, and said cable being clamped between a rim and a wall of said enclosure on either side of said trough-shaped member.

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