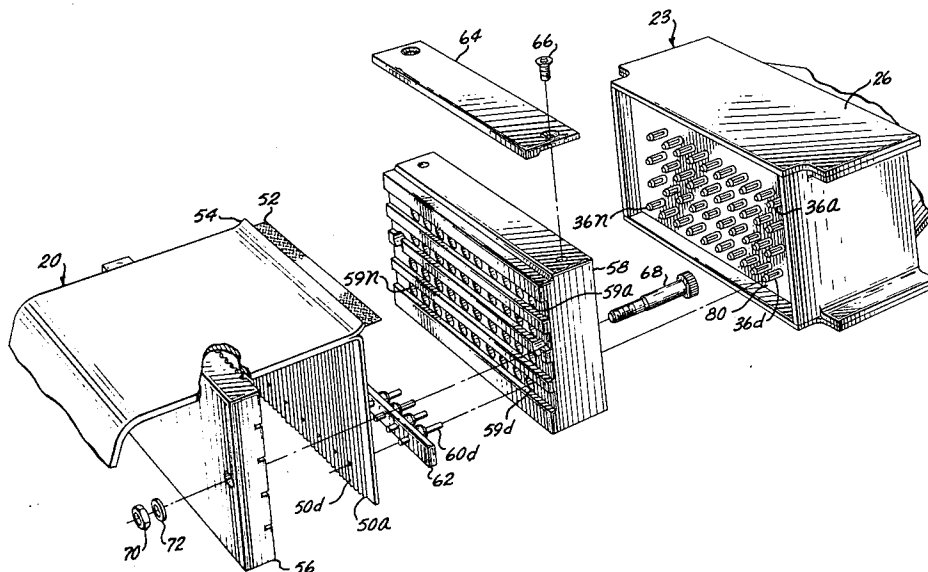


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 [21] Appl. No. **835,388**
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 [45] Patented **Apr. 6, 1971**
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[54] **FLATLINE CABLE IMPEDANCE MATCHING
 ADAPTER**
 26 Claims, 8 Drawing Figs.
 [52] U.S. Cl..... 339/14,
 339/17, 339/97, 339/176
 [51] Int. Cl..... H01r 3/06
 [50] Field of Search..... 339/14, 17,
 97, 176 (MMF)

ABSTRACT: A connector is shown that is capable of interconnecting a shielded stripline flat cable adapter and another adapter for a group of conventional coaxial cables and at the same time maintaining an impedance match between the two adapters. The impedance match results from the geometric configuration of the attachment of the flat cable to its adapter member and from the use of an electrically conductive block member which provides a common "ground bus" for the shields.



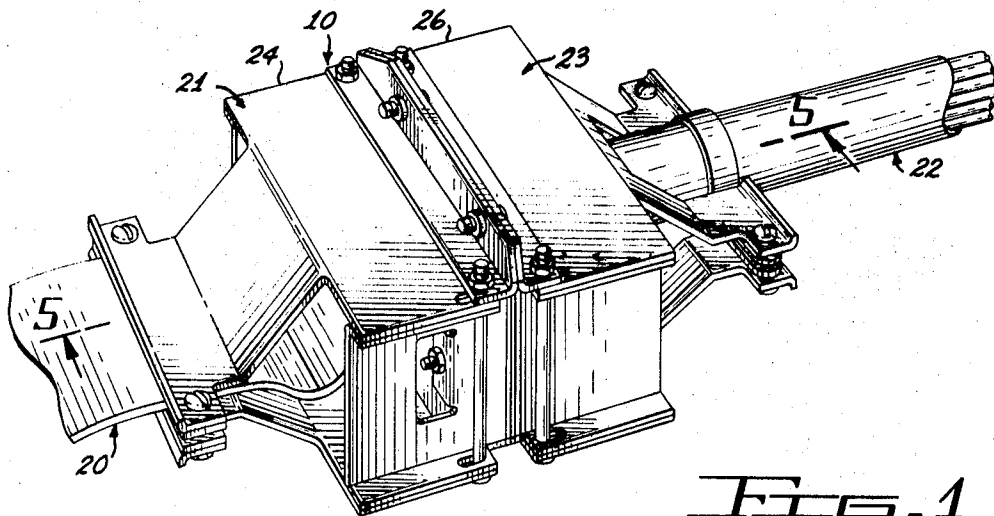


FIG. 1

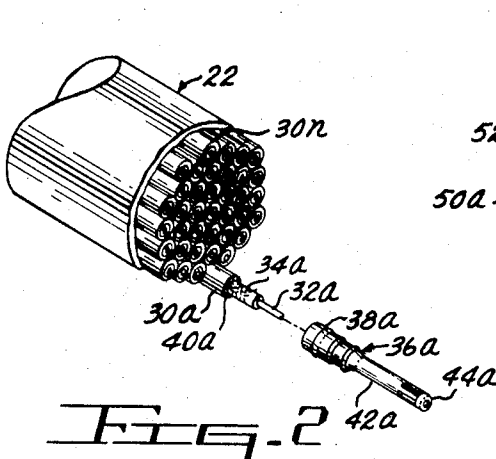


FIG. 2

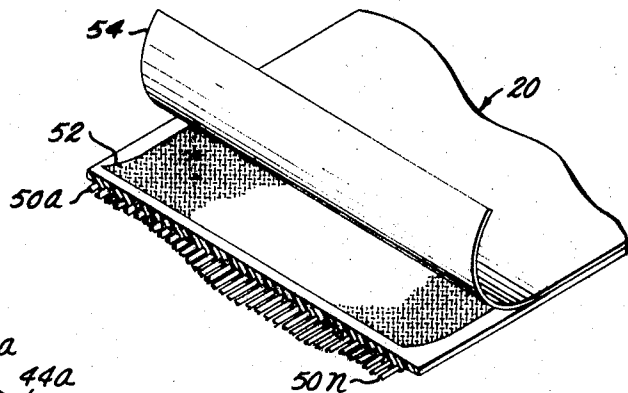


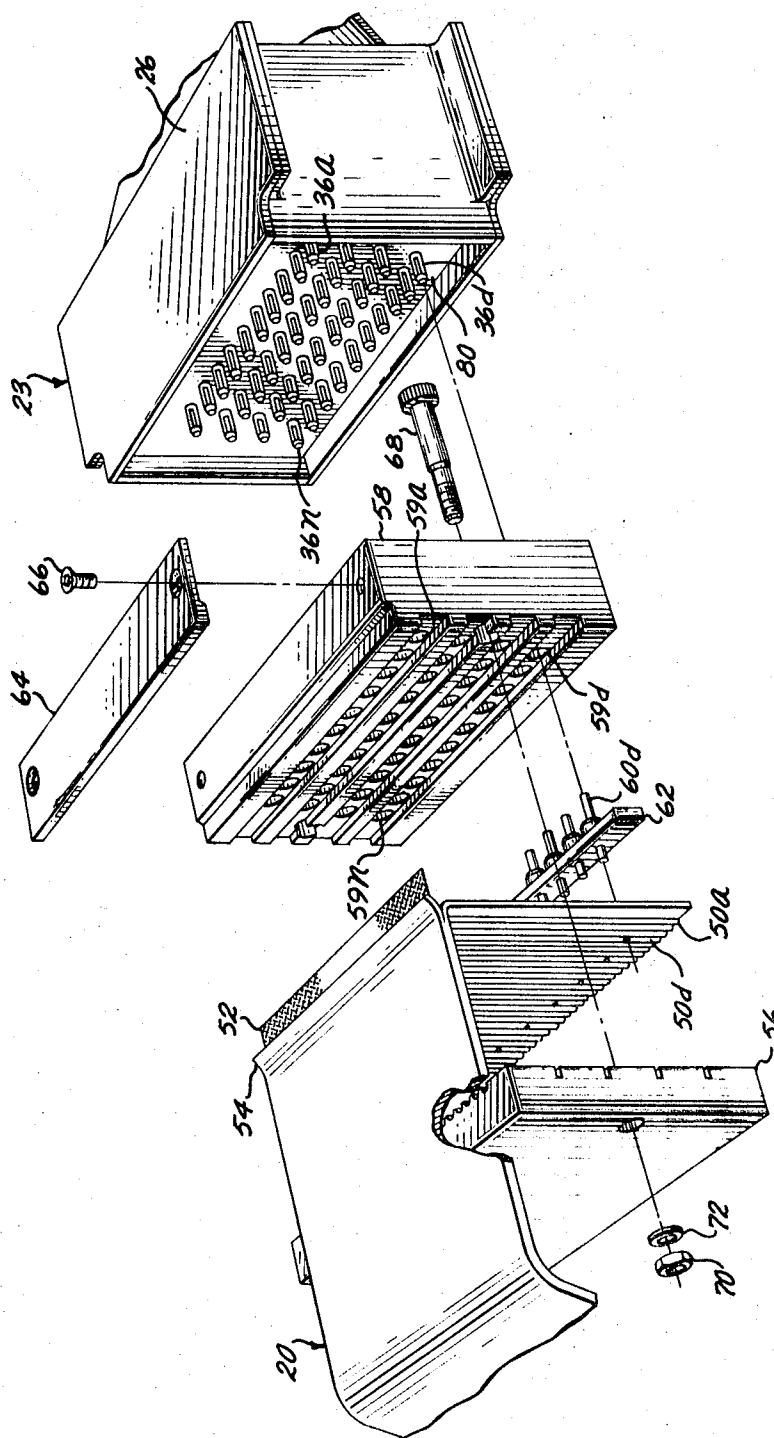
FIG. 3

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4 Sheets-Sheet 2



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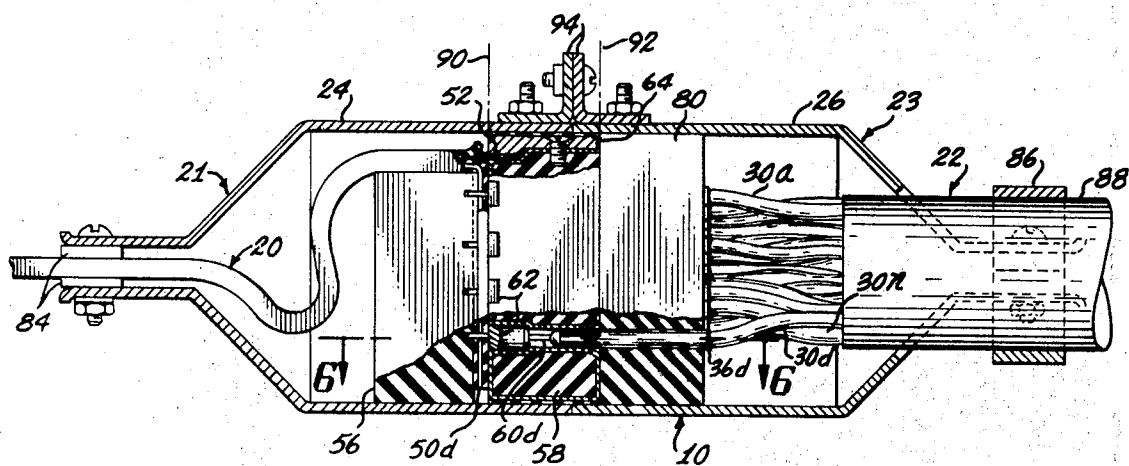


Fig. 5

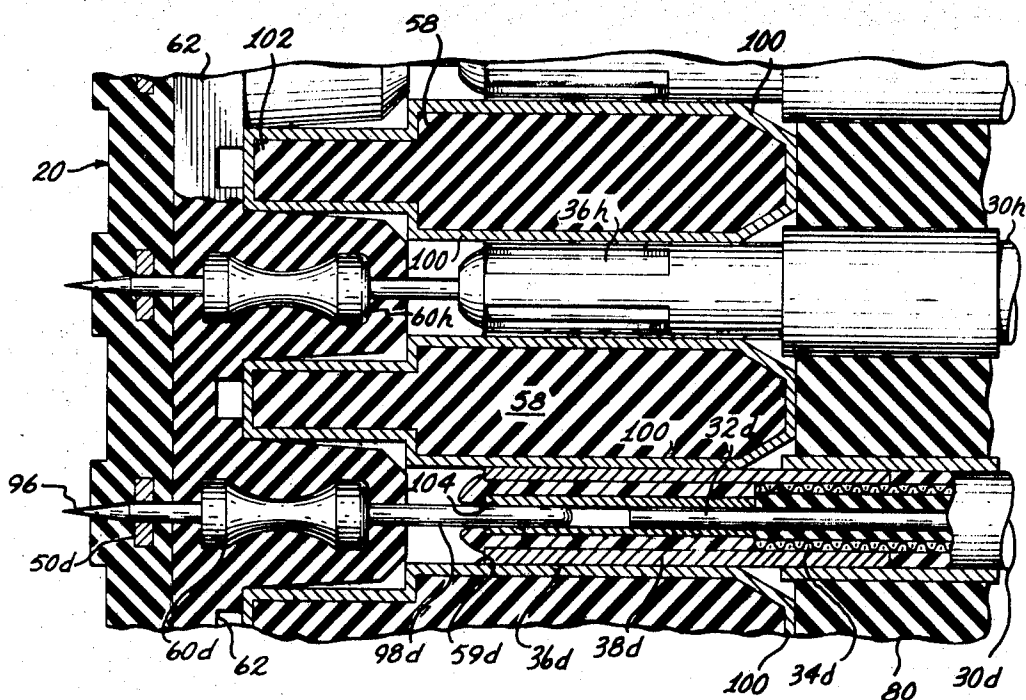
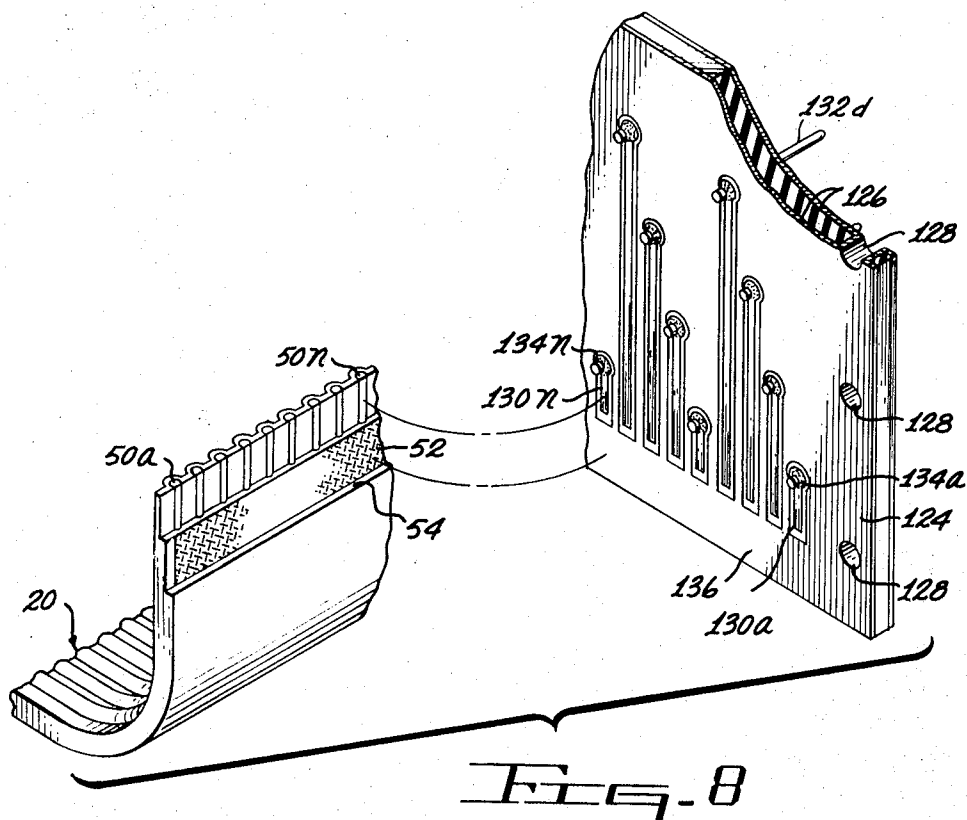
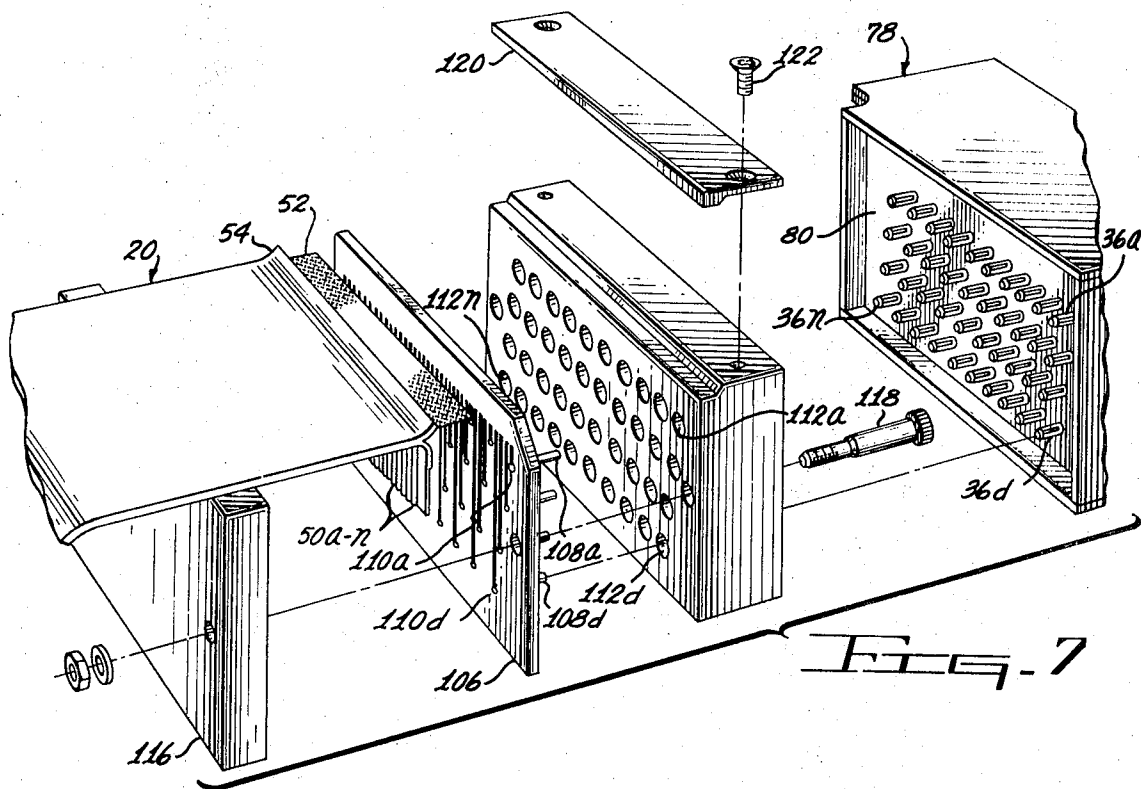


Fig. 6



FLATLINE CABLE IMPEDANCE MATCHING ADAPTER

BACKGROUND OF THE INVENTION

This invention related generally to an electrical connector and more particularly to adapters for providing an electrical connection that permits an impedance match between each conductor of a stripline flat cable and each corresponding contact element of the flat cable adapter and continues the impedance match to another cable adapter such as an adapter for a group of coaxial cables.

Stripline or flat cables comprising a large number of leads are used quite extensively in data processors at the present time. The ease of gathering many individual signals from different circuits of a data processor and placing these individual leads into a common shielded flat cable for distribution to another section of the data processor or to a peripheral machine has fostered the increased use. The flat cable maintains a close relationship between each of the conductors comprising the flat cable and simplifies termination methods. The size, weight and flexibility advantages of the flat cable have been proven in many applications. However, for some uses, conventional coaxial cable provides advantages not found in a stripline flat cable. The use of coaxial cables is advantageous for long distance transportation of signals and in cases where a cable might be exposed to the elements or to damage.

Providing an adapter for connecting the stripline flat cable to the individual coaxial cables has long been a problem. Previously with the slower speed memory data processors, it was not necessary to provide a close impedance match between the flat cable and the coaxial cable. The flat cable was generally fanned out into an adapter with the shielding fastened to a grounding bus. The shield of each coaxial cable was stripped back and fastened together before tying to the grounding bus. This provided little or no impedance match between the two cables but operated satisfactorily for the relatively slow-speed data processors.

With the faster rise time pulses be developed for line transmission and retrieval of digital data in present day data processors, the need to minimize impedance discontinuities between the stripline flat cable and the coaxial cables has become increasingly important.

An impedance mismatch causes the reflection of a portion of the amplitude of the transmitted pulse back towards the source. The reflected wave attenuates the pulse thereby decreasing the reliability of the data processor. The need to minimize impedance mismatch has retarded the use of a stripline flat cable for a portion of the transmission of signals and a group or bundle of coaxial cables for the remaining portion of the transmission. Either the flat cable or the coaxial cables are presently used for the entire cable simply to avoid using a connector to interconnect one to the other. Thus, if a particular signal is to be fed over a long distance, a coaxial cable is presently used to pick up the signal at the originating point and the signal is then transmitted by the coaxial cable without connectors into the second device. The large size of the coaxial cable, however, causes space problems while carrying the signal within the machine. The conductors of a flat cable could be better used to pick up the internal signals, but a flat cable has disadvantages for a long transmission of a signal.

Until this present invention, there has been no satisfactory means available for providing a flat cable adapter with little or no impedance discontinuity. Without a matched impedance adapter that is highly reliable both mechanically and electrically, the stripline flat cable cannot be used to its best advantage in a high-speed data processor. Thus, what is needed is an adapter, which can be easily fastened to the conductors of a shielded flat cable to provide an electrical matched impedance connection between the shielded flat cable and another adapter for a shielded cable such as a bundle of coaxial cables.

SUMMARY OF THE INVENTION

The adapter, according to the disclosed invention, provides an impedance match for a shielded stripline flat cable by placing the conductors of the flat cable in relation to the contact elements of the adapter such that a metallic block member surrounding the contact elements becomes an extension of the shield or ground return conductor of the cable, thereby, retaining the characteristic impedance of the cable. The flat cable adapter can then be attached to another adapter for mating the flat cable to another shielded cable such as another flat cable or a bundle of coaxial cables.

It is, therefore, an object of the present invention to provide a means for connecting a multiple conductor flat cable to an adapter.

A further object of this invention is to provide a means for connecting a multiple conductor stripline flat cable to a group of coaxial cables while providing an impedance match between the flat cable and the group of coaxial cables.

Another object is to provide an adapter which includes an inexpensive means for readily affixing shielded multiple conductor flat cable to the adapter while maintaining an impedance match between the shielded flat cable and the adapter.

Still another object is to provide an adapter for a multiple conductor shielded flat cable wherein a portion of the connector comprises a printed circuit board.

These and other objects will become realized according to a preferred embodiment as the description proceeds and the features of the novelty, which characterize the invention, will be pointed out in particularity in the claims forming a part of this specification.

BRIEF DESCRIPTION OF THE DRAWING

Further features and a more specific description of an illustrated embodiment of the invention are presented hereinafter with reference to the accompanying drawing, wherein:

FIG. 1 is a perspective view of a fully assembled adapter-connector connecting the shielded stripline flat cable to a group of coaxial cables;

FIG. 2 is a perspective view of a group of coaxial cables showing one cable stripped ready for use;

FIG. 3 is a perspective view of a flat stripline cable showing the multiple conductors and the shielding stripped back from the cable;

FIG. 4 is an exploded view of an embodiment of a connector according to the present invention;

FIG. 5 is a cross-sectional view taken along the lines 5-5 of FIG. 1;

FIG. 6 is closeup view taken along lines 6-6 of FIG. 5 showing the geometry involved in accomplishing an impedance match in a connector environment;

FIG. 7 is an exploded view of another embodiment of the present invention showing a flat cable adapter using a printed circuit board; and

FIG. 8 is a perspective view of an adapter with a flat cable prepared for attachment to another embodiment of a printed circuit board.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 is shown a connector 10 for connecting an adapter 21 for a shielded stripline flat or ribbon cable 20 to an adapter 23 for a coaxial cable bundle or group 22. The connector 10, according to this invention, provides an impedance match between the flat cable 20 and the coaxial cable group 22. Covers 24 and 26 are placed over each half of the connector 10. The covers 24 and 26 are preferably made of metal in order to protect the connection from injury. The covers, however, do not form a part of the impedance match since they do not come into electrical contact with either cable. It is possible to use a plastic material, or the like, for the covers 24 and 26, the requirements being to provide a strain relief for both the

flat cable 20 and the coaxial cable group 22, and a protection for the internal connections.

As shown in FIG. 2, the coaxial cable group 22 comprises several individual coaxial cables 30a—n. One coaxial cable 30a includes a center conductor or signal lead 32a, and a tube of electrically conductive material, a shield or ground return conductor 34a, insulated from and surrounding the center conductor 32a. In FIG. 2, one coaxial cable 30a from the group of coaxial cables 22 is shown with a portion of one center conductor 32a and a portion of one shield 34a stripped and laid bare for placement into a female contact element 36a. The female contact element 36a includes a large diameter portion 38a for contacting and gripping the outer insulating cover 40a of the coaxial cable 30a. This provides a strain relief for the female plug or contact element 36a. The bared shield 34a of the coaxial cable 30a comes into contact with a narrow diameter portion 42a of the female contact element 36a to which it contacts and provides an electrical connection between the female contact element 36a and the coaxial cable shield 34a. The center conductor or signal lead 32a of the coaxial cable 30a is connected to an internal portion of the female contact element 36a which in turn is insulated from the narrow diameter portion 42a by an insulation 44a, a portion of the insulation 44a protrudes at the tip of the female contact element 36a. The internal connection of one coaxial cable fastened to a female contact element is shown in FIG. 6 and will be described later.

A stripline flat cable 20, see FIG. 3, comprises a group of parallel conductors 50a—n, an electrically conductive screen shield 52 insulated and spaced a specific distance away from the conductors 50, and an insulating cover 54 encasing the shield 52. In FIG. 3, the shield 52 and the insulating cover 54 are shown stripped back from the conductors 50 in preparation for assembly according to an embodiment of the present invention.

Referring now to FIG. 4, for an exploded view of the flat cable adapter 21. After the flat cable 20 is prepared by separating the insulating cover 54 and the shielded screen 52 from a portion of an end of a flat cable 20, the conductors 50a—n are formed around a support block member 56 such that the conductors 50a—n are perpendicular to the shielding 52. The support block 56 is nonmetallic so that it has little or no effect on the impedance of the flat cable. The shield 52 is placed in electrical conduction with an electrically conductive block member 58 having holes or openings 59a—n into which is placed electrically conductive male plugs or contact elements 60a—n. The male contact elements 60a—n contact each conductor 50a—n respectively of the flat cable. For instance, contact element 60d is a male contact element for contacting the conductor 50d of the flat cable 20 and protruding into opening 59d in the metallic block 58. The male contact element 60d is insulated from the metallic block 58.

The contact elements 60a—n are fastened together by an electrically nonconductive mounting bar 62 and then mated with holes 59a—n in the conducting block 58. Several mounting bars 62 can be used in order to obtain a sufficient number of contacts for the conductors of the flat cable. For instance in the embodiment shown in FIG. 4, four rows of openings 59a—n are shown in conductive block 58. Thus, four mounting bars are needed, with the contact elements 60a—n mounted in each mounting bar 62 contacting every fourth conductor of the flat cable 20. Conductor 50d is shown prepared to be connected to contact element 60d and placed into opening 59d in the conductive block 58.

The shield 52 of the flat cable 20 is electrically fastened to the conductive block 58 by a shield clamping bar 64 which is fastened to the conducting block 58 by screws 66. The conductive block 58, the mounting bar 62, the conductors 50 of the flat cable 20, and the support block 56 are all clamped together by screw guides 68. A nut 70 and a washer 72 hold the group together and the screw guides 68 are also used to provide a method of mating the flat cable adapter 21 of the connector to the coaxial cable adapter 23.

Still referring to FIG. 4, the standard coaxial cable adapter 23 is shown fully assembled. A group of female contact elements 36a—n for the coaxial cable are shown mounted in a connector or adapter block member 80. The adapter block 80 supports each of the female contact elements 36a—n and insulates each contact element from each other. The female contact elements such as 36a are fastened to each of the coaxial cables as previously described in FIG. 2 and provide the connection from the center conductor 32a of the coaxial cable 22 to a corresponding one of the conductors 50a of the flat cable 20 and also to connect the shield 34a of the coaxial cable to the conductive block 58.

FIG. 5 shows a cross-sectional view of a completely assembled impedance controlled connector shown in FIG. 4. As stated previously in FIG. 1, neither the shield 52 of the flat cable 20 nor the shields 34a—n of the coaxial cables 30a—n comes in contact with the covers 24 and 26 of the connector. An insulating clamp liner 84 is placed above and below the flat cable 20 at the strain relief point to prevent the flat cable 20 from coming in contact with the cover 24. Likewise, the strain relief holder 86 for the coaxial cable group 22 is insulated from the individual coaxial cables 30a—n by the insulation 88 which is formed around the group of coaxial cables.

The conductive block 58 and the support block 56 constitute a pair defining a first mutual interface 90 in the flat cable adapter with the openings such as 59d in the conductive block placed perpendicularly to the first mutual interface 90. The connector block 80 supporting the female contact elements 36a—n of the coaxial cable group 22 is shown fastened to the conductive block 58 to form a second mutual interface 92 that is parallel to the first mutual interface 90 defined by the conductive block 58 and the support block 56. The flat cable adapter 21 and the coaxial cable adapter 23 of the connector 10 are held together by mounting brackets 94 fastened to each half of the cover 24 and 26 and fastened together by screws and nuts. A similar pair of mounting brackets (not shown) are also fastened to the bottom of the cover to complete the connection of the two adapters.

The shield 52 of the flat cable 20 is held in place against the conductive block 58 by the shield clamping block 64 and provides a means for providing electrical conduction between the shield 52 and the conductive block 58 as was previously described. The male contact element 60d is shown piercing the conductor 50d of the flat cable 20 and contacting the support block 56.

The impedance of a shielded cable is determined by the capacitive reactance and the resistance of the cable per unit distance of cable length. The capacitive reactance or distributed capacity of a shielded cable depends upon the distance between the signal lead and the shield and the dielectric constant of the insulation between them. The resistance of a cable depends upon its length and the gauge of the wire used. Therefore, to obtain an impedance match between a shielded cable and an adapter used on the shielded cable, the distributed capacity and the resistance of the adapter per unit length must match that of the cable.

The resistance of the contact elements in an adapter is extremely small because of short length of leads involved and therefore the resistance can be disregarded. Thus, in order to obtain an impedance match between a shielded cable and its adapter it is necessary to keep the distributed capacity the same through the connection. Essentially this means that the distance between the signal lead and the shield should be kept as nearly the same in the adapter as that in the cable, assuming that the dielectric constant of the insulation of both the cable and the adapter is approximately the same. A closeup view of the actual connection between the contact elements of both cables and the accomplishment of the impedance match in the connector is shown in FIG. 6.

Referring now to FIG. 6, the element mounting bar 62 is shown in cross section including the contact element 60d. The contact element 60d has a pin portion 96 for connecting to the conductor 50d of the flatline cable 20 and a male contact ele-

ment 98d for connection to the female contact elements 36d of the coaxial cable 30d. The conductive block 58 shown in FIG. 7 is a plastic molded block with an electrically conductive surface 100 plated over the entire outside surface of the block and also inside of each opening, such as 59d, in which the actual contact between the flat cable and the coaxial cable is made. The conductive plating 100 electrically contacts the shield 34d of the coaxial cable 30d through the outer conductive covering or large diameter portion 38d on the end of the female contact element 36d as was previously described in FIG. 2. The conductive plating 100 on the conductive block 58 extends between the male contact element 60d and 60h. This is done in order to keep the distance between the male contact element 60d and a portion 102 of the conductive block 58 which extends into the element mounting bar 62 as nearly the same as the distance between the signal conductor and the shield of the cables. The conductive plating 100 becomes an extension of the shield 34d of the coaxial cable 30d and since the shield of the flat cable 20 is fastened to the conductive block member 58 as previously described, the shields of both cables are electrically fastened together. The female contact element 36d keeps the spacing between the inner contact portion 104 and the outer conductive covering 38d essentially the same as the spacing between the center conductor 32d of the coaxial cable 30d and its shield 34d. Thus, the impedance characteristics of the shielded flat cable 20 are copied in the flat cable adapter while providing a means for connection the shielded flat cable to another shielded cable.

It is readily apparent that the impedance matching characteristic, according to the geometric configuration shown in FIG. 2, lends itself to many different types of connectors. It is also apparent that many techniques could be used for fastening the individual coaxial cables to the coaxial cable adapter of the connector as well as many ways in which the flat shielded cable can be attached to its adapter portion of the connector. For instance, in FIG. 7, a printed circuit board is used to contact individual conductors of a shielded flat cable.

Referring to FIG. 7, an exploded view of another embodiment of an impedance matching flat cable adapter is shown. The conventional coaxial cable adapter 78 shown on FIG. 7 is assembled in a manner as was previously described. The flat cable adapter comprises a printed circuit board 106 for connecting to conductors 50a—n. The printed circuit board 106 includes signal runs 110a—n to which the flat cable conductors are soldered.

The shielded flat cable 20 is stripped as shown in FIG. 3, wherein the insulated cover 54 is peeled back from the shield 52 and the individual conductors 50a—n are formed perpendicularly to the shield 52 of the flat cable. Each conductor 50a—n of the flat cable is soldered to a corresponding signal run 110a—n formed in the printed circuit board 106. The group of male contact elements 108a—n are soldered to the signal runs 110a—n respectively, and these contact elements 110a—n in turn are located into a group of holes or openings 112a—n formed in a conductive block 114. The conductive block 114 is constructed from a solid metal block or a metal-plated molded block as will be described. The conductive block 114 is fastened to the printed circuit board 106 and a support block 116 which supports the flat cable, in a manner similar to the first embodiment, that is, by the use of guide screws 118 which hold the combination firmly together through a nut and a washer fastened to the threaded end of each of the guide screws. Also, in this embodiment, the flat cable shield 52 is again fastened to the conductive block 114 by a shield clamping bar 120 which is fastened to the conductive block 114 by screws 122.

Still referring to FIG. 7, the contact elements 108a—n for the flat cable 20 fit into the holes 112a—n formed into the conductive block 114 in a manner such that the metallic portion of the conductive block 114 does not come into electrical contact with any of the contact elements. A cover (not shown) can again be used to protect the connector elements. The

combination of the connector elements of the flat cable adapter and the coaxial cable adapter are fitted together in a manner similar to that shown in FIG. 6 for the connector of the first embodiment.

The signal run elements in the printed circuit board 106 shown in FIG. 7 can be shaped such that the impedance characteristics of the flat cable 20 is retained by the geometric configuration of the copper lamination. The conductive block 114 is in turn electrically connected to a proper metallic coating over the printed circuit board which acts as a shield or ground for each element of the signal run. A configuration of this type of printed circuit board and also a board onto which the flatline cable can be directly soldered without stripping back the insulating cover and the shield is shown in FIG. 8.

Referring now to FIG. 8, a double-sided copper-clad printed circuit board 124 is shown. A copper laminate 126 is plated on both sides of the printed board 124 and includes a group of plated-through holes 128 which electrically interconnect the copper laminates 126 on the opposite sides of the board. The copper laminate 126 acts as a shield to a group of signal runs 130a—n. The group of signal runs 130a—n are etched in the printed circuit board 124 to provide the connection between the conductors 50a—n of a flat cable 20 and male contact elements 132a—n. The male contact elements 132a—n are soldered into a group of holes 134a—n formed through the plated signal runs 130a—n. A bottom portion 136 of the shield laminate 126 of the printed circuit board 124 is connected to the shield 52 of the flat cable 20.

The flat cable 20 can be prepared for soldering to the printed circuit board 124 as shown. The shield 52 and the conductors 50a—n of the flat cable 20 are bared at the end of the cable which is to be fastened to the printed circuit board 124. The insulation 54 formed over the shield 52 is stripped or ground away. The insulation covering the conductors 50a—n is then ground away to bare the individual conductors. The entire flat cable 20 is then placed against the printed circuit board as shown in FIG. 8. Shield 52 is soldered to the bottom of the shield laminate 126 and the individual conductor such as 50a is soldered to the individual etched signal run such as 130a. The soldering is done preferably by dip soldering but is obvious that other methods may be used. The flat cable adapter is then ready to be fastened to the coaxial cable adapter as previously shown and described in FIG. 7.

Referring again to FIG. 8, it is the geometric transfer of the equivalent distributed capacity of the cables to the laminations of a printed circuit board 124 that allows a close impedance match in this embodiment from the flat cable 20 to the group of coaxial cables 22. The equivalent distributed capacity is produced by providing a distance between the signal run 130a and the shield lamination 136 equivalent to that of the distance between the signal conductor and shield of a cable. The impedance match is kept constant through the connector by the use of a conductive block, such as conductive block 58 and conductive block 114, either a solid metallic conductive block or a copper laminated plastic conductive block.

The conductive block member in the embodiments shown can be a solid metallic block member with a group of openings drilled into the block for the contact elements of both cables. The metallic material provides an electrically conductive path for the shields of the flat cable and the coaxial cables. The conductive block may also be made of a nonconductive material, such as plastic, having a group of holes drilled therethrough. A metallic electrically conductive covering is then laminated over the entire outer surface of the block member. The conductive covering would produce the same results as a solid metallic block, that is, providing a conductive path for the shields of both cables.

Several embodiments have been shown in the present disclosure to produce a shielded flat cable adapter that provides a constant impedance to the transmission of a high frequency signal. There are, of course, many methods that could be used for contacting each of the wires of the flat cable, especially

since flat cables can have round or rectangular conductors. A flat cable having rectangular conductors can be pierced by a pointed contact element held by an element mounting bar forced against a support block as is shown in FIG. 6. The rectangular conductors can also be predrilled and contact elements having blunted ends could be used. The requirement is that the contact element must be placed into electrical contact with the conductors when the element mounting bar is assembled to the supporting block. Bifurcated contact elements that pierce the insulation surrounding the conductors of the flat cable and contact the individual conductors can be used for round conductors. The supporting block again supports the conductors to allow the knifing action and the ultimate contact between the individual conductors and the individual contact elements.

In the embodiments shown, a male plug or contact element is shown connected to the conductors of the flat cable and a female plug or contact element is shown connected to the coaxial cables. It is, of course, apparent that this selection was one of expediency and in no way is to be taken to limit this invention. The female adapter portion of the connector could very easily have been connected to the flat cable with but a very small change. Likewise, the male adapter portion could have just as easily been attached to the coaxial cable.

The impedance matching connector is disclosed as connecting a shielded flat cable to a group or bundle of coaxial cables. It is readily apparent that by using the invention disclosed, the impedance matching shielded flat cable adapter could be connected to an adapter for any type of shielded cable such as a second shielded flat cable by using a similar adapter as shown for the first flat cable. The male contact elements from the flat cable adapters could be interconnected inside of each opening in the conductive block member by an electrically conductive tubing insulated a specific distance from the conductive block member.

While the principles of the invention have now been made clear in an illustrative embodiment, there will be, immediately obvious to those skilled in the art, many modifications of structure, arrangement, proportions, the elements, materials, and components, used in the practice of the invention, and otherwise which are particularly adapted for specific environments and operating requirements without departing from those principles. The appended claims are therefore intended to cover and embrace any such modifications, within the limits only of the true spirit and scope of the invention.

I claim:

1. An adapter for providing an impedance match between the adapter and a stripline flat cable having a plurality of parallel conductors insulated from each other and a shield common to the conductor, said adapter comprising:

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough;

said support and said conductive block member constituting a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface;

means for providing electrical conduction between the shield of said flat cable and said conductive block member;

a plurality of spaced-apart electrically conductive contact elements mounted such that each contact element projects into a corresponding one of the plurality of holes formed in said conductive block member;

said plurality of contact elements electrically insulated from said conductive block member and from each other; and

fastening means in said interface for providing electrical conduction between each of the conductors of the flat cable and a corresponding one of said contact elements while maintaining a distance between the conductors and the conductive block member which is essentially the same as the distance between the conductors and the shield of the flat cable.

2. The adapter of claim 1 wherein the support block member forms the conductors of the flat cable parallel to said interface.

3. The adapter of claim 2 wherein the fastening means electrically contacts each of the conductors of the flat cable without removing the insulation from the conductors.

4. The adapter of claim 1 wherein the fastening means is a printed circuit board.

5. The adapter of claim 4 wherein the printed circuit board includes a signal path for each of the corresponding conductors of the flat cable and a common ground path laminated on both faces of the printed circuit board for the shield of the flat cable.

6. The adapter of claim 5 wherein the printed circuit board includes the means for providing electrical conduction between the shield of the flat cable and the conductive block member.

7. A connector for providing an impedance match between a stripline flat cable having a plurality of parallel conductors insulated from each other and a shield common to the conductors, and a plurality of coaxial cables each cable having a signal lead and a shield, said connector comprising:

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough;

said support and said conductive block members constituting a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface;

means for providing electrical conduction between the shield of said flat cable and said conductive block member;

a plurality of spaced-apart electrically conductive contact elements mounted such that each contact element projects into a corresponding one of the plurality of holes formed in said conductive block member;

said plurality of contact elements electrically insulated from said conductive block member and from each other;

fastening means in said interface for providing electrical conduction between each of the conductors of the flat cable and a corresponding one of said contact elements while maintaining a distance between the conductors and the conductive block member which is essentially the same as the distance between the conductors and the shield of the flat cable;

means projecting into said conductive block for fastening each of the signal leads of said group of coaxial cables to a corresponding one of said plurality of contact elements; and

means for providing electrical conduction between a shield of each of said group of coaxial cables to said conductive block member.

8. The connector of claim 7 wherein the support block member forms the conductors of the flat cable parallel to said interface.

9. The connector of claim 8 wherein the fastening means electrically contacts each of the conductors of the flat cable without removing the insulation from the conductors.

10. The connector of claim 7 wherein the fastening means is a printed circuit board.

11. The connector of claim 10 wherein the printed circuit board includes a signal path for each of the corresponding conductors of the flat cable and a common ground path laminated on both faces of the printed circuit board for the shield of the flat cable.

12. The connector of claim 11 wherein the printed circuit board includes the means for providing electrical conduction between the shield of the flat cable and the conductive block member.

13. An adapter for providing an impedance match between the adapter and a stripline flat cable having a plurality of parallel insulated conductors and a shield common to the conductors, said adapter comprising:

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough; said support and said conductive block members constituting a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface; 5

means for providing electrical conduction between the shield of said flat cable and said conductive block member;

a plurality of spaced-apart electrically conductive contact elements mounted such that each contact element projects into a corresponding one of the plurality of holes formed in said conductive block member; 10

said plurality of contact elements electrically insulated from said conductive block member and from each other; and 15

fastening means in said interface for providing electrical conduction between each of the parallel conductors of the flat cable and a corresponding one of said contact elements such that the contact elements are perpendicular to the plane of the conductors. 20

14. The adapter of claim 13 wherein the fastening means electrically contacts each of the conductors of the flat cable without removing the insulation from the conductors.

15. The adapter of claim 13 wherein the fastening means is a printed circuit board. 25

16. The adapter of claim 15 wherein the printed circuit board includes a signal path for each of the corresponding conductors of the flat cable and a common ground path laminated on both faces of the printed circuit board for the shield of the flat cable. 30

17. The adapter of claim 16 wherein the printed circuit board includes the means for providing electrical conduction between the shield of the flat cable and the conductive block member.

18. A connector for providing an impedance match 35

between a stripline flat cable having a plurality of parallel insulated conductors and a shield common to the conductors, and a plurality of coaxial cables each having a signal lead and a shield, said connector comprising:

a support block member for forming the parallel conductors 40

of the flat cable in a configuration perpendicular to the plane of the flat cable shield;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough; 45

said support and said conductive block members constituting a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface;

means for providing electrical conduction between the shield of said flat cable and said conductive block member; 50

a plurality of spaced-apart electrically conductive contact elements mounted such that each contact element projects into a corresponding one of the plurality of holes formed in said conductive block member;

said plurality of contact elements electrically insulated from said conductive block member and from each other;

fastening means in said interface for providing electrical conduction between each of the parallel conductors of the flat cable and a corresponding one of said contact elements; 60

means projecting into said conductive block for fastening each of the signal leads of said group of coaxial cables to a corresponding one of said plurality of contact elements; and

means for providing electrical conduction between a shield of each of said group of coaxial cables to said conductive block member.

19. The connector of claim 18 wherein the fastening means is a printed circuit board.

20. A connector for providing an impedance match between a stripline flat cable having a plurality of conductors and a shield common to the conductors, and a plurality of coaxial cables having a center conductor and a shield, said connector comprising: 70

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough;

said support and said conductive block members constituting a pair defining a first mutual interface with the holes in said conductive block member perpendicular to said first mutual interface;

a plurality of spaced-apart first electrically conductive contact elements mounted for insertion into a corresponding one of said plurality of holes in said conductive block member, each first contact element having an end projecting into said corresponding holes and electrically insulated from said conductive block member and from each other;

means in said first interface for providing electrical conduction between each of the conductors of the flat cable and a corresponding one of said contact elements while maintaining a distance between the conductors and the conductive block member which is essentially the same as the distance between the conductors and the shield of the flat cable;

means for fastening said support block member to said conductive block member;

means for providing electrical conduction between said shield of said flat cable and said conductive block member;

an adapter block member;

said adapter and said conductive block member constituting a pair defining a second mutual interface parallel with said first mutual interface;

a plurality of spaced-apart second electrically conductive contact elements mounted in said adapter block member, each second contact element having one end projecting into a corresponding one of said plurality of holes in the conductive block member, each second contact element including an inner portion formed to mate with a corresponding one of said first contact elements and an outer portion insulated from said inner portion for mating with its corresponding hole in the conductive block member;

means for providing electrical conduction between each of the center conductors of the plurality of coaxial cables and a corresponding one of said second contact element inner portions;

means for fastening each of the shield of the plurality of coaxial cables to a corresponding outer portion of said second contact elements; and

means for providing cooperative alignment between said support block member and conductive block member combination with said adapter block member.

21. The connector of claim 20 wherein the electrically conductive block member comprises a solid metallic piece.

22. The connector of claim 20 wherein the electrically conductive block member comprises an electrically nonconductive material having an electrically conductive lamination covering its exterior surface.

23. The connector of claim 20 wherein the means in said first interface for providing electrical conduction between each of the conductors of the flat cable and a corresponding one of said contact elements is a printed circuit board.

24. The connector of claim 23 wherein the printed circuit board includes a signal path for each of the corresponding conductors of the flat cable and a common ground path laminated on both faces and spaced a distance from the signal paths such that the impedance of the flat cables is maintained through the electrical connection between each of the conductors of the flat cable and a corresponding one of said contact elements.

25. An adapter for providing an impedance match between 75

the adapter and a stripline flat cable having a plurality of parallel conductors insulated from each other and a shield common to the conductors, said adapter comprising:

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough;

said support and said conductive block member constituting a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface;

means for providing electrical conduction between the shield of said flat cable and said conductive block member;

a printed circuit board located in said mutual interface and having a plurality of electrically conductive signal runs formed thereon;

means for fastening each of the conductors of the flat cables to a corresponding signal run of said printed circuit board; and

a plurality of spaced-apart electrically conductive contact elements electrically fastened to said signal runs and mounted such that each contact element projects into a corresponding one of the holes formed in said conductive block member.

26. An adapter for providing an impedance match between the adapter and a stripline flat cable having a plurality of parallel conductors insulated from each other and a shield common to the conductors, said adapter comprising:

a support block member;

an electrically conductive block member having a plurality of holes parallel to each other formed therethrough;

said support and said conductive block member constituting

a pair defining a mutual interface with the holes in said conductive block member perpendicular to said interface;

a printed circuit board located in said mutual interface and having an electrically conductive lamination formed on both sides of said printed circuit board, the laminations on both sides being electrically interconnected;

a plurality of signal runs formed in said electrically conductive lamination on said printed circuit board such that each signal run is insulated from each other;

means for fastening each of the conductors of the flat cable to a corresponding signal run of said printed circuit board;

a plurality of spaced-apart electrically conductive contact elements electrically fastened to said signal run and mounted such that each contact element projects into a corresponding one of the holes formed in said conductive block member;

means for providing electrical conduction between the shield of the flat cable and the electrically conductive lamination on the printed circuit board; and

means for providing electrical conduction between the electrically conductive lamination on the printed circuit board and the electrically conductive block member.

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