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ELECTRICAL TEST-POINT CONNECTOR

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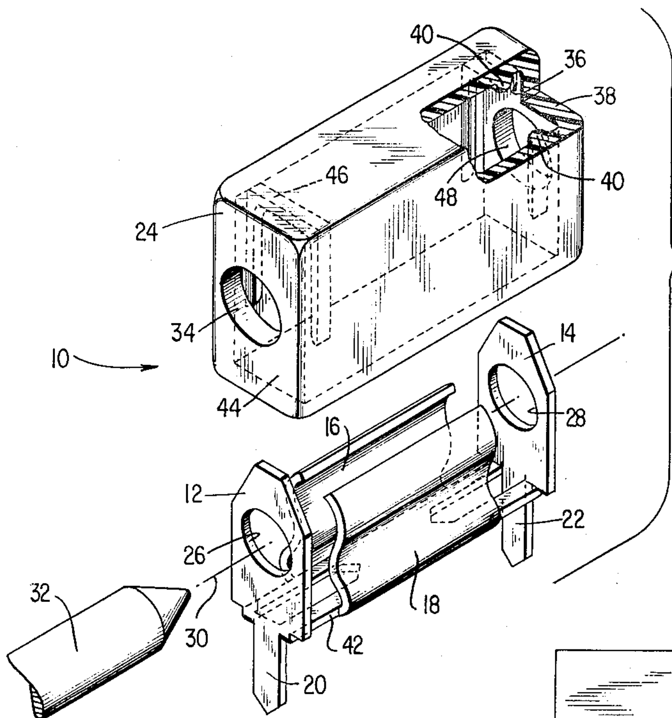


FIG. I

FIG. 2

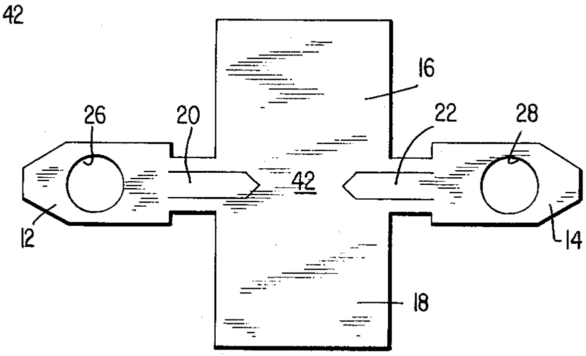
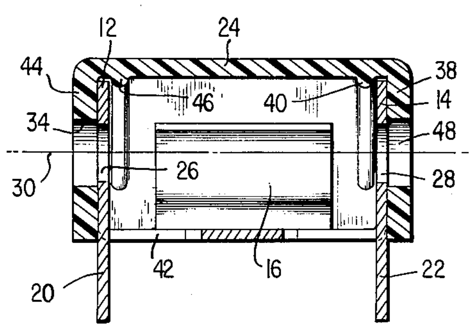


FIG. 3



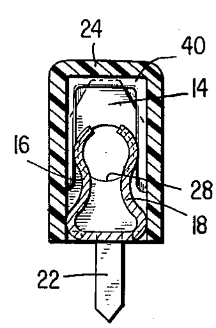


FIG. 4

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ELECTRICAL TEST-POINT CONNECTOR
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This invention pertains generally to electrical test-point connectors, and more specifically to test-point connectors of the type employing resilient or spring finger contact members.

Electrical connector devices employing resilient contact members are common in the art, and their uses are many. One ideal application for resilient contact members is found in the test-point connector, wherein a contact finger or the like (and usually a pair of such elements) is adapted to frictionally engage, by virtue of its resilience, an inserted elongate pin or male lead.

Test-point connectors may be generally defined as electrical connector devices which provide a good electrical connection with a test prod or the like which is inserted therein for the purpose of making a short-term or transitory contact with the circuit of which the test-point connector is a part. It is common practice to provide a plurality of test-point connectors in a given electrical equipment, the several connectors being placed at respective desired locations, so that an indication of the voltage at such respective locations may be had by the insertion of a voltmeter lead or test prod in each of the several connectors. Obviously, the connection between the meter and the equipment circuitry is only temporary, and it is a great convenience in practice to be able to achieve a good electrical connection to the circuitry by a mere insertion of the test prod into the connectors without having to perform other operations, such as manipulating threaded connectors and the like. As is apparent, the well-known resilient contact connector provides a ready solution to this requirement, since the test lead need merely be inserted into the connector device where it is received in and frictionally engaged by resilient contact members, such frictional engagement resulting from a slight deformation or bending displacement of portions of the resilient contact members.

As will be appreciated by those skilled in the art, resilient-contact connector devices must be designed and constructed in connection with a selected range of transverse dimensions of the pins or leads which are to be inserted therein. That is to say, for a given size of resilient contact member, there is a maximum permissable diameter or other transverse dimension for the lead to be inserted, in order to avoid exceeding the mechanical elastic limit of the material of the resilient contact during the deformation incident to the insertion of the lead. It is thus desirable to provide some protective means for limiting the size or transverse dimension of the test prod that may be inserted, and while the prior art has produced a few examples of means for achieving this limited entry, such prior art devices have generally proven either unsatisfactory in use or impractical and cumbersome to fabricate.

It is accordingly a primary object of the present invention to provide an electrical test-point connector of the type having one or more resilient contact members, one or more members for providing a limited entry thereto and one or more connector members, affording the desirable characteristics of the devices of the prior art and avoiding the disadvantages thereof.

More specifically, it is an object of the present invention to provide an electrical test-point connector device of a simplified and improved construction which, as com-

pared to the devices of the prior art, is both easier to fabricate and more reliable in use.

In accordance with the present invention, the above and other objects are achieved by means of an electrical test-point connector device of unitary construction, including (1) a resilient, electrically conductive contact member adapted to frictionally engage an inserted elongate conductor of up to a selected maximum transverse dimension without exceeding the mechanical elastic limit of the material of such contact member, (2) an apertured plate member integral with such contact member and disposed athwart the path of insertion of such elongate conductor, the aperture in such plate member being in substantial alignment with such path and having a transverse dimension substantially equal to such selected maximum dimension, and (3) a connector member integral with such contact member for connecting the latter to an external circuit. In one preferred embodiment, the test-point connector of this invention includes an insulating case or cover member having an internal boss or other upstanding portion thereon lying between the apertured plate member and the contact member to prevent displacement of the latter toward the former. Also, there may be a plurality of integral contact members, a plurality of integral apertured plate members and a plurality of integral spaced-apart connector members.

With the above considerations and objects in mind, the invention itself will now be described in connection with a preferred embodiment thereof given by way of example and not of limitation, and with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of a preferred form of the test-point connector of the present invention, showing the insulating cover member in exploded relationship with respect to the unitary conductive member,

FIG. 2 is a plan view of a representative stamping from which the unitary connector is formed,

FIG. 3 is a central vertical longitudinal section of the device illustrated in FIG. 1, and

FIG. 4 is a central vertical transverse section of the device of FIG. 1.

Referring now particularly to FIG. 1, the unitary electrical test-point connector is indicated generally at **10**, including a pair of apertured plate members **12** and **14** which are integral with a pair of resilient contact members **16** and **18** and a pair of connector members **20** and **22**, as well as an insulating cover member **24** which is adapted to be positioned over the aforementioned conductive elements as will be shown and further described in connection with subsequent figures of the drawings herein.

The apertures **26** and **28** in the plate members **12** and **14**, respectively, are in substantial alignment along a center line **30**, which is also the center line for a generally cylindrical configuration of the upper portions of the two resilient contact members **16** and **18**. It will be understood that center line **30** generally defines the path of insertion of an elongate conductor **32**, such as a test circuit lead or the like.

The insulating cover member **24** includes a pair of corresponding apertures in the end walls thereof, one of the apertures being shown at **34** in FIG. 1; as will be seen in connection with subsequent figures in the drawings herein, the other aperture in insulating cover member **24** is similarly positioned in the opposite end wall thereof. The cover member **24** is adapted to be positioned around the unitary conductive contact members and the parts associated therewith by sliding the former down over the latter, with the apertured plate members **12** and **14** thereupon sliding into respective grooves in the insulating cover member **24**, one of such grooves being indicated at 36 in FIG. 1 and being defined by the end wall 38 and the upstanding portion or boss 40. As shown, the boss 40 is substantially the shape of an inverted U and is substantially parallel to the end wall 38 and spaced therefrom a distance substantially equal to the thickness of the apertured plate member 14, so as to provide frictional retention of the insulating cover member 24 on the conductive members of the connector. Further, the width of apertured plate member 14 (i.e., the dimension of the plate member transverse of the center line 30) will preferably be sufficiently large to provide a forced-fit engagement with the inner walls of the insulating cover member 24 within groove 36. To aid the process of insertion of the apertured plate members in such a forced-fit relationship, the upper portions of the respective plate members 12 and 14 are tapered, as shown.

The partially cylindrical elements which form the extremities of the contact members 16 and 18 generally define a cylindrical volume which is occupied by the elongate external lead 32 when the latter is inserted within the test-point connector device of the present invention. As is common in the resilient contact art, the cylindrical volume represented by the positions of these contact member extremities when they are at their natural or unstrained position is somewhat smaller than the actual volume of the elongate lead 32. Accordingly, the insertion of the lead or prod 32 causes a deformation or bending displacement of the extremities of the contact members 16 and 18 in an outward direction, and the resulting resilient restoring force provides the desired frictional engagement with the lead 32. As was previously explained, it is desirable to protect the contact members 16 and 18 from deformation past the mechanical elastic limit of the material of the contact members, a condition which might be produced by the insertion of a lead 32 of an excessive transverse dimension. In accordance with this invention, this undesirable circumstance is prevented by the presence of the apertures 26 and 28 in the respective plate members 12 and 14, with such apertures being of a diameter (assuming the apertures to be circular, as shown) which is equal to the maximum permissible transverse dimension of the lead 32 for a given set of contact members 16 and 18.

As may be seen in FIG. 1, the contact members 16 and 18 are formed as integral portions of the conductive member of the device of the present invention, being connected to the apertured plate members 12 and 14 and the connector members 20 and 22 by means of a common base portion 42. With respect to the connector members 20 and 22, any desirable configuration may be employed, but the pointed or tipped connectors 20 and 22 shown herein are representative of connectors which are adapted to extend through printed circuit boards and the like for connection to the circuitry carried thereby.

In the operation of the device illustrated in FIG. 1, and assuming the insulating cover member 24 to be in position over the conductive elements of the connector so as to insulate such elements from their surroundings as well as to protect operating personnel from shock, the elongate conductor 32 is inserted into the test-point connector device along center line 30, first passing through the aperture 34 in the insulating cover member 24, then through aperture 26 in conductive plate member 12 and into the space between the partially cylindrical extremities of the contact members 16 and 18. Similarly, the elongate lead may be inserted in the opposite direction, passing through the aperture 28 in plate member 14 and then between the extremities of the contact members 16 and 18. The connector device of the present invention thus constitutes a double-ended test-point connector of the so-called "right-angle" construction, wherein the path of insertion of the test lead (defined generally by the center line 30) is perpendicular to the orientation of the connector members 20 and 22 which connect the contact members 16 and 18 of the device to an associated circuit. Furthermore, the double-ended, right-angle test-point connector of this invention achieves the desired result with a simplified and improved unitary construction, in sharp contrast to the relatively cumbersome and less practical devices of the prior art.

FIG. 2 is illustrative of the simplicity of the unitary conductive member of the present invention, showing a preferred form of a metallic stamping or the like in plan view. In FIG. 2, the several elements of the conductive member are shown in coplanar relationship as they appear subsequent to a stamping operation but prior to bending or formation into the final configuration. In order to form the conductive member shown in FIG. 1, the connector member 20 is bent downwardly out of the plane of base member 42 along the line of intersection of the connector member with the apertured plate member 12. The latter is bent upwardly out of the plane of base member 42 at this same line. Similarly, connector member 22 is bent downwardly at the intersection of the connector member with plate member 14, with the latter being bent upwardly from such line. The contact members 16 and 18 are bent up out of the plane of the base member 42 along the respective lines of their connection with such base member, and the two contact members 16 and 18 are also subjected to a further forming operation in which the extremities thereof are given substantially opposite partially cylindrical configurations by means of a reverse bend, as is shown in FIG. 1.

FIG. 3 shows the several elements of the test-point connector device of the invention in central vertical longitudinal section. As may be seen, the apertured plate member 12 is positioned within a slot or groove formed by end wall 44 and the boss or other upstanding portion 46, with the aperture 26 in plate member 12 being substantially coaxial with aperture 34 in end cap 44 along center line 30. Similarly, the boss or other upstanding portion 40 is positioned between the apertured plate member 14 and the contact member 16 so as to prevent displacement of the plate member 14 to the left toward the contact member. In this manner, the action of the apertured plate members 12 and 14 in providing a limited entry size for leads inserted within the device is reinforced by the support gained from the respective ribs or bosses 46 and 40. The aperture 28 in plate member 14 substantially aligned with an aperture 48 in end cap 38 of insulating cover member 24, both such apertures being substantially coaxial with apertures 26 and 34 on center line 30.

FIG. 4 shows a central (section plane 4—4 in FIG. 3) vertical transverse section of the device, particularly illustrating the substantial alignment of the partially cylindrical extremities of the contact members 16 and 18 with the aperture 28 in plate member 14 (as well as with aperture 26, not shown in this figure).

The invention has been described above in some detail, and particularly with reference to its application to a double-entry, right-angle test-point connector. However, it will be apparent to those skilled in the art that the invention is also applicable to other resilient contact connector devices where oversize pin insertion is to be prevented. Hence the invention is not to be considered as limited to the particular details given, nor to the specific application to which reference has been made during the description of the apparatus, except insofar as may be required by the scope of the appended claims.

What is claimed is:

1. A unitary limited-entry resilient-contact electrical test-point connector, comprising a one-piece conductive member embodying a base member, opposed side portions bent at substantially right angles to the base member substantially parallel to each other and providing a pair of resilient electrically conductive contact members adapted

to receive therebetween and frictionally engage an inserted elongate conductor of up to a selected maximum transverse dimension without exceeding the mechanical elastic limit of the material of said contact members, a pair of apertured plate members integral with said contact members and base member and extending from the ends of the base member at substantially right angles thereto and disposed athwart the path of insertion of such elongate conductor on respectively opposite sides of said contact member, the aperture in each of said plate members being in substantial alignment with such path and having a transverse dimension substantially equal to said selected maximum dimension, and a plurality of spaced-apart connector members integral with said base member and contact members for connecting the latter to at least one external circuit, the connector members being struck-out portions of the base member integral with the respective plate members and extending therefrom in common planes therewith in a direction away from said path of insertion of the conductor.

2. A connector as set forth in claim **1** wherein the one-piece conductive member is encased within an insulating cover member.

3. A connector as set forth in claim **2** wherein the insulating cover member has first and second internal

bosses each lying between a respective one of said apertured plate members and said contact members to prevent displacement of the former toward the latter.

4. A connector as set forth in claim **3** wherein the cover member has apertured end walls spaced outwardly from the respective internal bosses, the spaces therebetween defining grooves adapted to slidably receive the respective plate members.

References Cited by the Examiner

UNITED STATES PATENTS

1,702,451	2/1929	Phillippi.	
2,428,022	9/1947	Harrison et al.	339—258
2,703,872	3/1955	Doane	339—258
2,958,020	10/1960	Eannarino	339—258 X
2,958,065	10/1960	Flanagan	339—17
3,059,208	10/1962	Concelman	339—65
3,138,419	6/1964	Hammell et al.	339—217 X
3,148,010	9/1964	Woodward	339—17 X

FOREIGN PATENTS

54,552	10/1949	France.
216,289	5/1924	Great Britain.

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