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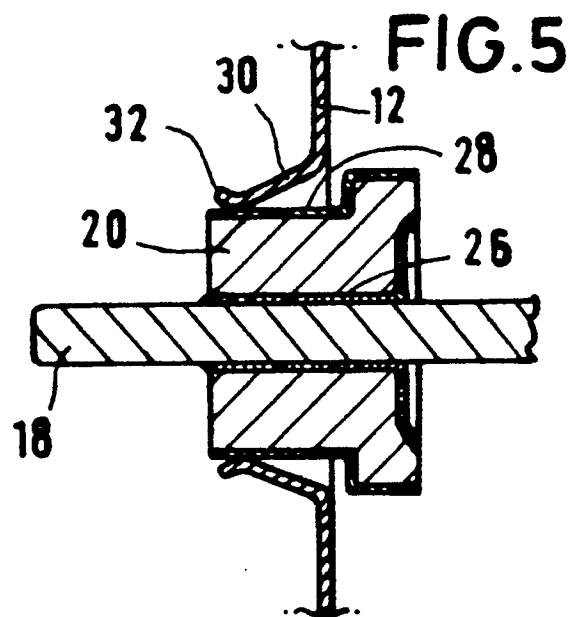
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**Electrical multiple plug.**

A multiple plug comprises a metal plate having a plurality of bores provided therein into which feed-through capacitors are fitted. From the center point of each bore an opening is punched from the metal plate forming triangular wedge portions and round openings between the tips of the wedge portions. The feed-through capacitors are positively inserted between the bent away wedge portions. The wedge portions form resilient suspension elements which extend between the metal plate and the feed-through capacitors for holding such capacitors in place. The wedge portions are capable of flexing in the event of differences resulting from thermal expansion or contraction of the metal plate or the feed-through capacitors. As such, they provide compensation for thermal expansion and variations in configuration resulting therefrom. In addition, the mechanical and electrical connection between the plate and the feed-through capacitors is maintained.



## ELECTRICAL MULTIPLE PLUG

### FIELD OF THE INVENTION:

The invention relates to a multiple plug comprising a metal plate with bores provided therein and feed-through capacitors which are fitted into same, with openings, through which plug pins are passed and soldered in position.

### BACKGROUND OF THE INVENTION:

It is known for electric cables to be screened by covering them with a wire mesh sheath. It is also known for electrical components or units to be screened for example by being enclosed in a metal housing. Frequently, multi-conductor cables are connected by way of a multiple plug to such electrical units. In an early state of the art, it was possible for electromagnetic interference fields to penetrate into the circuits by way of those plugs as, although the cable and the units were screened, the plug itself was not. Therefore screened multiple plugs were developed. A screened multiple plug of that nature includes a metal plate with bores which are arranged to correspond to the arrangement of the plug pins. What are known as feed-through capacitors with a central opening are fitted into the bores. The feed-through capacitors are of substantially cylindrical shape and essentially consist of ceramic material. They have internal and external metallisation thereon. The plug pins are soldered to the internal metallisation. Together with the internal and external metallisation and the insulating ceramic material, they form a capacitance. High frequency interference voltages which are induced in the plug pins by electromagnetic interference fields are drained off to ground by way of those capacitances and the metal plate. Under some circumstances, voltage breakdowns may also occur between the metal layers within the ceramic material and the voltages are drained off directly. The structure and the mode of operation of such feed-through capacitors are known and they are therefore not further described herein. Accordingly the feed-through capacitors which hold the plug pins and which are fitted into the bores in the metal plate result in the multiple plug being screened. The feed-through capacitors are soldered to the bores in the metal plate by way of their external metallisation. The coefficients of thermal expansion of the insulating material of the multi-point connector in which the plug pins are pressed, and the metal plate, are different. That means that, in the event of fluctuations in temperature, substantial forces are applied to the capacitors and cause

them to fracture so that they are no longer guaranteed to operate. It is no longer possible for such a capacitor to be soldered in position again or replaced. That means that, once a single capacitor is fractured, a multiple plug of that kind is useless and has to be totally replaced.

### SUMMARY OF THE INVENTION:

On that basis the underlying problem of the invention is that of providing a temperature-insensitive multiple plug in which, even in the event of fluctuating temperatures, the feed-through capacitors retain their electrical function and their condition of being mechanically and electrically connected to the metal plate. In a multiple plug of the kind set forth in the opening part of this specification, the solution to that problem in accordance with a preferred form of the invention provides that the metal plate is punched, starting from the centre point of each of the bores, forming triangular wedge portions and forming round openings between the tips of the wedge portions, the wedge portions are bent away to one side and the feed-through capacitors are positively inserted between same. The feed-through capacitors are therefore no longer disposed directly in the bores. Between the bores and the feed-through capacitors are the wedge portions which are provided in accordance with the invention. The wedge portions form resilient suspension means which extend between the metal plate and the feed-through capacitors and which hold the latter. The wedge portions are resilient in themselves and they flex somewhat in the event of differences in expansion or contraction of the metal plate on the one hand and the feed-through capacitors on the other hand. In that way they compensate for thermal expansion and alterations in shape resulting therefrom. The mechanical and electrical connection between the plate and the feed-through capacitors is retained.

The tips of the wedge portions are desirably rounded off. That provides a larger area for the wedge portions to bear against the feed-through capacitors. That arrangement also ensures that the external metallisation on the feed-through capacitors is not scraped off when they are pushed into position between the wedge portions.

In another advantageous embodiment the feed-through capacitors are soldered to the tips of the wedge portions. That provides a force-locking connection as between the wedge portions and the feed-through capacitors. The feed-through capacitors are better held between the wedge portions

and thus in the metal plate.

In a further embodiment of the feed-through capacitors are not disposed directly in the plate, but with the interposition of metal sleeves. More specifically that arrangement provides that a respective metal sleeve is pushed on to each feed-through capacitor and soldered thereto and the sleeves are force-lockingly inserted between the tips of the wedge portions. The sleeves are soldered to the external metallisation on the feed-through capacitors. However the sleeves are not soldered to the tips of the wedge portions. It is sufficient for the sleeves to be positively held between the tips, in a kind of press fit.

The feed-through capacitors may be of a smooth cylindrical configuration, in which case the sleeves extend over the entire length of the feed-through capacitors. The feed-through capacitors may also have a shoulder at one end and the sleeves then extend from the opposite end face of the feed-through capacitors to the inward edge of the respective shoulder. The outside diameter of a shoulder may be larger than that of a sleeve. The outside diameter of the shoulder and the sleeve may also be identical.

As stated, the wedge portions form resilient suspension means for the feed-through capacitors so that differences in thermal expansion are accommodated thereby. In order to enhance that effect, it is recommended that the metal forming the plate is elastic and the gauge of the plate is so selected that the wedge portions are resilient over their length. The length and the width of the slots which extend between the wedge portions and therewith also the dimensions of the wedge portions themselves determine the degree of resiliency of the resilient suspension means. Those dimensions, together with the gauge of the plate, and the resiliency of the metal forming the plate, together with other properties, are so selected that the feed-through capacitors are mechanically firmly but nonetheless adequately resiliently held in position.

#### BRIEF DESCRIPTION OF THE DRAWINGS:

The invention will now be described in further detail by way of example by means of the embodiments illustrated in the drawing in which:

Figure 1 is a plan view of the metal plate which is included in the multiple plug and which holds the plug pins.

Figure 2 is a view in section taken along line II-II in Figure 1.

Figure 3 is an exploded perspective view of a feed-through capacitor and a part of the metal plate with the opening accommodating the capaci-

tor and the wedge portions holding the capacitor.

Figure 4 is a view of a feed-through capacitor which is fitted into an opening, viewing in the direction indicated by the arrow IV in Figure 3.

Figure 5 is a view in section taken along line V-V in Figure 4.

Figure 6 is a view in section through an embodiment of a feed-through capacitor with sleeve pushed thereon and the wedge portions holding the capacitor.

Figure 7 is a sectional view similar to that of Figure 6 showing another embodiment.

Figure 8 is a sectional view similar to that of Figure 6 showing yet another embodiment.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Figure 1 shows the metal plate 12. At its ends it has bores 14 for connecting it to the plug housing. It also includes the openings 16 for receiving the plug pins 18. Some of the plug pins 18 are shown in diagrammatic form in the left-hand part of Figure 1. The wedge portions according to the invention are not shown in Figure 1, for enhanced clarity of the drawing. Figure 2 diagrammatically shows from the side the wedge portions which extend from the edges of the openings 16 and the feed-through capacitors 20 which are pushed into position between the wedge portions. The feed-through capacitors 20 in turn receive the plug pins 18. Figure 3 shows such a feed-through capacitor 20 in greater detail. The illustrated feed-through capacitor 20 includes a cylindrical portion 22 and a rectangular shoulder 24. As shown in Figure 5, the feed-through capacitor 20 has an internal metallisation 26 and an external metallisation 28. Figure 3 also shows a part of the metal plate 12. The triangular wedge portions 30 with their rounded-off tips 32 can also be seen therein. The wedge portions 30 are disposed around the opening 34. The slots 36 extend between the wedge portions 30. The wedge portions 30 are themselves formed by the punching of the opening 32 and the slots 36. When viewing the drawing, the wedge portions 30 are raised or bent forwardly out of the plane of the paper. Figure 4 shows the whole from above. Figures 4 and 5 in conjunction show that the feed-through capacitors 20 with the plug pins 18 carried thereby are simply pushed into position between the wedge portions 30. As a result of the resiliency of the wedge portions 30, the tips 32 thereof bear resiliently against the external metallisation 28 on the feed-through capacitors 20. That provides for the desired mechanical and electrical connection. The tips 32 are additionally soldered to the external metallisation 28.

The embodiments illustrated in Figures 6 through 8 additionally include metal sleeves 38 which are pushed on to the cylindrical portion of the feed-through capacitors and soldered to the external metallisation 28. Similarly to the embodiment shown in Figure 5, they are also disposed between the tips 32 of the wedge portions 30 where they are resiliently held in position. The resulting press fit is sufficient for the feed-through capacitors 20 to be firmly held in position. Generally the tips 32 are not soldered to the sleeves 38.

In the embodiments shown in Figures 6 and 8 the feed-through capacitors 20 have a shoulder 24. In Figure 6 the shoulder 24 is of a large outside diameter while in Figure 8 it is of a smaller outside diameter which is identical to the outside diameter of the sleeve 38. In Figure 7 the feed-through capacitor 20 is of a smooth cylindrical configuration. The sleeve 38 extends over the entire length thereof. A shoulder 24 as is also shown in Figure 3 permits the feed-through capacitor 20 to be gripped with a gripping tool and moved into a given rotational position. That makes it easier to push in the plug pins 18 if, as shown in figure 3, they are of a rectangular configuration. On the other hand round plug pins can be easily pushed into the feed-through capacitors without aligning the latter.

The preferred embodiments described herein are intended to be in an illustrative rather than limiting sense, it being understood that variations therefrom may be made without departing from the contemplated scope of the invention. The true scope of the invention is set forth in the claims appended hereto.

## Claims

1. A multiple plug comprising a metal plate with bores provided therein and feed-through capacitors which are fitted into same, with openings, through which plug pins are passed and soldered in position, characterized in that the metal plate (12) is punched, starting from the centre point of each of the bores, forming triangular wedge portions (30) and forming round openings (34) between the tips (32) of the wedge portions (30), the wedge portions (30) are bent away to one side and the feed-through capacitors (20) are positively inserted between same.

2. A multiple plug according to claim 1 characterized in that the tips of the wedge portions (30) are rounded off.

3. A multiple plug according to claim 1 or claim 2 characterized in that the feed-through capacitors (20) are soldered to the tips (32) of the wedge portions (30).

4. A multiple plug according to claim 3 characterized in that a metal sleeve (38) is pushed respectively onto each feed-through capacitor (20) and soldered thereto and the sleeves (38) are force-lockingly inserted between the tips (32) of the wedge portions (30).

5. A multiple plug according to claim 4 characterized in that the sleeves (38) extend over the entire length of the feed-through capacitors (20).

6. A multiple plug according to claim 4 characterized in that the feed-through capacitors (20) each have a shoulder (24) at one end and the sleeves (28) extend from the opposite end face of the feed-through capacitors (20) to the inward edge of the respective shoulders (24).

7. A multiple plug according to claim 6 characterized in that the outside diameter of a shoulder (24) is larger than that of a sleeve (38).

8. A multiple plug according to claim 6 characterized in that the outside diameters of the shoulder (24) and the sleeve (38) are identical.

9. A multiple plug according to claim 8 characterized in that the metal forming the plate (12) is elastic and the gauge of the plate (12) is so selected that the wedge portions (30) are resilient over their respective lengths.

FIG.1

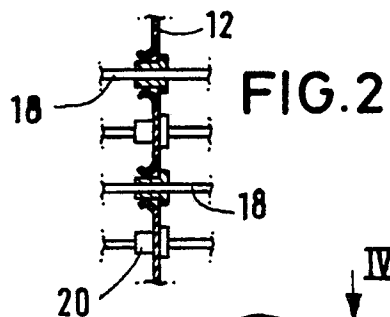
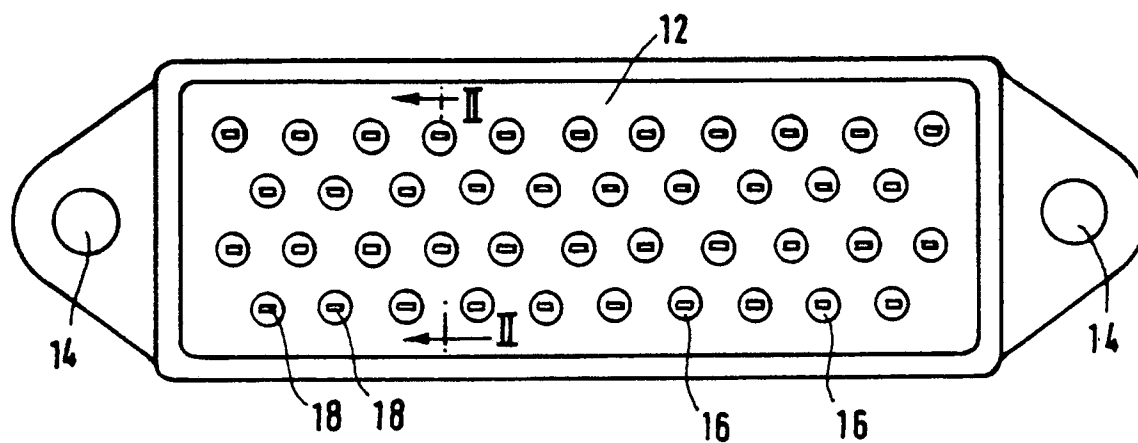


FIG.2

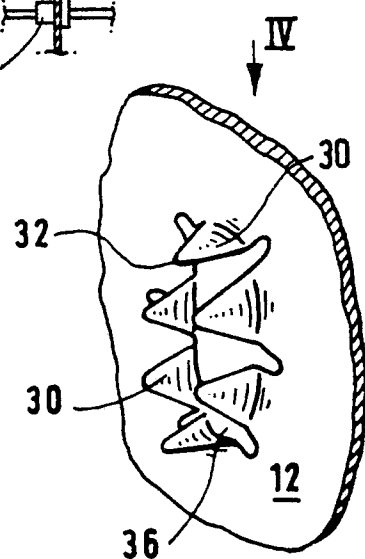


FIG.3

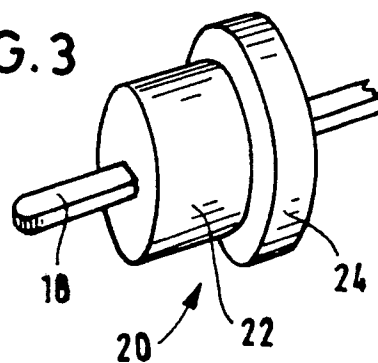


FIG.4

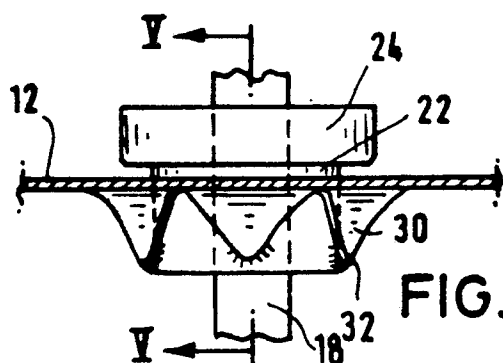
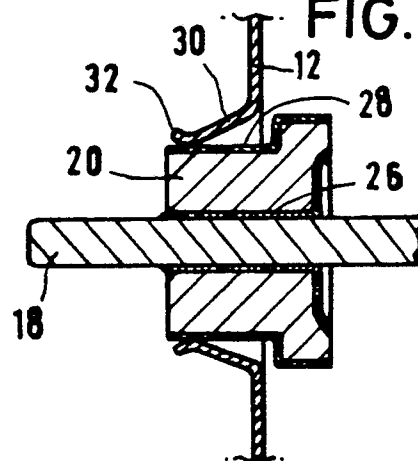


FIG.5



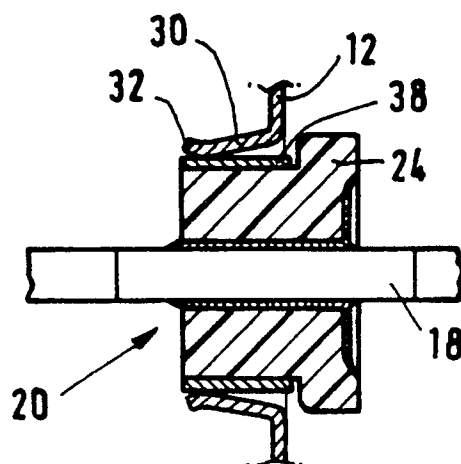


FIG. 6

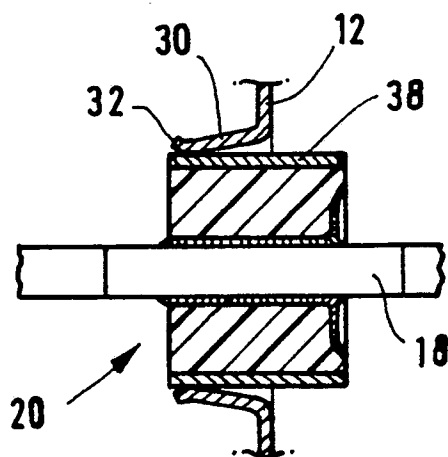


FIG. 7

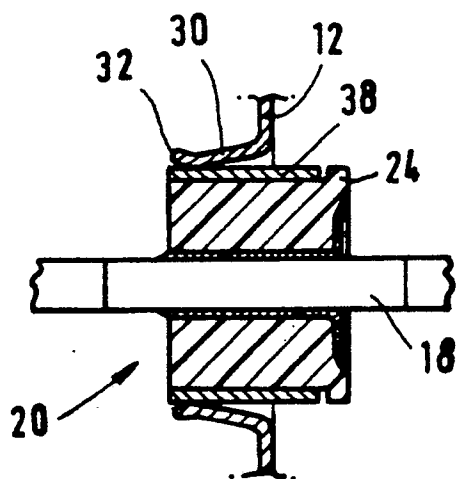


FIG. 8



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

EP 90 10 3368

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                          |                                                |                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                            | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE-A-1 946 115 (INTERNATIONAL STANDARD ELECTRIC)<br>* page 3, paragraphs 2,3; page 4, paragraph 2; figures 1,2 *                                                                                                         | 1,2                                            | H 01 R 13/719                                 |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ---                                                                                                                                                                                                                      | 4,9                                            |                                               |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DE-A-2 103 032 (INTERNATIONAL STANDARD ELECTRIC)<br>* page 2, paragraph 2; figures 1-3 *                                                                                                                                 | 1,2                                            |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | NEW ELECTRONICS<br>vol. 19, no. 13, June 1986, pages 63,64, London, GB; P. CALLAGHAN:<br>"Filtered connectors protect against RFI/EMI" * page 63, middle column - right hand column, paragraph 1; figures 1,2 *<br>----- | 1,4,5                                          |                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                          |                                                | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                          |                                                | H 01 R 13/00                                  |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                          |                                                |                                               |
| Place of search<br>BERLIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                          | Date of completion of the search<br>22-05-1990 | Examiner<br>ALEXATOS G                        |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                                                          |                                                |                                               |