Oct. 11, 1966 J. BERNUTZ 3,278,714

SUPPORTING FRAME FOR PRINTED CIRCUIT BOARD

Filed Nov. 5, 1964 3 Sheets-Sheet 1

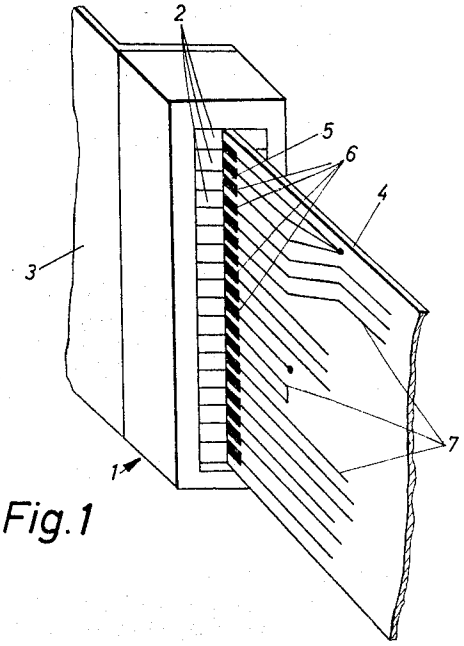

Fig. 1

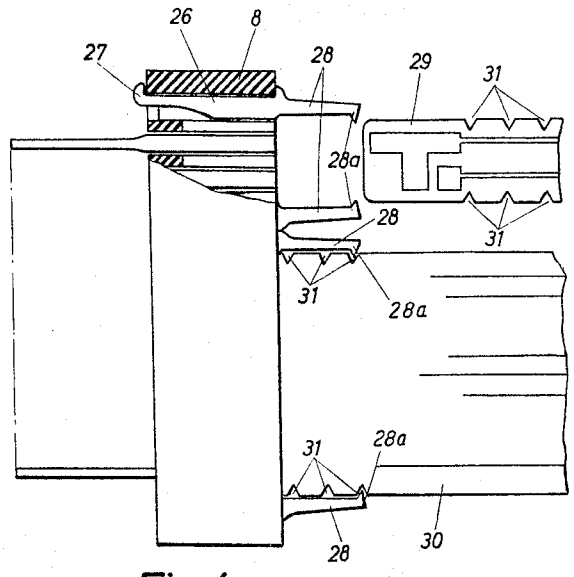

Fig. 4

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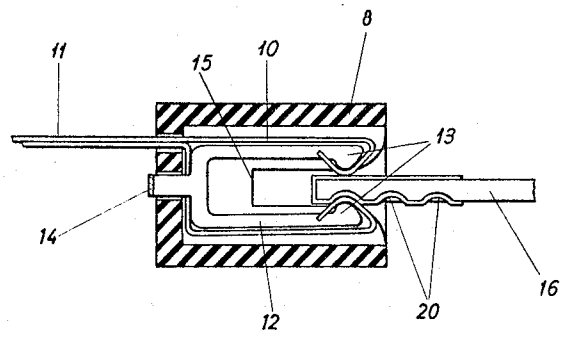

Fig. 3

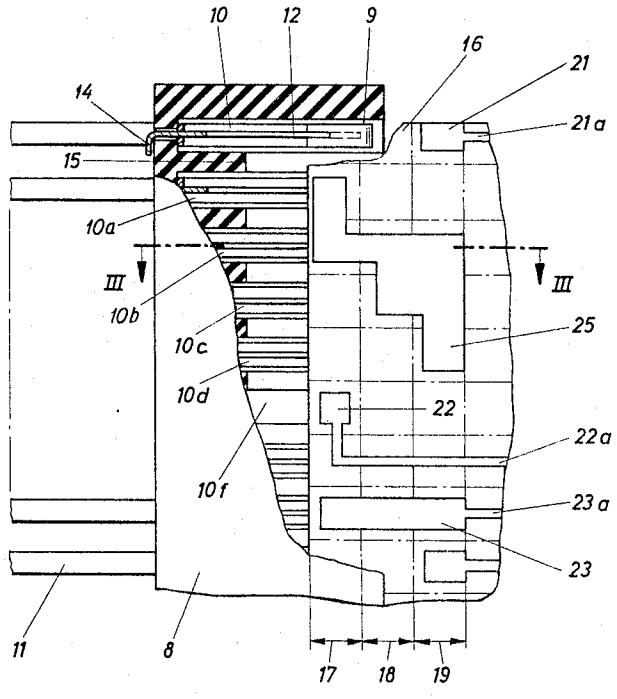

Fig. 2

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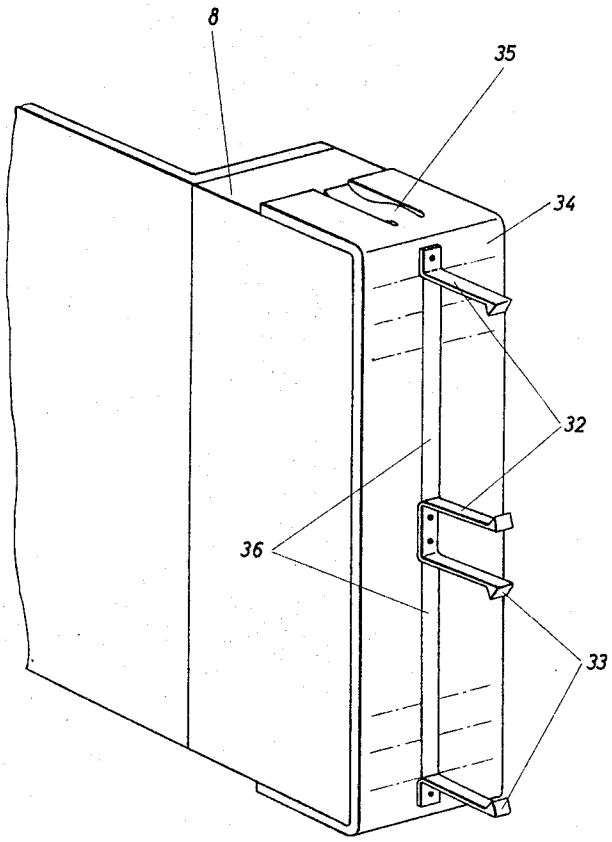

Fig. 5

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3,278,714

SUPPORTING FRAME FOR PRINTED CIRCUIT BOARD

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Claims priority, application Germany, Nov. 14, 1963, St 21,325
5 Claims. (Cl. 200—166)

The present invention relates to electrical contacts and in particular to an arrangement for contact spring strips including contacts arranged in rows in a manner to accept a contacting knife blade or several contacting knife blades to connect a multiplicity of contacts.

Contact spring strips serve, among other things, to connect components mounted on wafers or component supports. One section of the edge of such a wafer is thereby provided with side by side conductive sections corresponding to the sub-division of the contact strips and serves directly as a contact knife blade. The invention, described below, however, also applies for such arrangements in which a separate knife blade strip with the required contacting points is provided.

For circuit arrangements including a large number of such circuit components, it is generally necessary to remove components or circuit wafers respectively for testing purposes and to connect instead individual contacts or contact groups with each other or with external circuit components by hand-operated contacts of various types.

Depending on the type of the circuit arrangements given, simple make and break contacts must be considered as well as more extensive combinations of switch-over and sequence-contacts. It is conventional to use contact spring sets with particular operating elements which are connected through a corresponding number of individual plug-in contacts. A primary object of this invention is to provide a circuit contacting arrangement for contact spring strips of the type mentioned, which is of singular construction and is easier to handle than the facilities hitherto available.

The problem is solved by providing a contact knife blade, in parallel to the knife blade edge and oriented in the direction of insertion. With this construction, at least two contact rows are provided side by side and between the contact strip and contact knife blade engaging elements are provided which engage at different inserting positions of the contact knife blade in the contact springs with the respectively associated recesses of the opposite contacting piece. By this means it is possible to connect an arbitrary number of contact groups, using the conventional contact knife blades, dimensioned to a width corresponding to the respective number of contacts. Furthermore, this facility permits switching processes for individual contacts as well as for an arbitrary number of contact groups without separate contact spring sets. Moreover, particular actuating elements can be deleted, because the switching processes are made by setting the respective contact knife blades into one of several possible inserting positions. The conductive sections of the contact knife blade, arranged in several rows, can be connected in an arbitrary way with each other or with external switching elements of a testing circuit or the like, thus warranting a most favorable adaptability of the device to various switching tasks. Finally, the position of

the contact knife blade in the once definitely set insertion depth can be obtained, independently of the continuance of the operative force, with the aid of relatively simple engaging elements.

According to a particular embodiment of the invention, various possible positions for insertion of the contact knife blade can be used to realize stable as well as variable switching positions. This is achieved by resetting elastic elements which are provided between the contact spring strip and the contact knife blade. These last elements cause at least one of the varying inserting positions of the contact knife blade to depend on the maintenance of an actuating force. In this way, an essential easement of attendance is achieved, particularly for example when tests are to be made repeatedly.

When a contact knife blade covering all contacts of a contact strip is used instead of several separated contact knife blades of a smaller width, the engaging elements can be made like leaf-type springs according to a further embodiment of the invention and provided on the knife blade side of the contact spring strip on either side of each knife blade. Thereby, a particularly safe locking of the contact knife blades in their engaged positions is obtained.

According to another embodiment of the invention for which the above-mentioned prerequisite also applies, the engaging elements are made as leaf-type spring filler pieces representing extended sections beyond the knife-blade side of the contact strip and insertable instead of a contact spring into the contact strip. The filler pieces inserted in such a contact strip simultaneously serve as lateral guides for the individual contact knife blades.

If, however, the alternate use of a contact knife blade passing over all contacts respectively the use of several separated contact knife blades is demanded a type of construction is recommended in which the engaging springs are provided on a cover plate arranged on the knife blade side of the contact strip which engaging springs are equipped with recesses to insert the contact knife blade. Fixing of such a cover plate on the contact strip is possible without difficulties, thus enabling in a simple manner to replace various cover plates with the pertaining contact knife blade sets.

Further advantages and features of the invention may be gathered from the following description of examples, represented schematically in the attached drawings, wherein:

FIG. 1 shows a conventional contact spring strip with inserted contacting wafer in a perspective view;

FIG. 2 shows a contact spring strip according to the invention in a partial section;

FIG. 3 shows a section of the contact spring strip according to FIG. 2 in the plane III—III;

FIG. 4 shows a contact spring strip with inserted filler pieces and elastic engaging elements; and

FIG. 5 shows a contact spring strip with cover plate and thereto fixed engaging elements in a perspective view.

FIG. 1 shows a contact spring strip **1** with contact springs **2** arranged in rows in a housing section **3**. A circuit wafer **4** is shown inserted into the contact springs, the vertical edge **5** of said wafer serving as a contact knife blade and being provided with the conductive sections **6**. The sections **6** are connected through leads **7** either with each other or with components mounted on the wafer, but not shown in the drawing.

In the arrangement according to the invention, shown in FIGS. 2 and 3, the actual contact strip remained unchanged. The latter one consists of a housing **8**, made of insulating material, with pocket-shaped recesses **9**, accommodating one of the contact springs **10**. The extended spring ends are led through the rear wall of the housing and provided as terminal lugs **11**. A bow-shaped tension spring **12** is inserted into each contact spring **10**, the claw-like ends **13** engage into the bent spring ends of the contact spring, thereby providing the necessary contact pressure. The vertexes of the bows of the tension spring **12** are anchored into the rear wall of the housing by means of bent studs **14**.

The insulating partitions between the individual contact springs are recessed at the bottom of the recesses up to the edges **15**, enabling insertion of a contact knife blade **16** bridging several contacts. This contact knife blade bears three rows **17**, **18** and **19** of contact sections arranged in parallel to the knife blade edge, which contact sections are connected partly with each other or with the components mounted onto the wafer. Each of the contact rows **17** to **19** corresponds to an inserting position of the contact knife blade into the contact springs. At the bottom side of the contact knife blade cylindrical recesses **20** are provided at each point of a contact section in the three contact rows, into which recesses the bow ends **13** of the tension spring, respectively the spring ends of the pertinent contacts **10**, engage. Due to this measure the contacts, composed of the tension spring and a contact spring, serve as engaging elements to keep the contact knife blade in the inserting position set.

The contacting sections on the contact knife blade can be used to perform a varying number of switchings. In the example shown, the contact section **21** is arranged in the contact row **19** and therefore engages with the pertinent contact spring only in the final position of the contact knife blade. On the other hand, the contact section **22** is arranged in the contact row **17** and makes contact with the first position of the knife blade. The contact section **23** extends, for example, across all contact rows **17** to **19** and therefore provides a conductive connection to the respective spring contact in all positions of the knife blade. All contact sections of the contact knife blade are connected through pertinent leads **21***a* to **23***a* with the other circuits on the wafer. The example for the contact section **22** shows the pertinent lead **22***a* running over a section of the contact knife blade, associated with a non-occupied contacting point **10***f*.

The contact panel **25**, composed of several contact sections or sections made of conductive material in the contact knife blade, is associated with the contact springs **10***a* to **10***d* of the contact strip. As may be gathered from FIG. 2, the two contact springs **10***a* and **10***b* are interconnected in the first position of the knife blade, corresponding to the contact row **17**. At the transition into the second position, corresponding to contact row **18**, at first the connection between the contact springs **10***a* and **10***b* is disconnected, whereupon the contact spring **10***b* is connected with the contact spring **10***c*. In the third position of the knife blade, corresponding to the contact row **19**, the contact springs **10***b*, **10***c* and **10***d* are conductively connected. This facility corresponds, with regard to the cooperation of the contact panel **25** with the contact springs **10***a* to **10***d*, to the sequence-switching of a break-contact with two make-contacts.

FIG. 4 shows that filler pieces **26** are inserted into some recesses of the contact housing **8** instead of spring contacts, said filler pieces being equipped with an elastic latching cam **27**, protruding through the rear side of the housing and pressed towards the rear wall of said housing from the other side. On the knife blade side the filler pieces **26** form leaf-type spring studs **28**, arranged on either side of contact knife blades **29** or **30**, respectively. In the example shown, the contact knife blades **29** and **30** cover different contact groups and are provided for three positions. To lock the insertion positions the spring studs

28 engage with cams **28***a* into the pertinent notches **31** on the lateral edges of the contact knife blade. The lateral surfaces of the filler pieces **26** serve as guiding surfaces when the contact knife blades are inserted.

FIG. 5 shows engaging springs **32** with cams **33** at their respective ends, fixed to a cover plate **34**. This cover plate is also fixed to the housing **8** by means of elastic engaging elements **35** and provided with slotted recesses **36**, matching the width of the pertinent contact knife blades. This makes it possible to used separate contact knife blades while the cover plate is in place. If the cover plate is removed, a through-running contact knife blade or a corresponding circuit wafer can be inserted.

The hitherto described examples of the invention refer to the inserting positions of the contact knife blades as stable positions. If required, it is also possible to make the individual positions dependent on the maintenance of an operative force. To this end, it is only required to flatten the recesses for a form-locking engagement of the corresponding engaging elements in the direction of insertion or to omit them entirely, while additional spring elements perform the operation of restoring the contact knife blade into the adjacent position.

While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What is claimed is:

1. Electrical contact making devices, comprising:
- a contact maker;
- a housing composed of insulating material for receiving said contact maker;
- a plurality of contact springs;
- means supporting said contact springs in rows side by side within said housing;
- said contact maker including a wafer having a knife blade edge along one end and a plurality of sections of conductive material along a face;
- said sections of conductive material being of varying sizes and shapes and supported at varying distances from the knife blade edge to be able to fit against said contact springs and to complete electrical connections;
- said contact maker including first engaging elements arranged at preselected distances from the knife blade edge to enable support of said contact maker at preselected depths within the housing;
- said sections of conductive material contacting various of said contact springs according to the preselected depth to which the contact maker is placed; and
- second engaging elements positioned with respect to said housing locking with said first engaging elements to hold said selected sections of conductive material in contact with said contact springs.

2. Electrical contact making devices substantially as claimed in claim **1**, in which:
- said second engaging elements are shaped like a leaf-type spring and are fastened to the housing on both sides of the contact maker to engage said first engaging elements.

3. Electrical contact making devices substantially as claimed in claim **2**, in which:
- said second engaging elements are fastened to said housing through insertion in spaces otherwise occupied by contact springs.

4. Electrical contact making devices substantially as claimed in claim **2**, in which:
- said second engaging elements are fixed to a cover plate; and
- said cover plate is fastened to said housing to cover said contact springs including recesses through which said contact knife may be inserted.

5. Electrical contact making devices substantially as claimed in claim **1**, in which:

said first engaging elements comprise recesses on the lateral edges of the contact maker.

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