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(54) Switch with two pairs of contacts and two-cell arc extinguishing chamber

(57) The arc extinguishing unit of the switch comprises a body of insulating material (20) and two packs (21, 21') of superposed laminae (23, 23') insulated from one another. Each pack of laminae has an arc splitting side and a gas discharge side, and is arranged beside the other with the interposition of a substantially flat portion (28) of the body. In order to obtain compactness, efficiency of extinguishing of the arc, and discharge of the gases without dispersions within the switch, means (31-34) are provided for channelling the gases formed, partly inside the body (20) and partly by conjugate surfaces of the body and of at least one of the shells (5, 5') which together constitute the housing of the switch. Said channelling means extend from a region adjacent to the discharge side of each of the two packs of laminae as far as apertures (15) provided on one side of the housing.

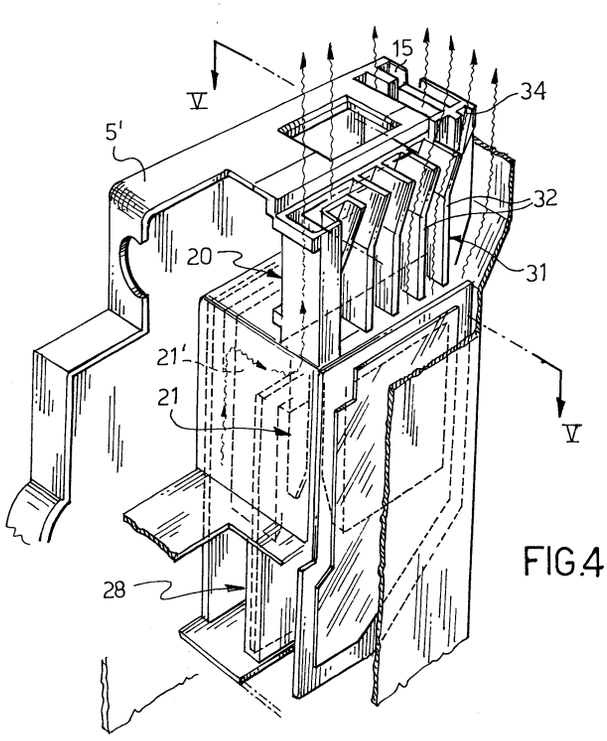

FIG.4

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Description

[0001] The present invention relates to electrical switches and, in particular, to a switch with two pairs of contacts and with a two-cell arc extinguishing unit.

[0002] The extinguishing cells widely used in the switches comprise a pack of thin metallic laminae spaced and electrically insulated from one another. As is known, the extinguishing cells are arranged in proximity to the contacts of the switch so that the electric arc which forms between the contacts on opening the switch is split into partial arcs between the laminae. The displacement of the arc towards the laminae and the migration of the partial arcs along the laminae themselves are induced essentially by electromagnetic phenomena due to the shape of the metallic member carrying the fixed contact and to that of any ferromagnetic elements which may bound the cell. The partial arcs, in their migration along the laminae of the pack, cool down and are de-ionized, and the gases produced by the arcs are conveyed by the laminae and by any suitable channels which may be provided in the structure of insulating material which constitutes the housing of the switch, towards apertures for communication with the outside, provided for this purpose in the housing itself.

[0003] The laminae of an extinguishing cell are customarily obtained by shearing from a thin steel sheet. The shape of a lamina is usually rectangular with a deep notch which extends longitudinally from a minor side. The plates are fixed, for example by caulking along the edges of the two major sides, to two plates of dielectric material. The pack of laminae thus formed is housed in the structure which contains the switch in proximity to the contacts and precisely oriented so that the notches of the superposed laminae are turned towards the path of the movable contact towards the fixed contact.

[0004] In many cases, the fixed contact is integral with a metallic strip which, when subjected to the opening overload, generates an electromagnetic field favouring the displacement of the arc towards the laminae of the extinguishing cell. Other elements of ferromagnetic metal are usually provided at the sides of the cell in order better to confine the electromagnetic field.

[0005] In the case of switches with more pairs of contacts, an extinguishing cell is customarily provided for each pair and the various cells are held in position in seatings provided in the structure of the housing of the switch. In the housing, apertures are provided for discharging to the outside the gases produced by the arcs.

[0006] The need to expel the gases efficiently and safely without interfering with the active and passive parts of the switch conflicts with the present tendency towards reducing the dimensions of the switches more and more, other characteristics being equal. Said problem is felt particularly when designing the modular switches of standard dimensions intended to be mounted side by side on suitable guides, which are also standard. In such switches the position of many of the component parts, in particular that of the terminals for the input and output connections is determined by modularity requirements, so that the choice of the position of the discharge apertures in the housing is also substantially obligatory.

[0007] The principal aim of the present invention is to make available a switch with two pairs of contacts and a two-cell arc extinguishing unit which is both very compact and also efficient with regard to the extinguishing of the arc, and which allows the discharge of the gases without interference with the internal parts of the switch.

[0008] This aim is achieved according to the invention by producing a switch as generally defined in the first claim.

[0009] The invention will be more clearly understood from the following detailed description of one of its non-limiting embodiments provided with reference to the appended drawings, in which:

Figure 1 shows in perspective a switch according to the invention with parts removed and parts shown as transparent,
Figure 2 shows in perspective an arc extinguishing unit which forms part of the switch in Figure 1,
Figure 3 shows in perspective the same extinguishing unit seen from another angle and with parts detached, and
Figures 4 and 5 show, respectively, in perspective and in section, the arc extinguishing unit and part of the housing of the switch.

[0010] In the example shown, the switch is of the monophase, double contact type, but the invention may be implemented with the same advantages also with two-phase switches, that is to say, with two pairs of contacts insulated from each other.

[0011] With reference to Figure 1, two plastics shells placed together and indicated by 5 and 5' enclose the various parts which constitute the switch, that is to say, a manual operation unit 7 with operating handle 8, an automatic safety operation unit 9 controlled by overloads, two fixed contacts, not visible in the drawing, fixed on two metallic strips 16, 16', preferably of copper, connected to an input terminal 11, two movable contacts 12, 12' connected to an output terminal 13 and a double-cell extinguishing structure 14.

[0012] The shells 5 and 5' have internal shapes, not shown, for defining the seatings of the terminals and apertures 15 for the discharge of the gases produced by the arcs.

[0013] As can be seen in Figures 2 and 3, from two different angles, the double-cell extinguishing structure 14 comprises a body 20 of insulating material, in the present example a single piece of moulded plastics material, two packs 21, 21' of rectangular laminae 23, 23' with deep notch 24 which constitute the active parts of the cells, two plastics covers 25, 25' with projecting parts 26, 26' which, together with the body 20, define two

spaces in which are housed the packs of laminae 21 and 21'. The laminae 23, 23' of each pack 21, 21' are held together, superposed and parallel, by two opposed connecting plates 27, 27' of insulating material. The sides with the notch 24 define the side of the cell, close to the pairs of contacts, where the splitting of the arc occurs, and the opposed sides define the side of the cell through which the discharge of the gases produced by the arc takes place.

[0014] The body 20 has a substantially flat portion 28 having two walls 29 separated by an air gap 30. Said portion 28 is connected to another portion 31 of the body, which portion is also substantially flat and parallel to the first, and which has on one face a series of parallel projections 32 which form, once closed by the internal walls of one of the shells, namely the shell 5, channelling means which extend from the discharge side of one of the two extinguishing cells to the apertures 15 of the housing.

[0015] The body 20 additionally has an inner channel 33 through which the space which receives the pack of laminae 21' which forms one of the cells is placed in communication directly with the outside of the body and namely at the apertures 15 on the side of the shell 5. It will also be observed that said space communicates with the apertures 15 also through a second channel 34 bounded by prolections of the body 20 and by internal walls of the shell 5'.

[0016] The structure for confining the electromagnetic field of the cells comprises three substantially equal plates of ferromagnetic material, one of which, indicated by 35, is arranged inside the air gap 30 of the body 20, and the other two, indicated by 36 and 36', are each fixed to one of the covers, respectively 25, 25', for the spaces of the cells. A pair of strips 39, also of ferromagnetic material, joined to one another by a cross-member 40 and mounted on the body 20, complete the structure laterally bounding the spaces of the two cells.

[0017] The two packs of laminae 21, 21' are each arranged with one side against the substantially flat portion 28 of the body 20, so that they are situated side by side but separated by said portion and by the plate 35 contained therein.

[0018] When the switch, inserted into a circuit under load, is opened, the electric arcs which form between the two pairs of contacts on opening are split in the two extinguishing cells by the electromagnetic field generated by the metallic strips 16, 16' carrying the fixed contacts. The gases which form, by the effect of the arcs, within the cell with the pack of laminae indicated by 21, are conveyed, as shown in Figures 4 and 5, towards the apertures 15 through the channels bounded by the conjugate surfaces of the portion 31 with its projections 32 and of the shell 5, while the gases which form within the cell with the pack of laminae indicated by 21' are conveyed towards the apertures 15 partly through the inner channel 33 and partly through the second channel 34. Therefore, owing to the particular configuration of the body 20 and of the channelling means which the latter defines, the discharge of the gases takes place through apertures which involve a limited area of only one side of the housing and without dispersions inside the housing itself.

Claims

1. A switch with two pairs of contacts and a two-cell arc extinguishing unit in a housing formed by two shells (5, 5') placed together,

   characterized in that the arc extinguishing unit comprises a body of insulating material (20) and two packs (21, 21') of superposed laminae (23, 23') insulated from one another, each pack of laminae having an arc splitting side and a gas discharge side and being arranged beside the other with the interposition of a substantially flat portion (28) of the body (20), and in that it comprises means (31-34) for channelling the gases which are formed, partly (33) within the body and partly by conjugate surfaces (31, 32) of the body and of at least one of the shells (5, 5') and extend from a region adjacent to the discharge side of each of the two packs of laminae as far as apertures (15) provided on one side of the housing.

2. A switch according to Claim 1, wherein the conjugate surfaces comprise projections (32) of the body (20) and internal walls of one (5) of the shells.

3. A switch according to claim 1 or 2, wherein the channelling means formed within the body (20) comprise a channel (33) which extends from a region adjacent to the discharge side of one (21') of the two packs of laminae directly to the apertures (15) of the housing.

4. A switch according to any one of the preceding claims wherein the arc extinguishing unit comprises three plates (35, 36 and 36') of ferromagnetic material which are parallel to one another, one of which (35) is inserted in an air gap (30) of the body (20) in the substantially flat portion (28) between the two packs (21, 21') of laminae and two (36, 36') on the respective opposed sides of the packs themselves.

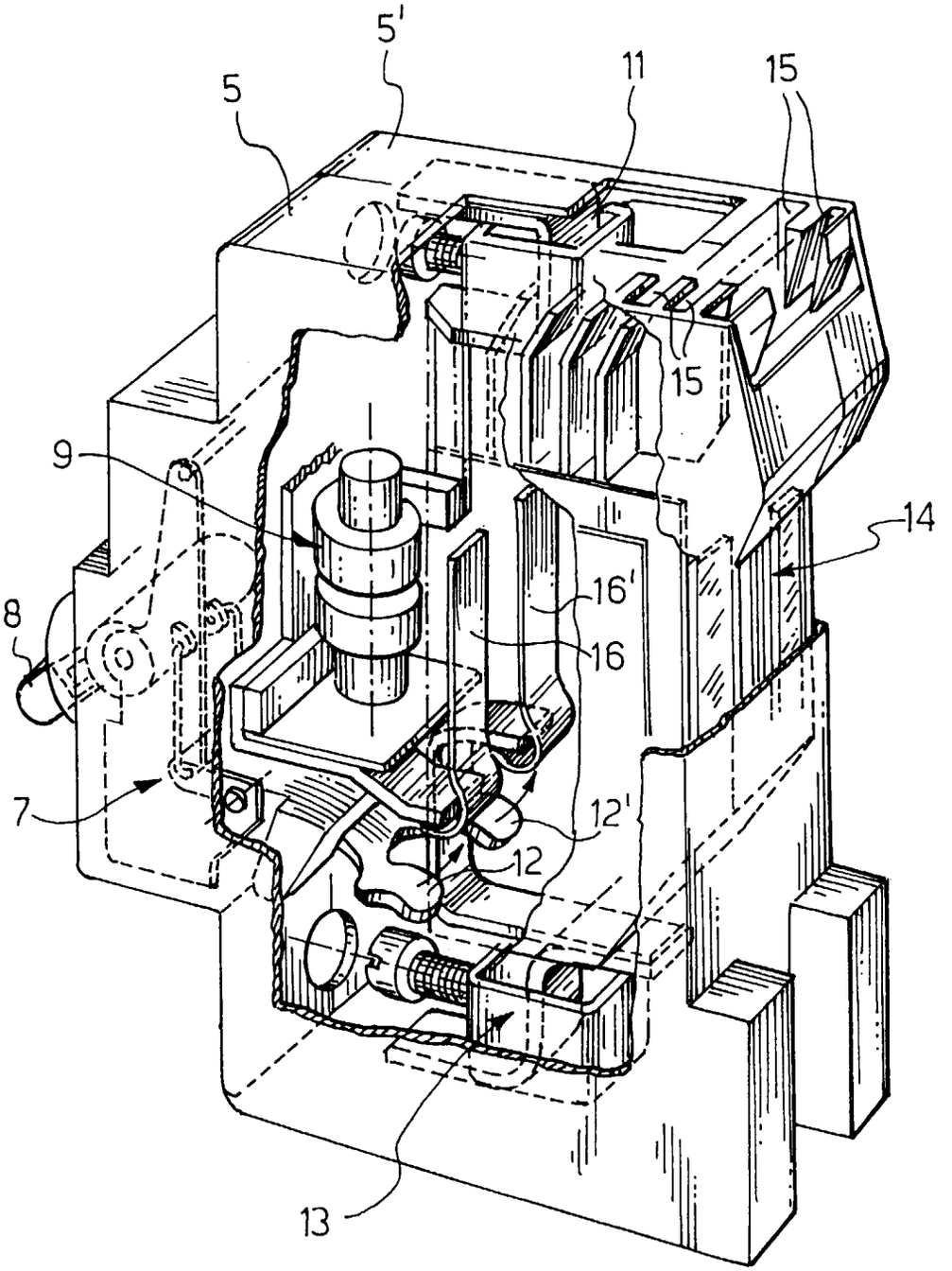

FIG.1

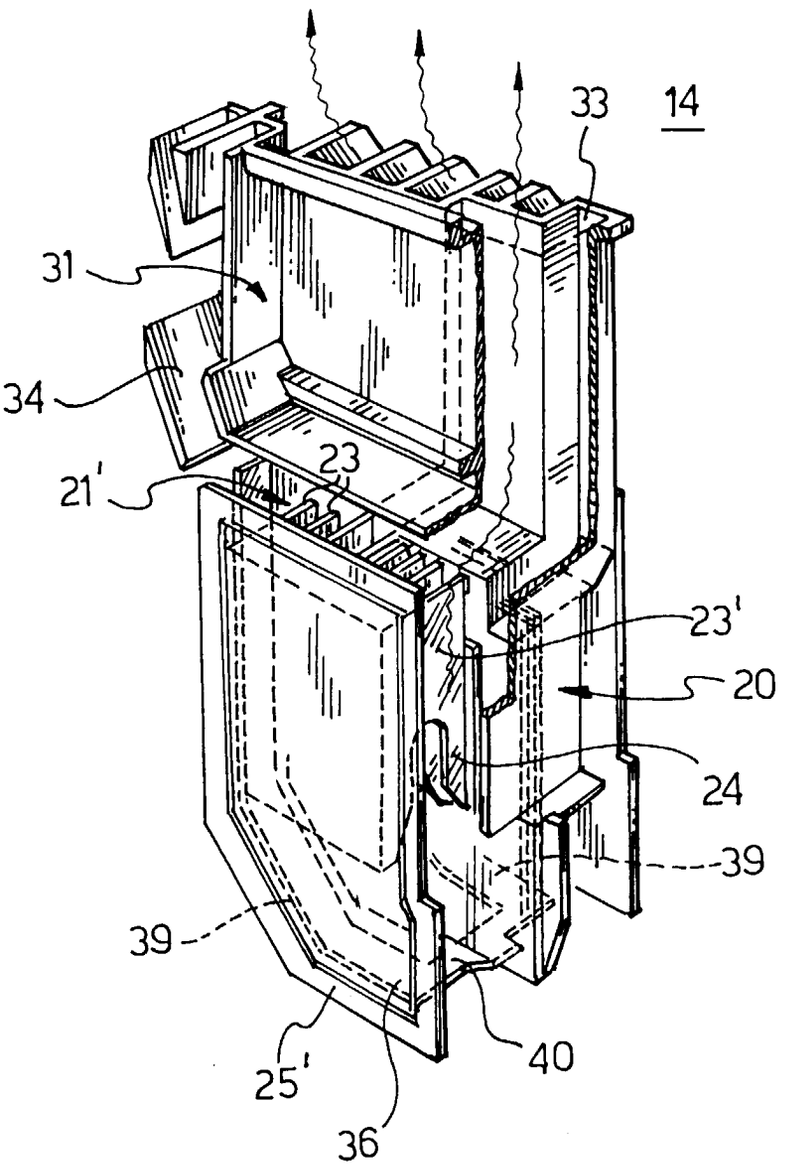

FIG.2

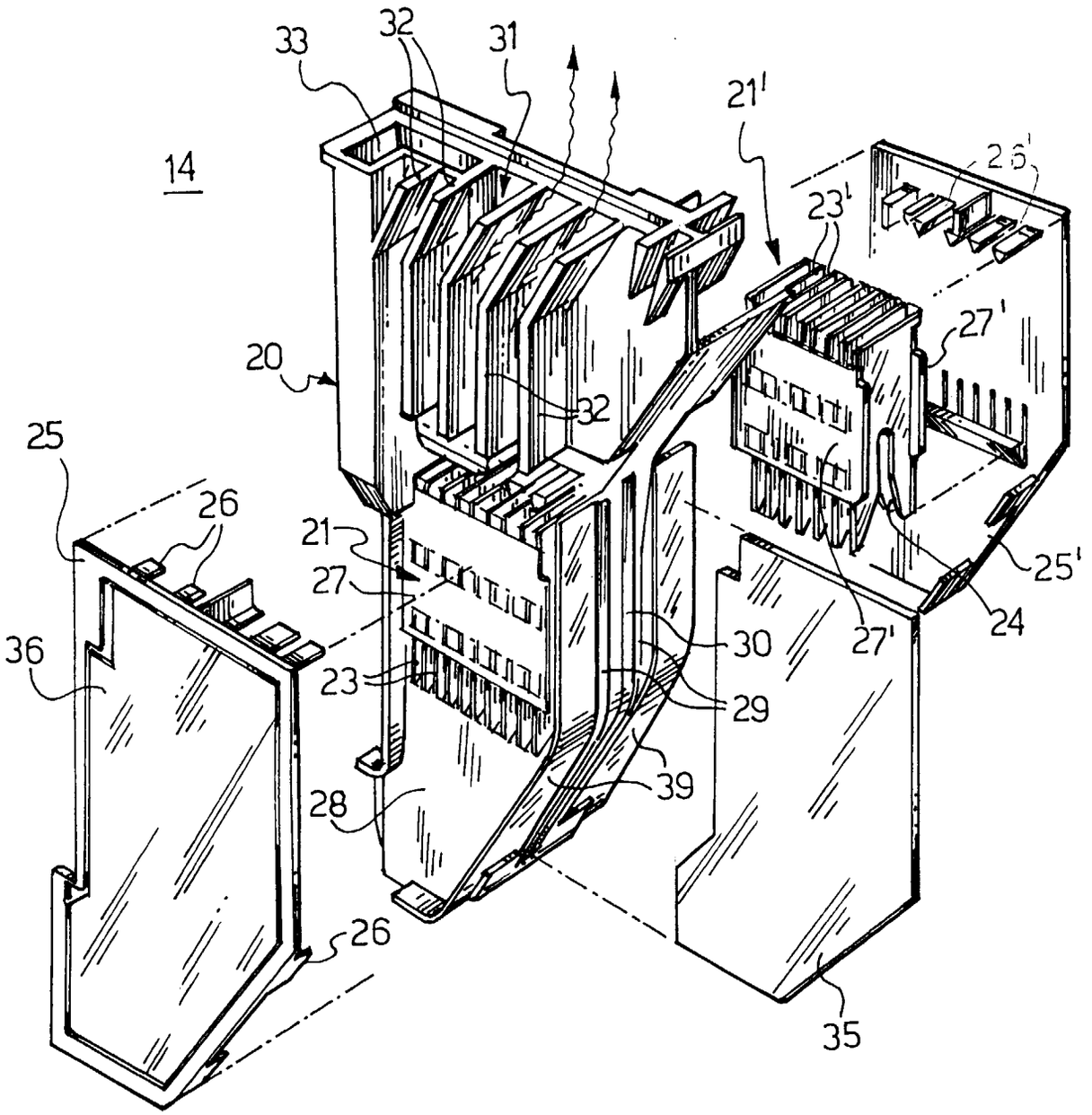
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FIG.3

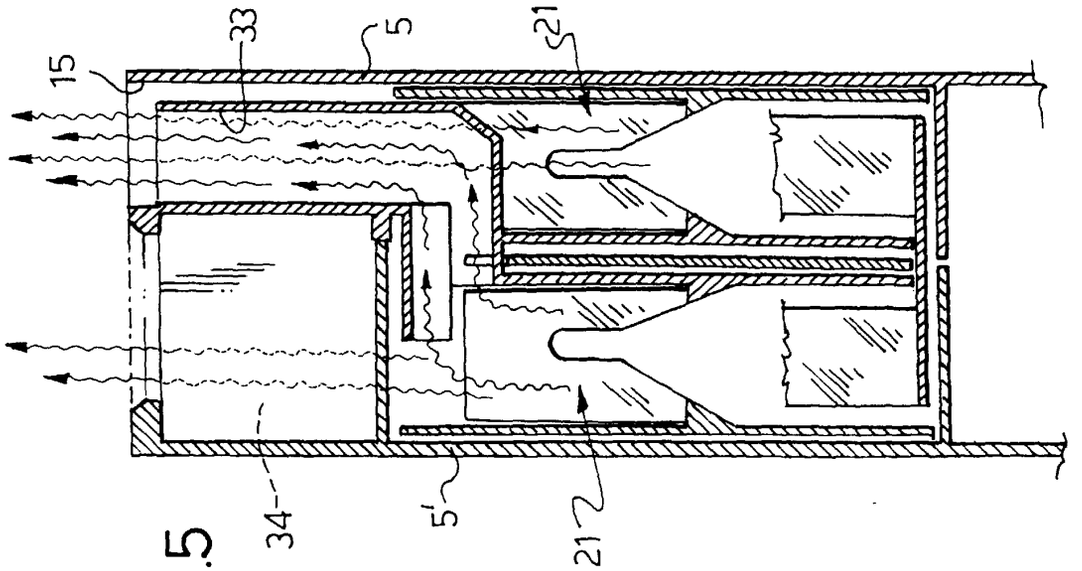

FIG.5

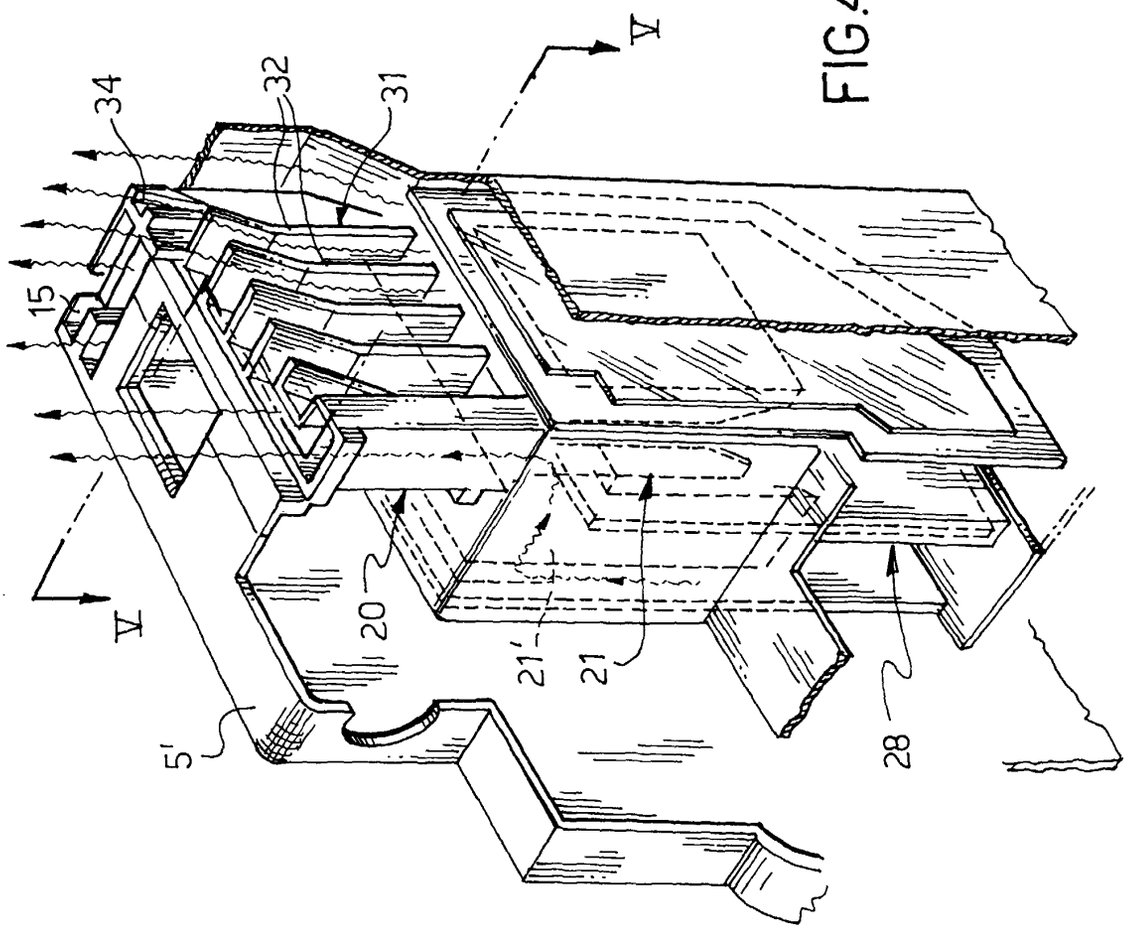

FIG.4