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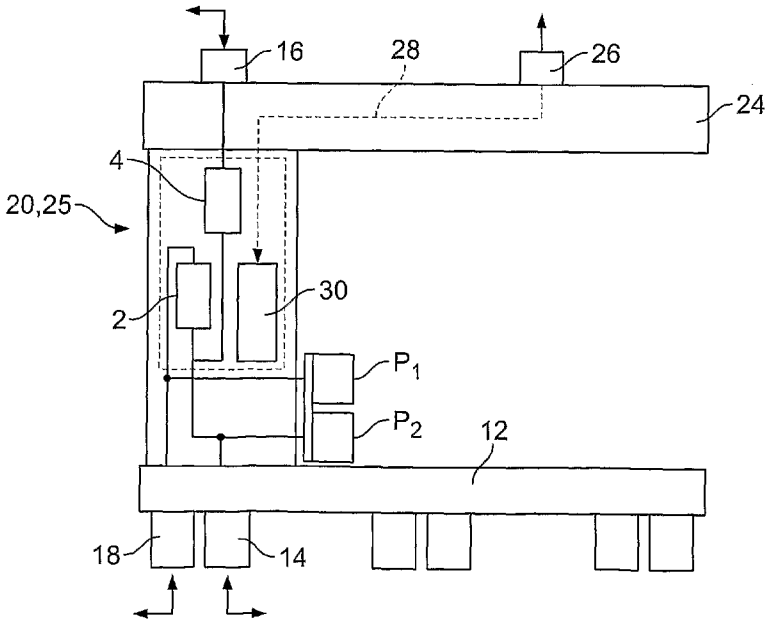
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[Continued on next page]

(54) **Title:** IMPROVEMENTS IN XDSL SERVICE PROVISION



(57) **Abstract:** A module is described comprising a low-pass filter for use in xDSL service provision, means for plugging the module into a connection block and a plurality of switches wherein the switches can bypass the low-pass filter and the switches can be activated remotely. An assembly is also described comprising the aforesaid module and a connection block wherein the module is plugged into the connection block. A telecommunications network having a distribution frame with connection blocks, can be upgraded by moving the connection block to expose a space behind the connection block, plugging in the module and replacing the connector block in its original position.

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IMPROVEMENTS IN XDSL SERVICE PROVISION

The present invention relates to methods and apparatus for service access on telecommunication networks, e.g. xDSL service access, and to methods and apparatus for testing, protecting or upgrading telecommunication networks, e.g. xDSL networks. In particular, this invention relates to the provision of broadband access on telecommunication networks, more specifically on twisted pair networks.

Background of the invention

ADSL (Asymmetric Digital Subscriber Line) technology is well known and currently the most widely deployed broadband technology on copper networks. Originally ADSL has been deployed in the central offices. Currently several variants are being used: ADSL, ADSL2, ADSL2+, VDSL1, VDSL2 as the technologies have been developed by the industry and been standardized in e.g. the ITU (International Telecommunications Union).

There are practical limitations to the distance between an xDSL DSLAM and the modem at the subscriber premise. E.g. VDSL1/2 provides higher bitrates, but the distance between the DSLAM and the customer modem is significantly reduced. Therefore, operators have started to install DSLAMs at locations between the central office (where the POTS switch is located) and the customer premise: e.g. in small buildings, shelters, or in cabinets.

Also the splitters that are required to combine POTS and ADSL or VDSL on the same copper pair are installed in these locations. Traditionally, the splitters are installed manually for each line for which they are required. If on a particular line the service changes, it is possible that somebody needs to be sent out to uninstall or install a splitter.

Summary of the invention

An object of the present invention is to provide good methods and apparatus for service access on telecommunication networks, e.g. xDSL service access, and/or good methods and apparatus for testing, protecting or upgrading telecommunication networks, e.g. xDSL networks. In particular, an object of the present invention is to provide broadband access

on telecommunication networks, more specifically on twisted pair networks.

One aspect of the present invention provides a module comprising a low-pass filter for use in xDSL service provision, means for plugging the module into a connection block and a plurality of switches wherein the switches can bypass the low-pass filter and the switches can be activated remotely. The module may have switches for use in test access and/or protection components such as overvoltage or over current protection.

The module may also have blocking capacitors and at least one further switch to bypass the blocking capacitors. The connection block may include sets of connectors for connecting to a customer premises and to an exchange and the module may further comprise a connection for an xDSL service. The switches can be adapted to provide any one of a service from the exchange alone, from the xDSL service alone or from both the xDSL service and the service from the exchange.

A control unit may be provided in the module for controlling the plurality of switches and/or the further switch remotely, e.g. via a bus or via a wireless connection.

Another aspect of the present invention provides an assembly comprising the aforesaid module and a connection block wherein the module is plugged into the connection block. The connection block may have sets of connectors for connection to a customer premises and to an exchange into which the module can be plugged. The assembly may be located on a distribution frame for example.

Another aspect of the present invention is a method of upgrading a telecommunications network using the module and or assembly of the present invention.

Description of the accompanying schematic drawings.

Figures 1a and b show configurations of a splitter and switches in accordance with embodiments of the present invention.

Figures 2 shows overvoltage and/or overcurrent protection components added to the circuits of Fig.1a (of Fig. 1b)

Figure 3a and 3b show test access switches added to the assembly of Figures 1a or 2 (or Fig. 1b).

Figure 4 shows an example of a connection block where space is available in the back switches in accordance with an embodiment of the present invention.

Figure 5a shows a splitter or splitter/bypass module installed in a connection block in accordance with an embodiment of the present invention. Figures 5b and c show exemplary wiring diagrams for the splitter/bypass module in accordance with embodiments of the present invention.

Figure 6 shows an advantageous combination of the circuitry of multiple splitter/bypass elements into a larger module that serves multiple lines switches in accordance with an embodiment of the present invention.

Figure 7 shows the mounting of modules that serve multiple lines in a connection block switches in accordance with an embodiment of the present invention.

Figure 8 shows installation of a complete unit comprising the connection blocks, splitter/bypass modules with optionally overvoltage protection and/or test access switches in accordance with an embodiment of the present invention.

Figures 9 to 12 show different views of a compact unit switches in accordance with an embodiment of the present invention with cable connections in the front and in the back switches.

Detailed Description of illustrative embodiments of the present invention

The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn to scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, integers, steps or components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. Thus, the scope of the expression "a device comprising means A and B" should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

In one aspect the present invention provides a splitter assembly comprising switches that enable putting into service or removing of the splitter on or from the line remotely. The splitter assembly comprises at least some switches that enable putting into service or removal of a low pass filter of the splitter on or from the line remotely. These switches that are used in any of the embodiments of the present invention can be any suitable remotely actuatable switches, e.g. electromechanical relays, dip switches, Micro-ElectroMechanical Switches (MEMS) or the like. Control means are connected to the switches in order to enable a remote activation or deactivation of the switches.

Figures 1a and b show a configuration of the splitter having a low pass filter (LPF) and at least switches (S1-2) in a first bypass element 2. LPF is a low pass filter portion of the splitter that eliminates high frequency components on the POTS signal on lines 8, 10 that can disturb the xDSL, e.g. ADSL signal on lines 6, 10. DCB are the DC blocking capacitors 4 and are part of a second bypass element 4 that includes at least a switch S3.

The blocking capacitors DCB prevent a DC bias voltage on a POTS line 8, 10 to reach a line card on the DSLAM on line 6 (not shown). The DCB may be bypassed by closing the switch S3. The DC blocking capacitors DCB may also be part of the ADSL DSLAM (not shown). In this case the second bypass element 4 with the switch S3 is not required. In a normal configuration the POTS service is coming from the central office on line 8 and the switches S1 and S2 are closed as in figures 1a and b. The POTS service is delivered to the customer premises on line 10. The POTS signal passes through the LPF. S3 is open and the ADSL signal passes through the DC blocking capacitors DCB. Changes of service configuration may occur. E.g. the customer may order a Leased Line service (LL) from the operator that is provided from the exchange. The Leased Line service may require a bandwidth higher than what is let through by the LPF. In this case the switches S1 and S2 are controlled remotely to switch them to the open position and the LPF is effectively bypassed. In one option, in the DSLAM, the port connected to the relevant line 10 is deactivated. Alternatively the metallic connection from the DSLAM to the customer line 10 may be manually removed or be removed from a distance if an automated MDF (Main Distribution Frame) is being used. In another service situation the customer may request a special service that is deployed from the location between the exchange and the subscriber premises by either the incumbent operator or an alternative operator. In one option a complete telephone and data service is supplied only via the xDSL service. In this case it is not desirable that the twisted pair 8 that is still connected to the exchange is still connected to the line 10. In the case of Fig. 1a the switch S2 is opened, thereby disconnecting the exchange from line 10. The position of switch S1 is irrelevant, and the switch S3 may be open or it may be closed if the service from the intermediate location does not need the DC blocking capacitors DCB.

Fig. 1a shows one architecture embodiment of the present invention as described above. Fig. 1b shows another architecture embodiment in accordance with the present invention. The main difference in this embodiment relates to the position of the connection from the DSLAM to customer line 10. In Fig. 1a this connection is closer to the customer premises than the switch S2. In Fig. 1b the switch S2 is closer to the customer premises than the

connection of the DSLAM to the line 10. This connection is now located between switch S1 and S2, namely between the LPF and switch 2. The advantage of this architecture is that POTS and xDSL, xDSL alone, are POTS alone services are all possibilities depending upon the position of the remotely actuatable switches S1 and S2. Assuming that the POTS service is a first service, the xDSL service is a second service then the relevant switch positions are shown in Table 1:

Services	Switch S1	Switch S2
Service 1 only (POTS only)	raised	raised
Service 2 only (xDSL only)	raised	lowered
Service 1 and 2 (POTS and xDSL)	lowered	lowered

Table 1

This demonstrates that switches S1 and S2 need not have only open and closed positions. The present invention is not limited to only open and closed switches. These switches may also have other arrangements with other switching positions provided they have some positions that allow bypassing of the LPF.

Additionally, protection units such as overvoltage and/or overcurrent protection components may be added to the circuit of either Fig. 1a or 1b. Such an arrangement based on the circuit of Fig. 1a is shown in figure 2. This shows an optional protection unit P1 located between the switch S1 and the exchange. It also shows an optional protection unit P2 located between the switch S2 and/or the connection to the xDSL DSLAM and the customer premises. The protection units P1 and P2 can be placed in the same position for

the circuit of Fig. 1b.

In another aspect of the present invention also test access switches may be added to the assembly. These test access switches can also be activated remotely and provide the capability to connected the line to a or multiple test heads as shown in Figure 3 for the circuits of Fig. 1a or Fig. 2. The test access can be provided between the switch S2 and the customer premises. A test head can be provided, e.g. at a remote location. This arrangement can be provided also for the circuits of Fig. 1b (and the corresponding circuit based on Fig. 1b and Fig. 2) with the test access switches being placed in the same position in both, namely at a position most adjacent to the customer premises.

In all the embodiments of the present invention the remote activation of any or all of the switches may be made remotely actuatable by any suitable means, e.g. via by cable, e.g. wired or by wireless, e.g. by radio or satellite connections.

Another aspect of the invention relates to the practical installation of the splitter/bypass assembly. One could install this circuitry in a separate rack. Cables or jumper wires would then be run from the main distribution frame (MDF) towards this rack and towards the DSLAM. In such a case, additional cabling is required for the control connections that enable the remote activation of the switches and test access switches. However, installing additional cabling is cumbersome, requires extra space and causes a service interruption of significant duration for the customers. It would be preferable if this installation would not require extra cabling, space or prolonged service interruption. This effect can be achieved in accordance with an embodiment of the present invention by mounting one or more modules containing the required circuitry directly on the main distribution frame. Accordingly, it is an aspect of the present invention to provide a module comprising a low-pass filter for use in xDSL service provision and a plurality of switches wherein the switches can be operated to bypass the low-pass filter and the switches can be activated remotely, the module being mounted on the main distribution frame. Also the module may include switches for use in test access and/or overvoltage protection components.

In accordance with a further embodiment connection blocks are located in the MDF and contain a provision to interrupt the lines to and from the MDF. This capability to interrupt the line may be present for reasons of manual test access or to allow for the installation of a protection module such as a 5-pin protection module. In a particular embodiment a module including at least the first bypass element 2 having at least an LPF and at least switches S1 and S2 to bypass the LPF, and optionally the bypass element 4 is adapted to be pluggable into a connection block. The connection block can be part of a distribution frame such as a Main Distribution frame or another distribution frame such as an Intermediate distribution frame. A Main Distribution Frame has vertical and horizontal connection blocks. The bypass module according to embodiments of the present invention having at least the first bypass element 2 (with at least switches S1 and S2 and the LPF) and optionally the second bypass element 4 may be installed on the front, on the side or on the back of the connection block. This will generally depend on the nature of the connection block and the space available. It can be advantageous to be able to install the module on the side or on the back, because in this case the front side of the connection block remains easily accessible for the operator.

Figure 4 shows an example of a connection block 12 in a housing 32 where space (22) is available at the back of a connection block 12. The housing 32 may contain a plurality of connection blocks 12. Each connection block 12 has at least two sets of connections and in this embodiment three sets of connections, namely connections 14, 16 and 18 for access to the customer line 10, the DSLAM line 6 (xDSL) and the exchange line 8 (POTS service), respectively. A splitter/bypass module 20 in accordance with the present invention is plugged into the back of the connection block 12 and is accommodated in the space 22 at the back of the connection block 12, i.e. accommodated within the housing 32. To achieve this the connection block 12 can be rotated about a hinge at one side (or by any other motion, e.g. by sliding) to open up access to the back of the connection block 12 and to the space 22 for accommodating the module 20. The splitter/bypass module 20 is provided with suitable members for plugging into the connection block. These members will

depend upon the design of the connection block and may include PCB edge connectors (an example is shown in Fig. 11), pins or sockets, bayonet connectors, jacks, etc.

Figure 5 shows in more detail how a splitter/bypass module 20 according to the present invention can be installed in the back of this connection block 12. As shown in Fig. 5a a splitter module 20 is plugged into the back of the connection block 12 and includes at least the first bypass element 2 having at least the switches S1 and S2 and LPF of any of Figs. 1a, 2, 3. A plurality of such splitter/byass modules 20 are plugged into the back of the connection blocks 12 which are contained within a housing 32. An exemplary wiring diagram of the circuits of Figs 1a, 2 and 3 as applied to a module 20 is shown in Fig. 5b. An exemplary wiring diagram of the circuits of Figs 1b, 2 and 3 as applied to a module 20 is shown in Fig. 5c. These show optional protection unit P1 connected onto the exchange line 8 via connector set 18, optional protection unit P2 connected onto the customer line 10 via connector set 14 and the first and optional second bypass units 2 and 4, respectively. Instead of the protection unit P2 or in addition thereto a test access switch may be provided as has been described with respect to Fig. 3. The first bypass element 2 includes the switches S1 and S2 and the LPF as shown in Fig. 1a or b. The optional second bypass element 4 includes the DCB and the switch S3 as shown in Fig. 1a or b. It is clear that in this configuration no additional cabling for the connection of the POTS, ADSL and customer lines 8, 6, 10 is required as they are already connected to the connection blocks 12. Moreover a simple plug-in action will cause only a momentary service interruption that will almost not be noticeable.

Figure 6 shows another embodiment of the present invention. It can be advantageous to combine the circuitry of multiple modules 20 having splitter/bypass elements 2, 4 into a larger module 25 that serves multiple lines. The module 25 is accommodated in the space 22 shown in Fig. 4, i.e. accommodated within the housing 32. The remainder of the connection block is as shown in Fig. 4. Module 25 is pluggable into the connection block 12, e.g. into the back thereof. The splitter/bypass module 25 is provided with suitable members for plugging into the connection block. These members will depend upon the

design of the connection block and may include PCB edge connectors (as shown in Fig. 11), pins or sockets, etc.

The provision of the pluggable module 25 reduces the number of individual components that are required. It will also reduces installation time because only one module 25 needs to be installed instead of multiple modules 20 of Fig. 4. Another advantage is that the control circuitry to activate the switches S1, S2 and optionally S3 can be shared over several lines. This reduces the required hardware and cabling towards a remote control unit for the switches.

Figure 7 shows the mounting of modules 25 that serve multiple lines in a connection block 12. In order to further reduce the circuitry that is required for communication between the splitter/bypass modules, a back plane 24 can be added. A plurality of modules 20, 25, each of which may serve one or more lines, can be plugged into the back plane 24 as shown in figure 7. A control bus for each module 20, 25 is connected to each module 20, 25 via a back plane connector 28, all of which are preferably connected to a connector 26 such as a network connector for connection to a remote control unit for the bypass elements 2, 4 via a control network. The control bus is carries the control signals to operate remotely the various switches S1-3 of each of the modules 20, 25. The back plane 24 comprises also the connector 26 to connect the control circuitry to the remote control unit for the switches S1-3. Advantageously, the backplane 22 may contain at least two connectors 26 which allow a loop through of the cable that connects the control circuitry with the remote control unit thus allowing daisy chaining. Daisy chaining means that each unit is joined to the next by only one cable. This further reduces the cabling required. To address any bypass element of the unit the relevant module 20, 25 can have a network address within a control network. Preferably, the modules 20, 25 have local processors and a network interface that control the access to and from the control network. The modules 20, 25 can be powered locally or powered remotely, e.g. by means of power supplied over a data cable and the control bus.

Another advantage of the installation of the splitter/bypass module 20, 25 on the back or on the side is that existing protection units, e.g. overvoltage protection modules which are usually installed on the front of connection modules can remain in place and be reused. In another aspect of the invention, the protection units, e.g. P1 and/or P2 can be integrated in the splitter/bypass module 20, 25.

In some cases an operator will have to install new connection blocks 12 when adding services because no spare capacity of connection blocks is available, e.g. on an MDF or intermediate distribution frame. In this case it can be advantageous to install immediately a complete unit comprising the connection blocks 12, splitter/bypass modules 20, 25 with optionally protection units such as overvoltage protection, and/or test access switches.

Figure 8 shows such an arrangement in a schematic way. This arrangement also has the first bypass element 2 (including the LPF and remotely controllable switches S1 and S2 as in Fig. 1a or b) and the optional second bypass element 4 (including the DCB and the remotely controllable switch S3) plugged into the back of a connection block 12, e.g. incorporated in a plug-in module type 20 or 25 as described above. However with this connection block 12 only the connections 14 and 18 for access to the customer line 10 and the exchange line 8 (POTS service), respectively, are located on the front. The ADSL connectors 16 are located on the back of the module. An advantage of this approach is that also the back space can be used for connecting e.g. the ADSL cable. Doing so reduces the number of cables that have to be connected in the front and this can lead to further reduction in the space required in the MDF. This modification requires a modification to the wiring diagram of the module 20 or 25. As shown in Fig. 8 the first bypass element 2 (including the LPF and switches S1 and S2) and optionally the second bypass element 4 are located within the module 20, 25. Advantageously one or more protection units P1 and/or P, e.g. overvoltage/overcurrent protection components, can be mounted on plug-in modules 20, 25 which allows for easy replacement in case one of the protection component would fail or be triggered in a fail-safe mode in which the line is connected to ground. Instead of the protection unit P2 or in addition thereto a test access switch may be

provided. In addition a relay control module 30 and a control bus 28 for the switches S1 to S3 is connected to a back plane connector 26 as already described with respect to Fig. 7.

Figures 9 to 12 show different views of an embodiment of such a compact unit with cable connections in the front and optionally in the back. As the complete unit can be designed from scratch, the components and the way they fit together can be optimized. In Fig. 9 the connection blocks 12 are shown in a housing 32. Each connection block has at least two rows of connectors 14, 18 for access to the customer line 10 and the exchange line 8 (POTS service), respectively, as shown in Fig. 8. A further set of connectors for the xDSL service can also be included either on the front or back of the unit. The connection blocks 12 can be hinged open to reveal the space 22 in which the bypass modules 20, 25 are housed. Also in this embodiment it is possible that the circuit module 20, 25 that contains the splitter/bypass elements 2, 4 (see for example a module 20 as shown in Figure 11 in the form of a printed circuit board) is plugged into the back of the front connection blocks 12 as shown in Figure 10. The means for plugging into the connector blocks of the module 20 or 25 can be selected in accordance with available plug types, e.g. an edge connector of a PCB can be used as shown in Fig. 11. The module 20 or 25 shown in Fig. 11 includes the LPF, the remotely operated switches S1 and S2, the optional DCB and switch S3 as well as a processor and a network interface and the optional protection units P1 and/or P2 as well as the optional test switches as well as a control module for remote control of the switches and its associated control bus. The front connection block 12 can be opened by a rotational movement (or a sliding or other movement) to expose an inner space 22 for accommodating modules 20 or 25. Figure 12 shows the rear view of the unit with the connectors 16 for the xDSL service and the back plane connector or connectors 26.

It is to be understood that although preferred embodiments, specific constructions and configurations, as well as materials, have been discussed herein for devices according to the present invention, various changes or modifications in form and detail may be made without departing from the scope and spirit of this invention.

Claims

1. A module comprising:
a low-pass filter for use in xDSL service provision, means for plugging the module into a connection block, and a plurality of switches wherein the switches are settable to allow bypassing of the low-pass filter and the switches can be activated remotely.

2. A module as in claim 1 further comprising additional switches for use in test access.

3. A module as in claim 1 or 2 further comprising protection components.

4. A module as in any of the previous claims, further comprising blocking capacitors and at least one further switch to bypass the blocking capacitors.

5. A module as in any of the previous claims, wherein the connection block includes sets of connectors for connecting to a customer premises and to an exchange and the module further comprises a set of connectors for an xDSL service.

6. A module according to claim 5 wherein the switches are adapted to be remotely settable to provide any one of a service of: to and from the exchange alone, to and from the xDSL service alone or to and from both the xDSL service and the service from the exchange.

7. A module as in any of the previous claims, further comprising a control module for controlling the plurality of switches and/or the additional switches and/or the further switch.

8. An assembly comprising a module as described in of the claims 1 to 7 and a connection block wherein the module is plugged into the connection block.

9. An assembly according to claim 8, wherein the connection block has sets of connectors

at least for connection to a customer premises and to an exchange.

10. An assembly according to claim 8 or 9, further comprising a housing, the housing having a back plane and the module is connected to the back plane.

11. An assembly according to claim 10, wherein the back plane includes a connector for connecting to a remote control unit for controlling the plurality of switches and/or the additional switches and/or the further switch remotely.

12. An assembly according to any of the claims 8 to 11, the connection block including sets of connectors for connecting to a customer premises and to an exchange and the module further comprising a set of connectors for an xDSL service.

13. An assembly according to claim 12, wherein the set of connectors of the xDSL service is located on the back plane of the housing.

14. An assembly according to claim 12, wherein the set of connectors of the xDSL service is located on the connection block.

15. An assembly according to any of the claims 8 to 14 located on a distribution frame.

16. A method of upgrading a telecommunications network having a distribution frame with connection blocks, the method comprising:
moving the connection block to expose a space behind the connection block,
plugging in a module according to any of the claims 1 to 7, and replacing the connector block in its original position.

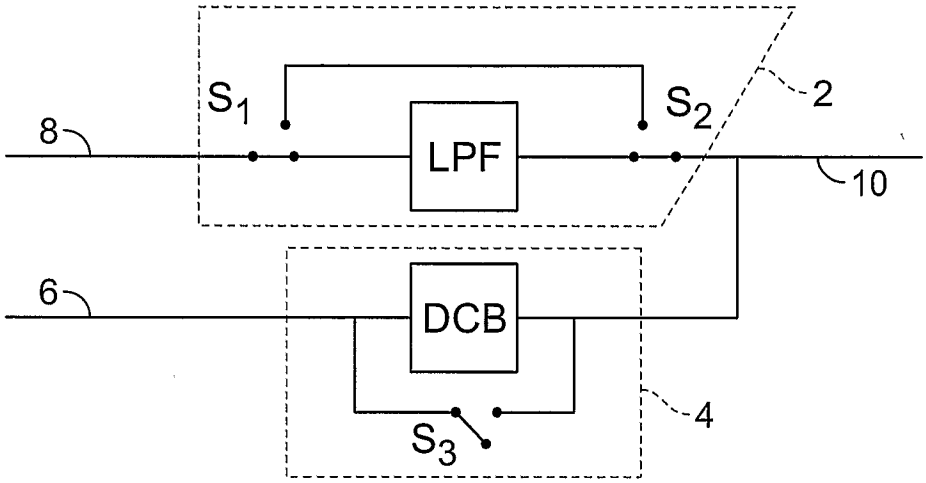


FIG. 1A

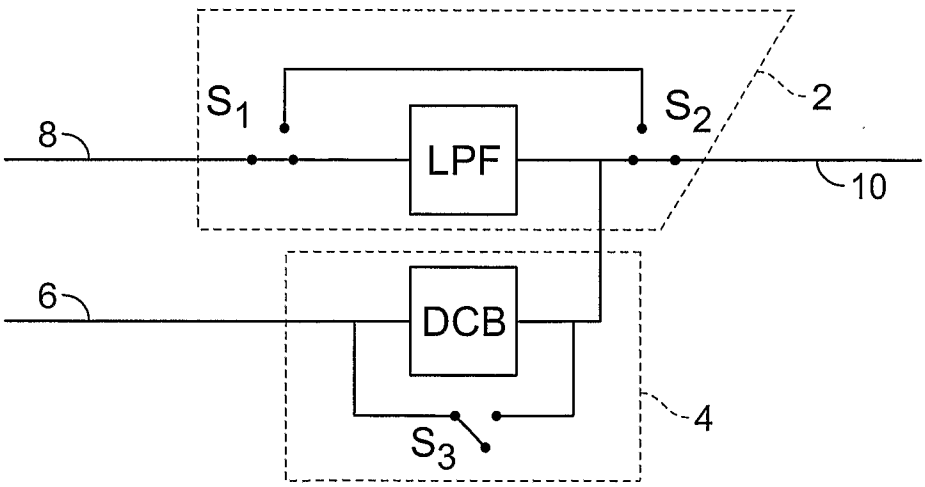


FIG. 1B

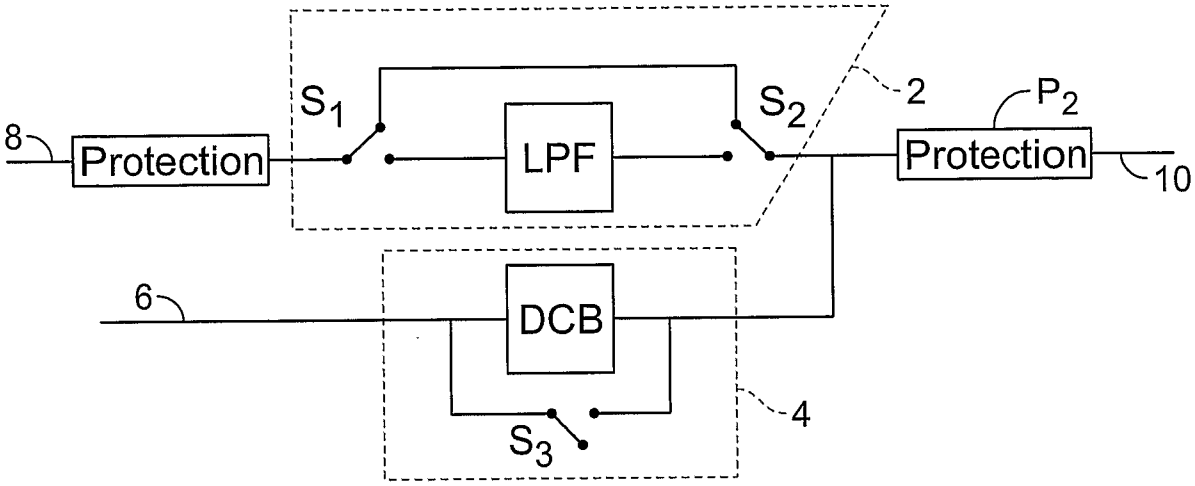

S1
S2
2
P2
8
Protection
LPF
Protection
10
6
DCB
4
S3

FIG. 2

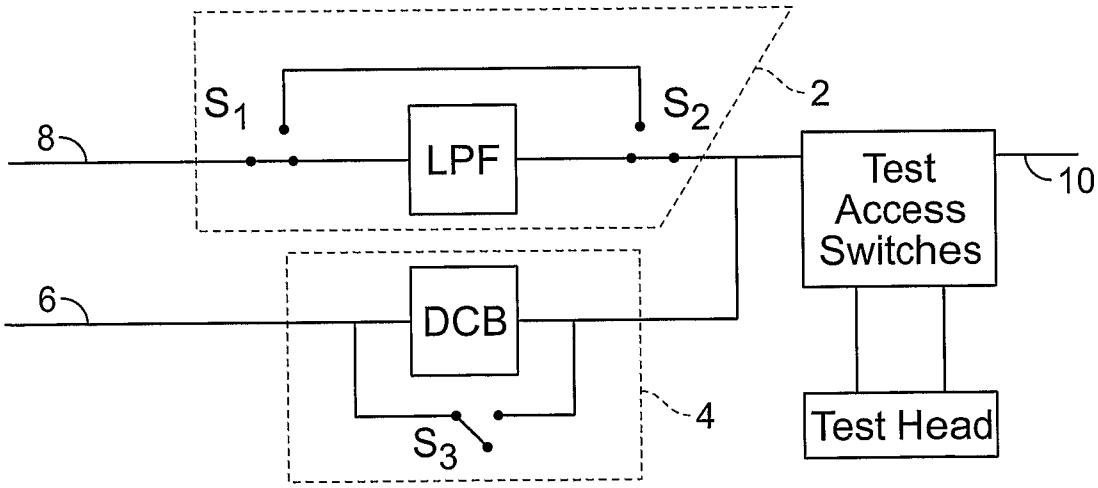

S1
S2
2
8
LPF
Test
Access
Switches
10
6
DCB
4
Test Head
S3

FIG. 3

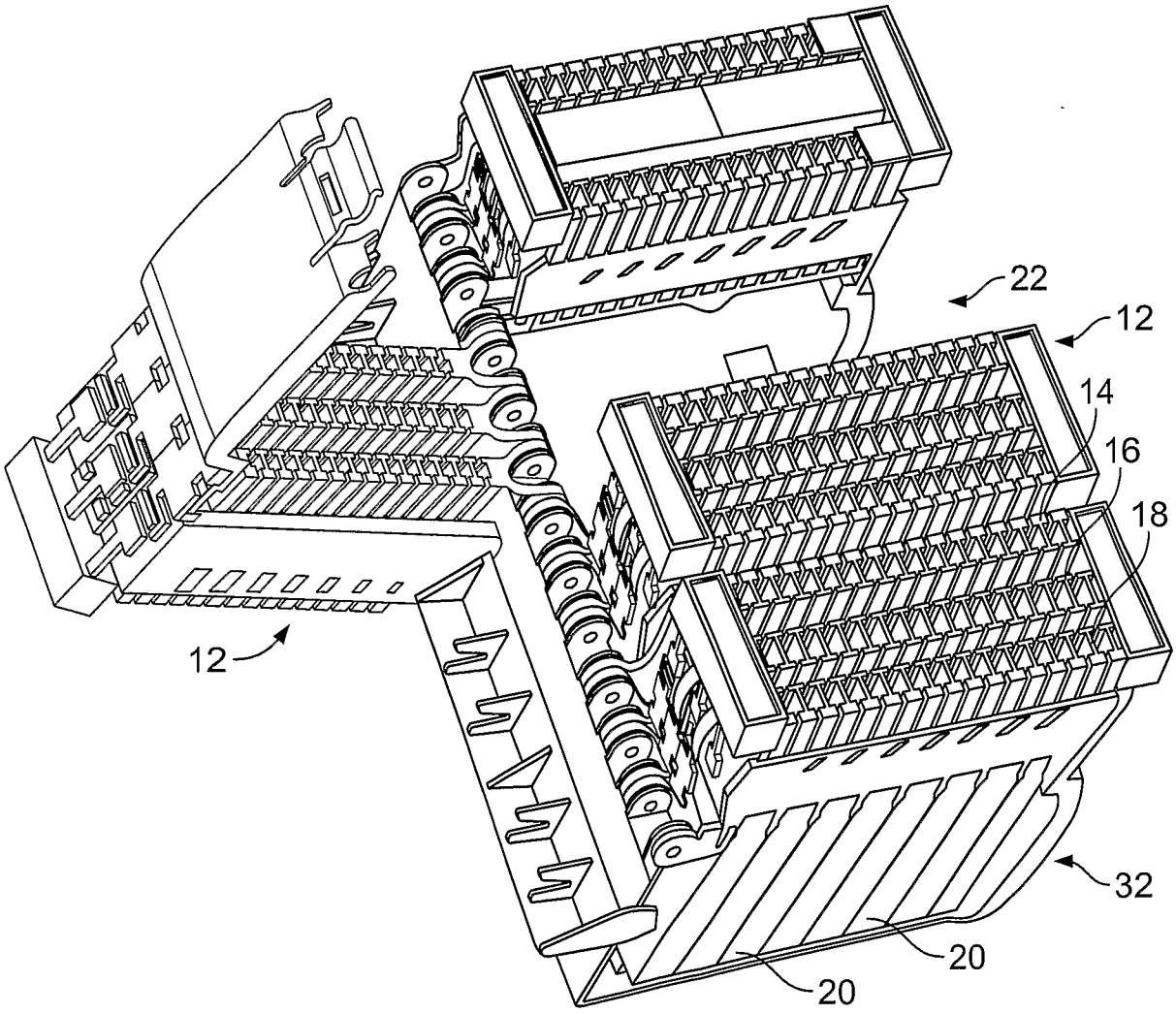


FIG. 4

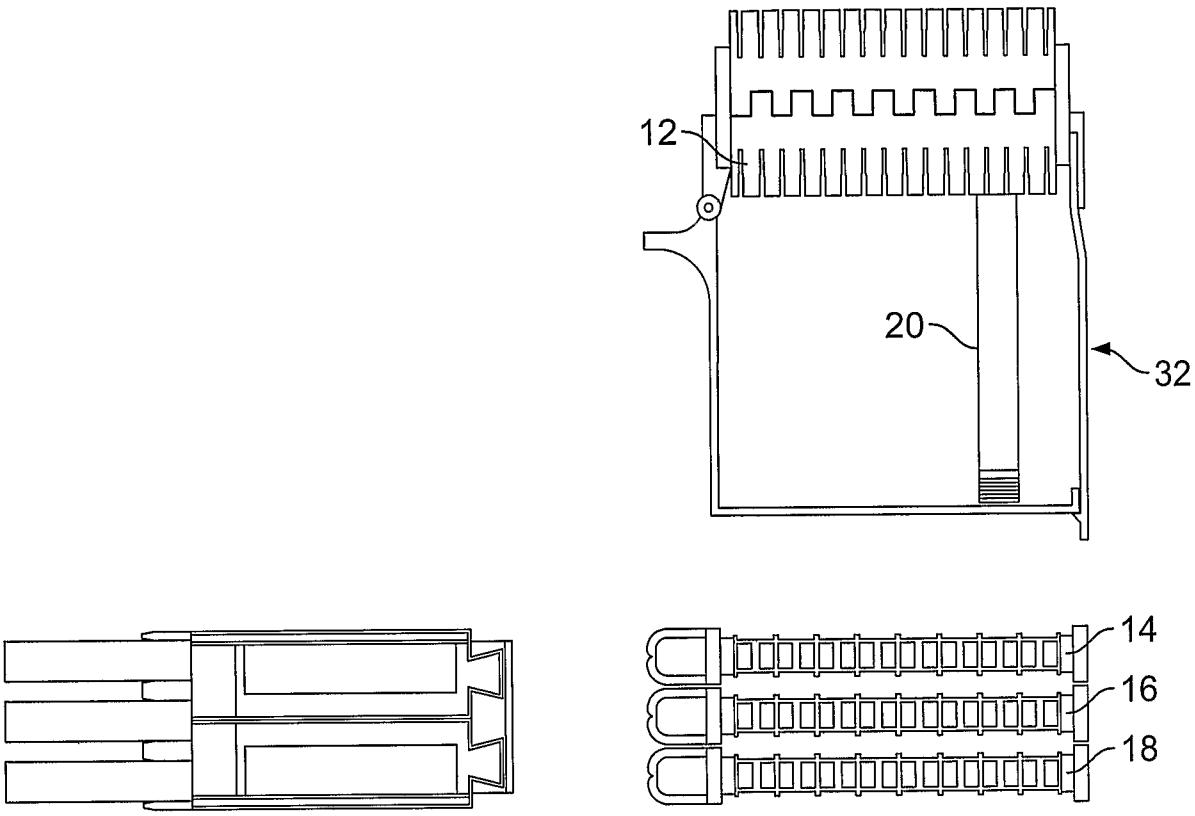


FIG. 5A

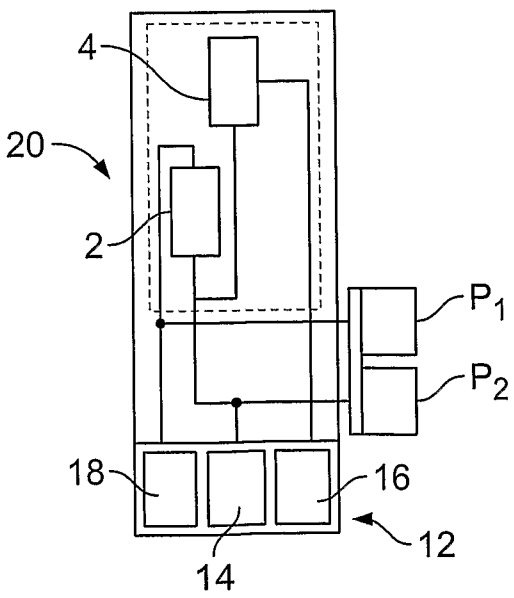


FIG. 5B

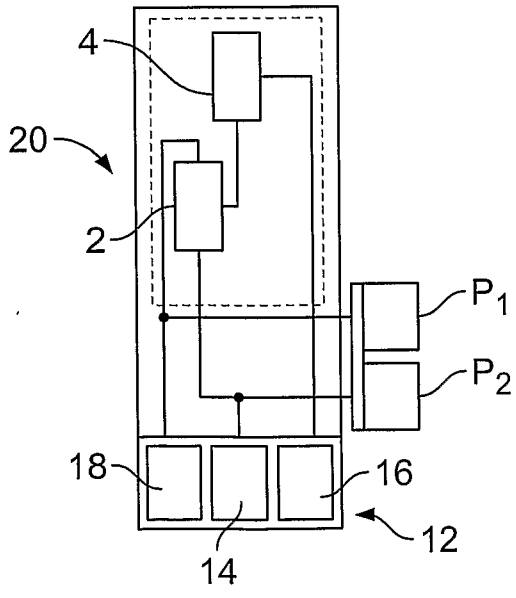


FIG. 5C

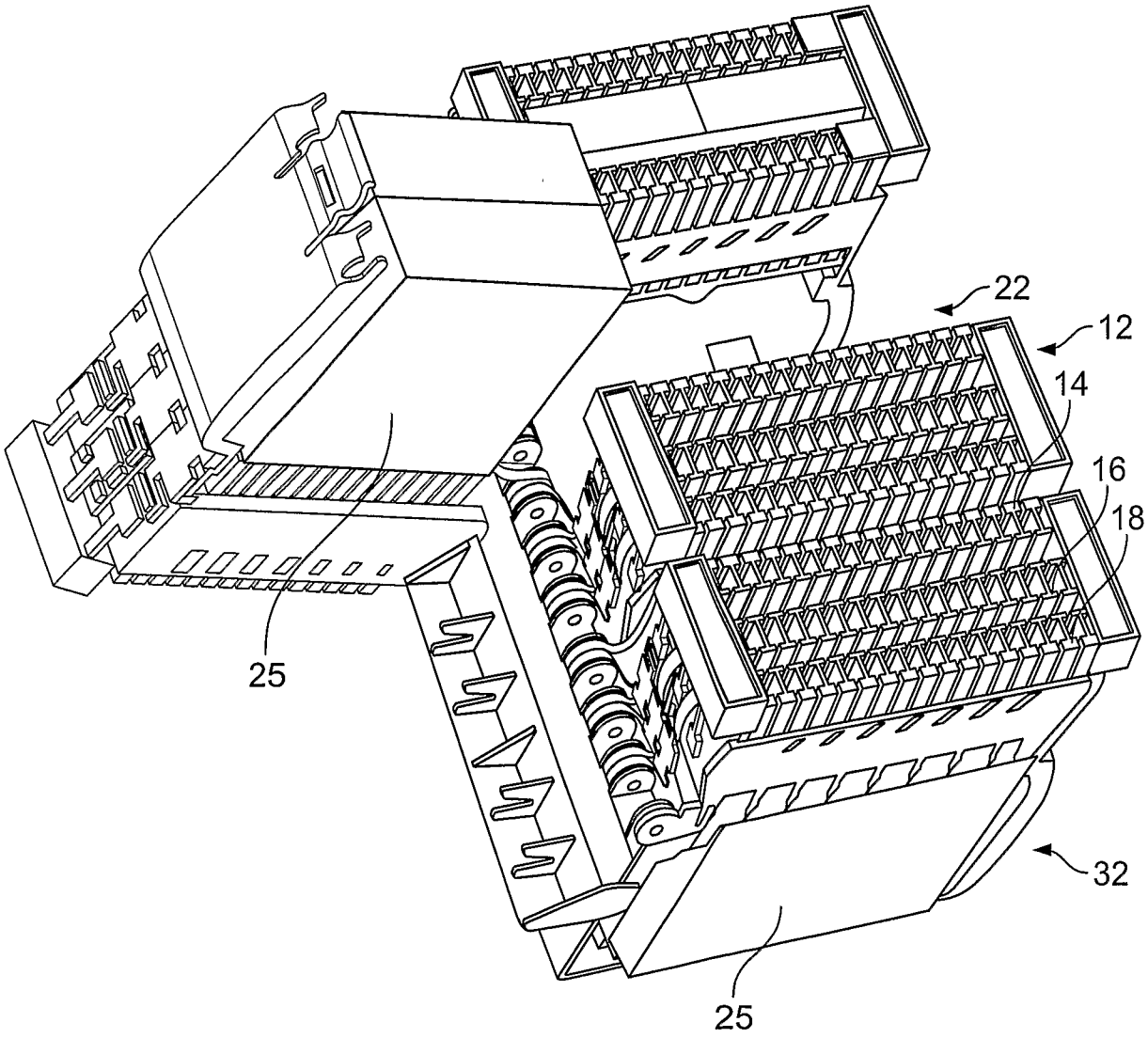


FIG. 6

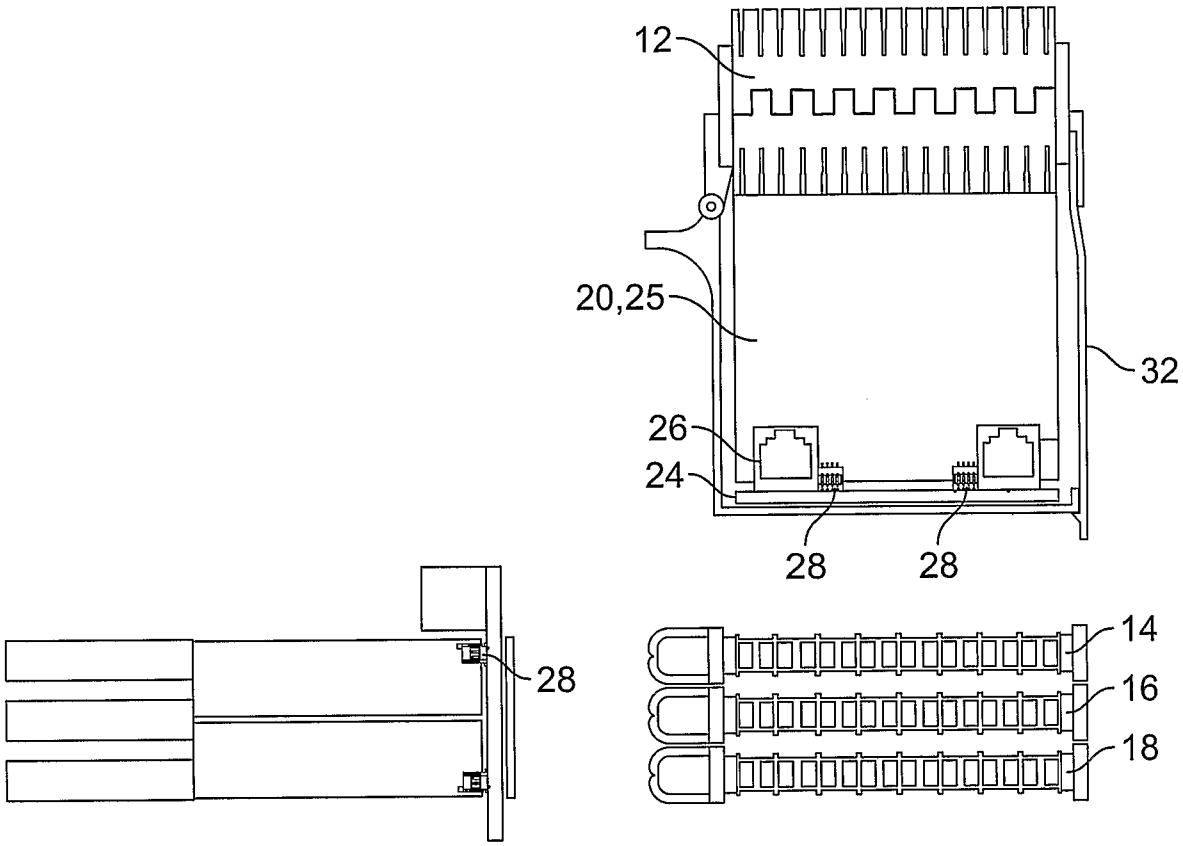

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FIG. 7

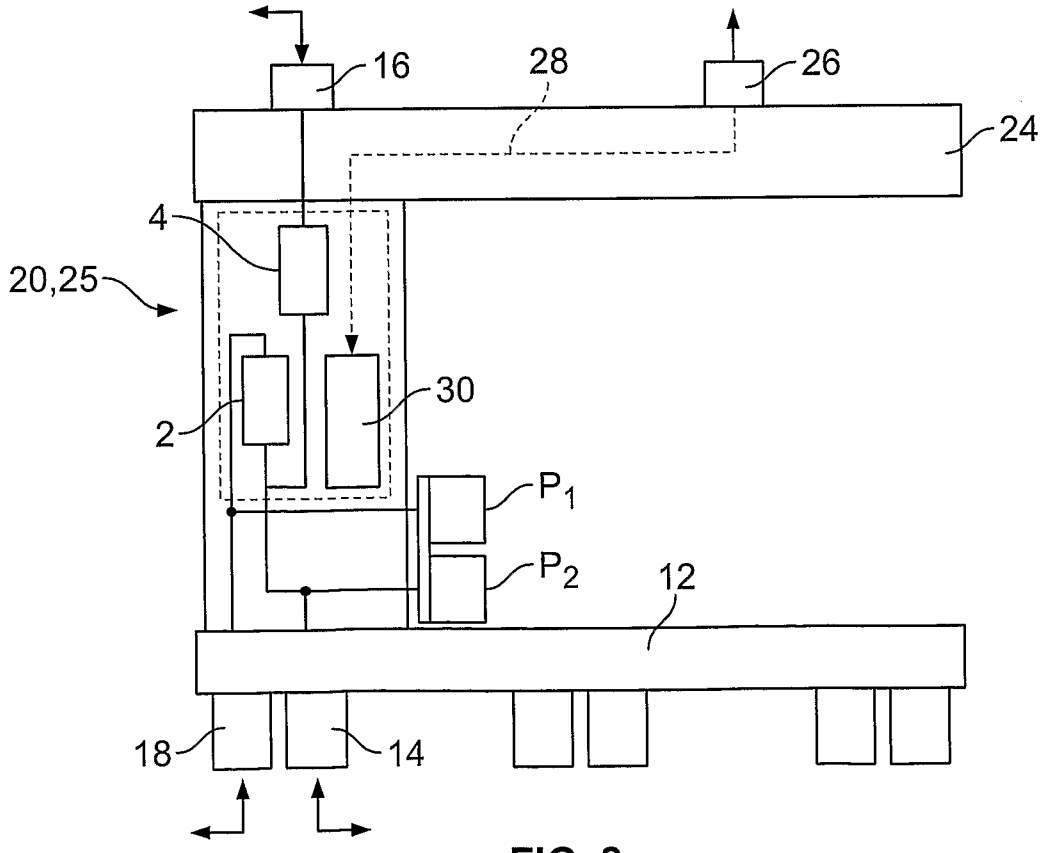

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FIG. 8

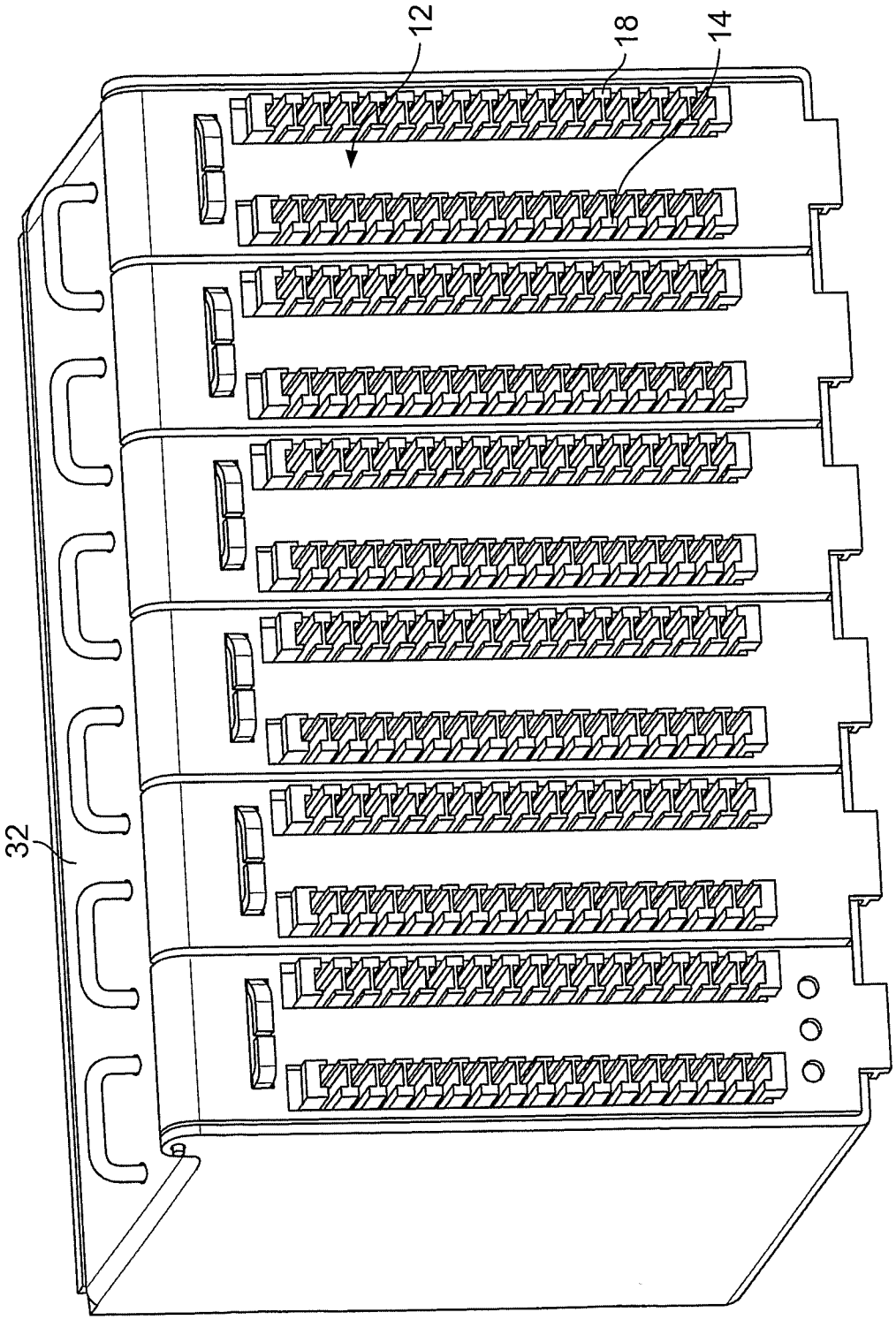


FIG. 9

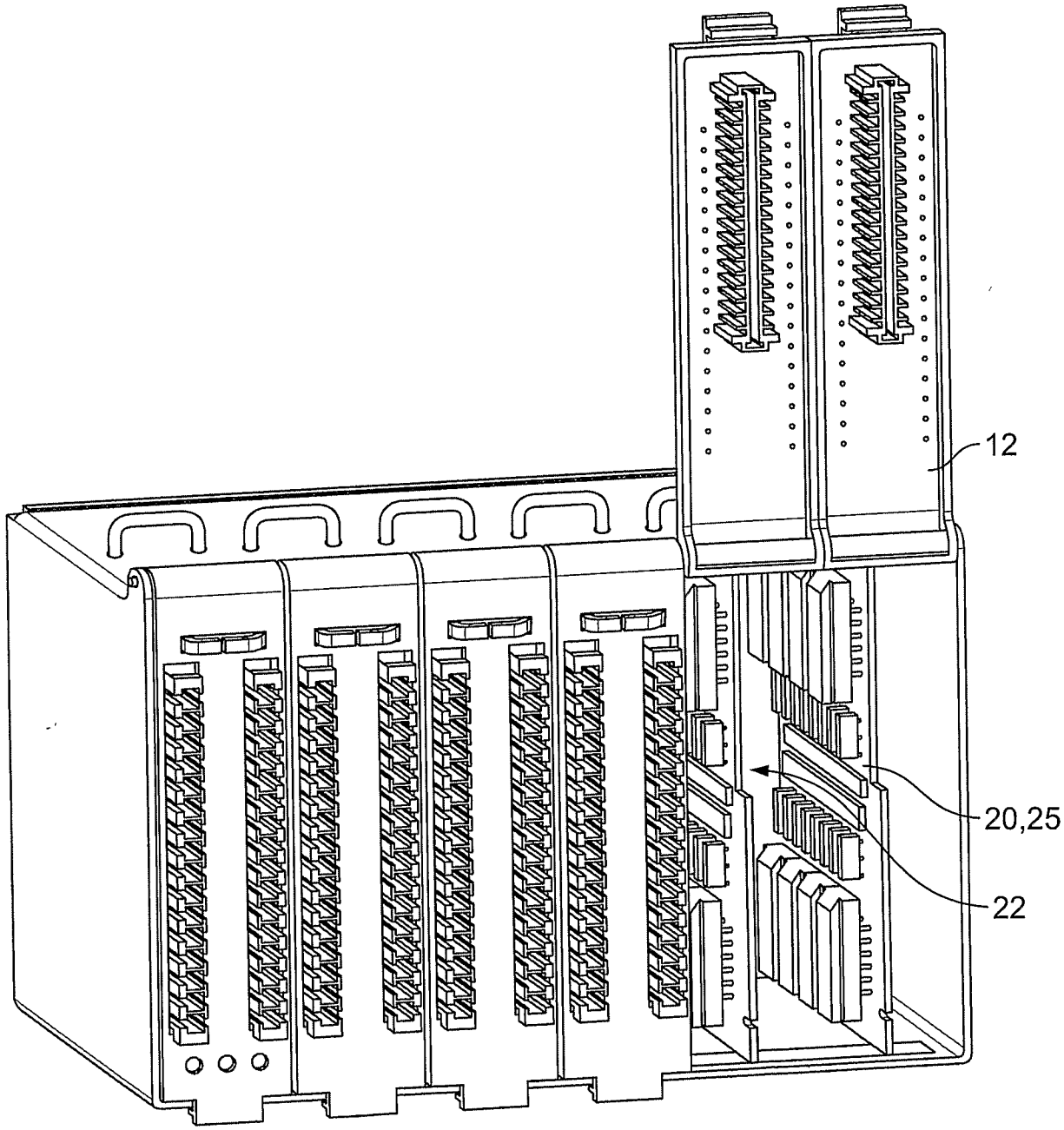


FIG. 10

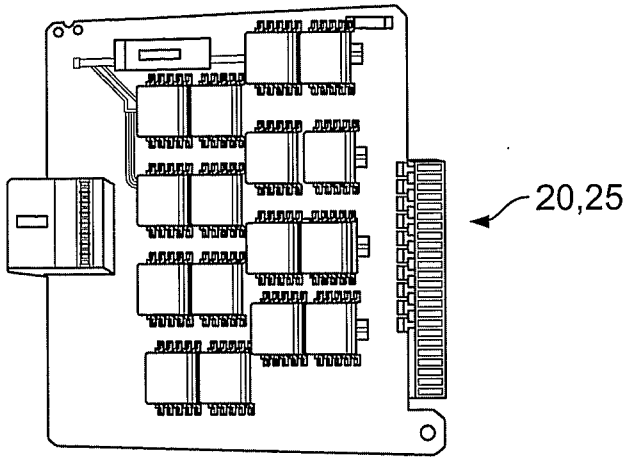


FIG. 11

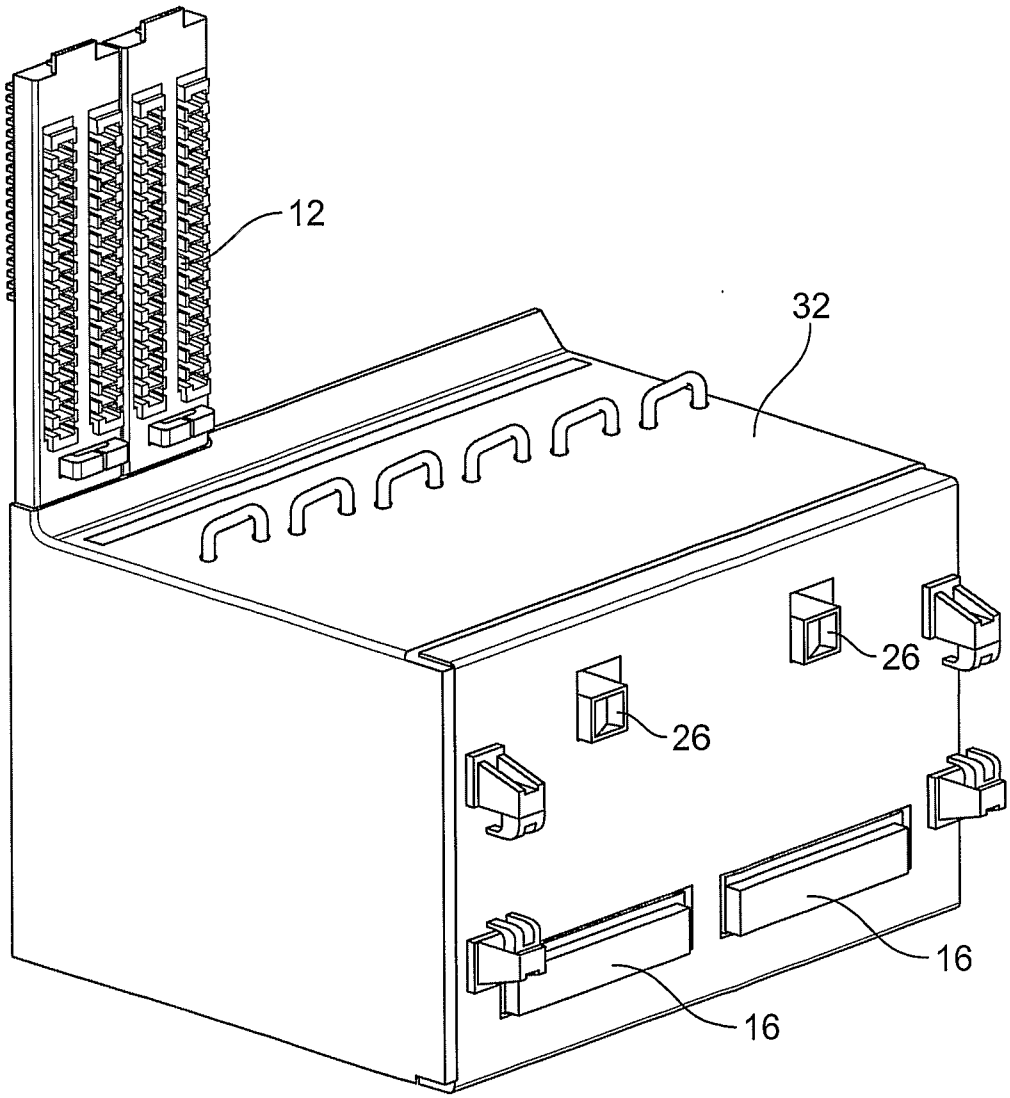


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/001614

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04M3/30 H04M11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 406 241 A (DONNELLY RORY JOSEPH [GB]) 23 March 2005 (2005-03-23) abstract figures 2,3 page 3, lines 25-36 page 8, line 18 - page 9, line 25 page 12, lines 31-35	1,7,8
Y A		2-6,9,12 10,11, 13-16
Y	US 6 594 343 B1 (DUFFIE P KINGSTON [US] ET AL) 15 July 2003 (2003-07-15) abstract figure 3 column 5, line 5 - column 6, line 33	2,5,6,9, 12

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 September 2007	10/09/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bonnet, Jérôme

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/001614

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 418 195 B1 (AUTRY JOHN [US] ET AL) 9 July 2002 (2002-07-09) abstract figure 1	3
Y	US 2002/172329 A1 (RASHID-FARROKHI FARROKH [US] ET AL) 21 November 2002 (2002-11-21) abstract figure 4 paragraph [0032]	4

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/001614

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US 2002172329 A1	21-11-2002	NONE	