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(54) **An electro-pneumatic braking control unit for a railway or tramway vehicle**

Elektro-pneumatische Bremsregleinheit für ein Schienenfahrzeug

Unité de contrôle de freinage électro-pneumatique pour véhicule ferroviaire

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(56) References cited:  
**EP-A- 0 958 980 EP-A- 1 319 566**  
**EP-A- 1 437 281 DE-A1- 10 161 497**

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## Description

**[0001]** The present invention relates to an electro-pneumatic braking control unit for a railway or tramway vehicle of the kind defined in the preamble of claim 1.

**[0002]** A unit of this kind is disclosed in DE 101 61 497 A1.

**[0003]** Electro-pneumatic brake control units are also described for example in EP 0 958 980A in the name of the same applicant.

**[0004]** One object of the present invention is to provide a pneumatic braking command and control unit which has an easily mountable and demountable structure so as to permit easy and rapid access to be gained to its electrical, pneumatic, electro-pneumatic or electronic components, for example during maintenance operations.

**[0005]** This and further objects are achieved according to the present invention by an electro-pneumatic braking control unit, the salient characteristics of which are defined in claim 1.

**[0006]** Further characteristics and advantages of the invention will become apparent from the following detailed description, given by way of non-limitative example, with reference to the attached drawings, in which:

Figure 1 is a perspective view of an electro-pneumatic unit according to the present invention;

Figure 2 is a partially exploded perspective view of the electro-pneumatic unit of Figure 1;

Figure 3 is a partly exploded partial perspective view of the electro-pneumatic unit of the preceding Figures;

Figure 4 is a view sectioned essentially along the line IV - IV of Figure 3;

Figure 5 is a plan view from below of a part of the electro-pneumatic unit of Figure 3, seen in the direction of the arrow V of this Figure;

Figure 6 is a plan view from above of an upper plate of an intermediate structure of an electro-pneumatic unit according to the present invention;

Figure 7 is a plan view from below of the plate shown in Figure 6;

Figure 8 is a plan view of an intermediate plate;

Figure 9 is a plan view from above of a lower plate of the intermediate structure of an electro-pneumatic unit according to the present invention; and

Figures from 10 to 12 are electro-pneumatic diagrams which show different pneumatic brake control circuits which can be achieved using an electro-pneumatic unit according to the present invention.

**[0007]** In Figure 1 and 2 an electro-pneumatic brake control unit according to the invention, for a railway or tram vehicle, is generally indicated 1.

**[0008]** In the exemplary embodiment illustrated the electro-pneumatic unit 1 comprises a support base and pneumatic interface 2 of substantially rectangular shape.

**[0009]** On the base 2 is a multi-layer intermediate structure generally indicated 3 in Figures from 1 to 4.

**[0010]** The intermediate structure 3 is in turn surmounted by an upper container 4 essentially in the form of an inverted basin.

**[0011]** The support base and pneumatic interface 2 has a plurality of inlet openings 11, i2 and i3, on its two opposite sides, and a plurality of output openings o1, o2 and o3 respectively (Figure 2).

**[0012]** The inlet openings 11, i2 and i3 are intended to be connected, respectively, to a main pneumatic braking supply duct, a general braking duct (for example through a brake control distributor), and an auxiliary reservoir.

**[0013]** The outlet openings o1, o2 and o3 are intended to be connected to brake cylinders associated with the wheels of one or more carriages of the vehicle, to actuators for the stationary parking brake, and possibly to further actuators, such as those associated with the so-called cleaning shoes, and possibly to yet others.

**[0014]** The inlet and outlet openings of the support base and pneumatic interface 2 are connected to connection apertures formed in the upper face of the base 2 by means of connections within this base. In Figure 2 some of these connection apertures have been indicated a1-a9, and other connection apertures have been indicated b1-b5.

**[0015]** In the intermediate part of the support base 2 is formed a recess or cavity 5 in which are housed silencers 6 and 7 for the discharge outlets to atmosphere of the various valves and solenoid valves incorporated in and/or carried by the multi-layer intermediate structure 3 as will be described in more detail hereinafter (Figure 2).

**[0016]** On one side the support base 2 further has an exhaust aperture indicated 8 in Figure 2.

**[0017]** In the exemplary embodiment illustrated the multi-layer intermediate structure 3 essentially comprises an upper plate 10, an intermediate plate 11 and a lower plate 12 clamped together by means of screws not illustrated.

**[0018]** The lower plate 12 has longitudinally projecting appendices 12a at its corners and is provided with respective holes through which pass threaded rods 13 which extend from the upper face of the support base 2. Fixing of the multi-layer intermediate structure 3 to the support base 2 is conveniently achieved by means of the said threaded rods 13 and corresponding nuts and washers coupled to them, such as those indicated 14 and 15 in Figure 2. As is shown in the Figure, between the intermediate structure 3 and the base 2 is interposed a plurality of shaped seals generally indicated 16.

**[0019]** Moreover, at its top the base 2 has at least one pair of reference pins 2a and 2b intended to engage in corresponding seats provided in the intermediate structure 3 for the purpose of ensuring correct relative positioning and perfect pneumatic seal.

**[0020]** The upper plate 10 of the intermediate structure 3 is shown, in an exemplary embodiment, in Figures 6 and 7, which illustrate respectively the upper and lower

faces thereof.

**[0021]** With reference in particular to Figures 3 and 4, the upper plate 10 of the structure 3 carries a plurality of pneumatic, electro-pneumatic and electrical components. In the exemplary embodiment illustrated these components comprise eleven solenoid valves EV1-EV11, a monostable or bistable valve EVB, three pressure regulators PR1, PR2, PR3, four pressure stabilisers PS1-PS4, and six electric pressure transducers PT1-PT6. Of these latter, one may be conveniently utilised as a safety transducer to provide pressure decoupling information in relation to the parking brake.

**[0022]** As can be seen better in Figure 4, in the multi-layer intermediate structure 3 is integrated a pneumatic relay valve, of type known per se, generally indicated RV. In the embodiment illustrated this comprises a relay valve with an inlet 17 for the brake pressure, an outlet 18 for the brake pressure intended for the brake cylinders associated with the vehicle wheels, and a plurality of piloting or control chambers, indicated 19a and 19b in Figure 4.

**[0023]** As can be seen from Figure 4, the inlet ducts 17 and the outlet ducts 18 of the relay valve RV are formed by through holes formed in the plates 10, 11 and 12, and coupling channels formed in the lower face 10b (Figure 7) of the upper plate 10 and in the upper face of the lower plate 12 (Figure 9).

**[0024]** By way of example the inlet duct 17 of the relay valve RV comprises a through hole 20 (Figures 4 and 9) which is formed in the lower plate 12 and opens into a coupling channel 21 formed in the upper face of this plate 12 and which communicates with the through hole 22 formed in the intermediate plate 11 (Figures 4 and 8). The aperture 22 in turn communicates with a channel 23 formed in the lower face of the plate 10 (Figures 4 and 7) into which opens a through hole 24 of the plate 10.

**[0025]** With reference to Figure 4, the upper end of the through hole 24 communicates with an L-shape duct 25 having a split form, which extends first vertically and then horizontally, in a body 26 fixed to the upper plate 10 of the intermediate structure 3 and converging to define the relay valve RV.

**[0026]** The plates 10, 11, 12 have a plurality of further apertures and coupling channels, which will not be described in detail but which, as a man skilled in the art will readily be able to appreciate, makes it possible to form connections between the pneumatic and electro-pneumatic components carried by the upper plate 10 and between these and the relay valve RV so as to form a predetermined pneumatic circuit, for example, one of the circuits shown in Figures from 10 to 12.

**[0027]** In these Figures at least some of the components shown here have been identified with the same alphanumeric symbols utilised in Figures 1 to 4.

**[0028]** Conveniently, the intermediate board 11 of the structure 3 can have a different number of piercings in different positions for the purpose of achieving different modes of interconnection between the pneumatic and electro-pneumatic devices carried by the plate 10, to form

different pneumatic circuits. For this reason the intermediate plate 11 can be defined as a "personalisation plate".

**[0029]** The electro-pneumatic unit 1 further includes, as mentioned above, an upper container 4 in the form of an inverted basin. As is seen in Figure 5, within this container are housed various circuit devices carried by a plurality of cards or boards. In the exemplary embodiment shown in Figure 5 there is provided a main board 30 to which is connected a further board 31 carrying supply circuits, a board 32 carrying processor circuit components, for example a microprocessor, and a further board 33 carrying the communication circuit components.

**[0030]** In an alternative arrangement, not illustrated, the circuit devices housed within the container 4 may comprise a main card or motherboard, and a further plurality of cards or boards interconnected together, and connected to the motherboard by means of so-called flexible flat cables or flexible printed circuits.

**[0031]** At least one circuit board housed in the container 4 may carry electrical pressure transducers coupled to pressure reading points arranged in the intermediate structure 3, for example by means of nipples.

**[0032]** Moreover, at least one card can be provided with electrical connectors coupled to corresponding electrical or electro-pneumatic terminals of the devices carried by the intermediate structure 3.

**[0033]** On its two opposite outer end faces the container 4 has multipolar electric connectors 41, 42, 43, (Figures from 1 to 3 and 5) through which the circuit devices contained within it can be connected to a communications network of the railway vehicle on which the electro-pneumatic unit 1 is installed.

**[0034]** To the end faces of the container 4 on which the above-cited connectors are carried, are further connected respective handles 50 able to allow the electro-pneumatic unit 1 as a whole to be carried easily.

**[0035]** At the corners of its free or open face the container 4 has projecting appendices 51 provided with through holes 52 for the passage of fixing screws 53 (Figures 1 and 2) which allow the connection thereof to the upper plate 10 of the multi-layer intermediate structure 3. This connection is easily undone when it is necessary to gain access to the circuit devices housed within the said container.

**[0036]** With reference to Figures 1 and 2, in the end portions of the support base 2 which are left exposed by the multi-layer structure 3 there is provided a plurality of pressure measurement points indicated S1-S7, each of which comprises for example a non-return valve.

**[0037]** The electro-pneumatic unit according to the invention can be assembled and dismantled in an extremely easy manner. This is particularly favourable in that it allows access to be gained in a rapid and easy manner for possible maintenance operations and/or component replacements.

**[0038]** The particular multi-layer intermediate structure of the electro-pneumatic unit makes it possible to reduce the complexity and size of the interconnections

between the pneumatic and electro-pneumatic devices. This also improves the performance and reliability of the unit.

**[0039]** The upper container of the electro-pneumatic unit, if made of a suitable metal, may conveniently act as a screen able to limit electromagnetic emissions towards the outside and protects the interior from disturbances. This upper container, which acts virtually as a cover, surrounds and encloses all the electrical and electronic components and the pneumatic and electro-pneumatic components, and protects them in all senses, that is to say also from dust and other external agents. Moreover it advantageously allows limitation of the escape of flames, fumes, and noxious gases in the case of a fire in components within it.

**[0040]** The support base 2 of the electro-pneumatic unit may in use be fixed to the supporting structure of a railway or tram vehicle, possibly with the interposition of suspension means, for the purpose of reducing the effect of vibrations.

**[0041]** The unit 1 may in particular be fixed to a supporting panel to which is further fixed a pneumatic control device such as, for example, a safety valve or distributor.

## Claims

1. An electro-pneumatic brake control unit for a railway or tram vehicle, comprising a structure (3) of multi-layer type comprising a plurality of superimposed layers (10 - 12), and in particular

- an upper layer (10) carrying and/or integrating a plurality of pneumatic, electro-pneumatic or electric components (RV; EV1-EV11; PS1-PS4; ...) and having a plurality of connection through holes (24) and associated coupling channels (23) provided in its lower face, and
- a lower layer (12) which has through holes (20) for connection with corresponding apertures and/or coupling channels of the upper plate (10), as well as associated coupling channels (21) arranged in its upper face;

the unit being **characterized in that** the said structure (3) further includes an intermediate layer or plate (11) having a plurality of connection passages (22) in positions predetermined as a function of a pneumatic circuit to be formed, and **in that** pneumatic and/or electro-pneumatic valve means such as a pneumatic relay valve (RV) are integrated in the said structure (3).

2. An electro-pneumatic unit according to Claim 1 in which the said structure (3) carries and/or integrates a plurality of solenoid valves (EV1-EV11), as well as pressure switches (PS1-PS4) and pressure regulators (PR1-PR3).

3. An electro-pneumatic unit according to Claim 2, in which the said structure (3) further carries at least one monostable or bistable pneumatic valve (EVB) usable for example for control of parking brake actuators.

4. An electro-pneumatic unit according to any preceding Claim, comprising

- a support base and pneumatic interface (2) having a plurality of inlet openings (i1-i3) intended to be connected to at least one main brake duct and to pressure accumulator means, and a plurality of outlet openings (o1-o3) intended to be connected to pneumatic brake devices; the said inlet and outlet openings (i1-i3; o1-o3) being connected to connection apertures (a1-a9; b1-b5) formed in the upper face of the said base (2) by mean of connections within the base (2);
- the said multi-layer structure (3) being fixed in a demountable manner to the support base (2) and forming passages and /or connection ducts (17-25) between the said components (RV; EV1-EV11; PS1-PS4, ...) and between at least some of these and the upper connection apertures (a1-a9; b1-b5) of the said support base (2) and

- a container (4) in the form of an inverted basin fixed in a removable manner to the multi-layer structure (3), and in which are housed supply, processing, communication and control circuit means (30-33) coupled to electro-pneumatic or electric device of the multi-layer structure (3); the said container (4) having electrical connection means (41-43) able to allow connection of the said circuit means (30-33) to a supply, communication and control network of the vehicle.

5. An electro-pneumatic unit according to any preceding Claim, in which the support base and pneumatic interface (2) carries silencer means (6, 7) for the discharge of pneumatic or electro-pneumatic components carried by the intermediate multi-layer structure (3).

6. An electro-pneumatic unit according to Claim 4 or Claim 5, in which the support base and pneumatic interface (2) carry pressure measurement points (S1-S7) associated with connections within the said base (2).

7. An electro-pneumatic unit according to any of Claims from 4 to 6, in which the said container (4) is of metal material able to provide protection from electromagnetic disturbances, and from atmospheric and/or, environmental agents.

8. An electro-pneumatic unit according to any of Claims

from 4 to 7, in which the intermediate structure (3) has a plurality of test points for measurement of the pneumatic pressure, and the said circuit means (30-33) carried by the container (4) include electrical pressure transducers coupled to the said test points to effect coupling of the said container (4) to the intermediate structure (3).

9. An electro-pneumatic unit according to any of Claims from 4 to 8, in which the said circuit means (30-33) carried by the container (4) include electrical connectors coupled with corresponding terminals of electrical or electro-pneumatic devices of the intermediate structure (3) by the action of coupling the said container (4) to the intermediate structure (3).
10. An electro-pneumatic unit according to any of Claims from 4 to 9, in which the base (2) and the said container (4) are connected to the intermediate structure (3) via respective fixing devices (13-15; 51-53) independent of one another, in such a way that the base (2) and the container (4) are individually dismantlable and separable from the intermediate structure (3).
11. An electro-pneumatic unit according to any of Claims from 4 to 10, in which the base (2) is fixed to a supporting panel including pneumatic control means such as a pneumatic control distributor or a safety valve.

#### Patentansprüche

1. Elektropneumatische Bremssteuereinheit für ein Eisenbahn- oder Trambahnfahrzeug, mit einem Mehrschichtaufbau (3), der eine Vielzahl von sich überlagernden Schichten (10-12) aufweist, und insbesondere eine obere Schicht (10), die eine Vielzahl von pneumatischen, elektropneumatischen oder elektrischen Komponenten (RV; EV1-EV11; PS1-PS4; ...) trägt und/oder einbindet und eine Vielzahl von Verbindungsdurchgangslöchern (24) und verbundenen Kopplungskanälen (23) hat, die an deren unteren Fläche vorgesehen sind, und eine untere Schicht (12), die Durchgangslöcher (12) zur Verbindung mit entsprechenden Öffnungen und/oder Kopplungskanälen der oberen Platte (10), als auch verbundenen Kopplungskanälen (21) hat, die an deren oberen Fläche angeordnet sind; wobei die Einheit **dadurch gekennzeichnet ist, dass** der Aufbau (3) ferner eine Zwischenschicht oder -platte (11) mit einer Vielzahl von Verbindungsdurchgängen (22) an Stellen hat, die als eine Funktion eines auszubildenden Pneumatikschaltkreises vorbestimmt sind, und **dadurch**, dass pneumatische und/oder elektropneumatische Ventileinrichtungen, wie etwa ein pneumatisches Relaisventil (RV), in

den Aufbau (3) eingebunden sind.

2. Elektropneumatische Einheit nach Anspruch 1, in der der Aufbau (3) eine Vielzahl von Solenoidventilen (EV1-EV11), als auch Druckschalteinrichtungen (PS1-PS4) und Druckreguliereinrichtungen (PR1-PR3) trägt und/oder einbindet.
3. Elektropneumatische Einheit nach Anspruch 2, in der der Aufbau (3) ferner wenigstens ein monostabiles oder bistabiles pneumatisches Ventil (EVB) trägt, das zum Beispiel zum Steuern von Parkbremsaktuatoren verwendbar ist.
4. Elektropneumatische Einheit nach einem der vorangehenden Ansprüche, mit einer Stützbasis und Pneumatikschnittstelle (2) mit einer Vielzahl von Einlassöffnungen (i1-i3), die dafür bestimmt sind, um mit wenigstens einem Hauptbremskanal und mit einer Druckspeichereinrichtung verbunden zu werden, und einer Vielzahl von Auslassöffnungen (o1-o3), die dazu bestimmt sind, mit pneumatischen Bremsvorrichtungen verbunden zu werden; wobei die Einlass- und Auslassöffnungen (i1-i3; o1-o3) mit Verbindungsöffnungen (a1-a9; b1-b5), die in der oberen Fläche der Basis (2) ausgebildet sind, mittels Verbindungen innerhalb der Basis (2) verbunden werden; dem Mehrschichtaufbau (3), der in einer demontierbaren Art und Weise an die Stützbasis (2) befestigt wird und Durchgänge und/oder Verbindungskanäle (17-25) zwischen den Komponenten (RV; EV1-EV11; PS1-PS4, ...) und zwischen wenigstens einigen von diesen und den oberen Verbindungsöffnungen (a1-a9; b1-b5) der Stützbasis (2) ausbildet, und einem Behälter (4) in der Form eines umgedrehten Beckens, das in einer entfernbarer Art und Weise an dem Mehrschichtaufbau (3) befestigt ist, und in dem Zuführ-, Verarbeitungs-, Kommunikations- und Steuerkreiseinrichtungen (30-33) untergebracht sind, die mit einer elektropneumatischen oder elektrischen Vorrichtung des Mehrschichtaufbaus (3) gekoppelt sind; wobei der Behälter (4) elektrische Verbindungseinrichtungen (41-43) hat, die in der Lage sind, eine Verbindung der Schaltkreiseinrichtung (30-33) mit einem Zuführ-, Kommunikations- und Steuer Netzwerk des Fahrzeugs zu ermöglichen.
5. Elektropneumatische Einheit nach einem der vorangehenden Ansprüche, in der die Stützbasis und Pneumatikschnittstelle (2) Dämpfereinrichtungen (6, 7) für die Abgabe von pneumatischen oder elektropneumatischen Komponenten trägt, die von dem mittleren Mehrschichtaufbau (3) getragen werden.
6. Elektropneumatische Einheit nach Anspruch 4 oder

Anspruch 5, in der die Stützbasis und Pneumatik-schnittstelle (2) Druckmesspunkte (S1-S7) trägt, die mit Verbindungen innerhalb der Stützbasis (2) verbunden sind.

7. Elektropneumatische Einheit nach einem der Ansprüche 4 bis 6, in der der Behälter (4) aus einem Metallmaterial ist, das in der Lage ist, einen Schutz vor elektromagnetischen Störungen und vor atmosphärischen und/oder ökologischen Wirkstoffen zu bieten.

8. Elektropneumatische Einheit nach einem der Ansprüche 4 bis 7, in der der Zwischenaufbau (3) eine Vielzahl von Testpunkten zur Messung des pneumatischen Drucks hat und die Schaltkreiseinrichtungen (30-33), die von dem Behälter (4) getragen werden, elektrische Druckwandler aufweisen, die an die Testpunkte gekoppelt sind, um eine Kopplung des Behälters (4) an den Zwischenaufbau (3) zu bewirken.

9. Elektropneumatische Einheit nach einem der Ansprüche 4 bis 8, in der die Schaltkreiseinrichtungen (30-33), die von dem Behälter (4) getragen werden, elektrische Stecker aufweisen, die mit entsprechenden Anschlüssen von elektrischen oder elektropneumatischen Vorrichtungen des Zwischenaufbaus (3) durch die Kopplungsaktivität des Behälters (4) an den Zwischenaufbau (3) gekoppelt werden.

10. Elektropneumatische Einheit nach einem der Ansprüche 4 bis 9, in der die Basis (2) und der Behälter (4) über entsprechende voneinander unabhängigen Befestigungsvorrichtungen (13-15; 51-53) mit dem Zwischenaufbau (3) auf solch eine Art und Weise verbunden sind, dass die Basis (2) und der Behälter (4) unabhängig demontierbar und von dem Zwischenaufbau (3) trennbar sind.

11. Elektropneumatische Einheit nach einem der Ansprüche 4 bis 10, in der die Basis (2) an einer Stützverkleidung einschließlich einer Pneumatiksteuer-einrichtung, wie etwa einem pneumatischen Steuerungsverteiler oder einem Sicherheitsventil, befestigt ist.

## Revendications

1. Unité de commande de frein électropneumatique pour un véhicule ferroviaire, comportant une structure (3) de type multicouche comportant une multiplicité de couches superposées (10 à 12), et en particulier

- une couche supérieure (10) supportant et/ou intégrant une multiplicité de composants pneu-

matiques, électropneumatiques ou électriques (RV ; EV1 à EV11 ; PS1 à PS4 ; ...) et ayant une multiplicité de trous débouchants de raccordement (24) et des canaux de couplage associés (23) prévus sur sa face inférieure, et

- une couche inférieure (12) qui a des trous débouchants (20) pour raccordement avec des ouvertures et/ou des canaux de couplage correspondants de la plaque supérieure (10), ainsi que des canaux de couplage associés (21) prévus sur sa face supérieure ;

l'unité étant **caractérisée en ce que** la structure (3) comporte en outre une couche ou plaque intermédiaire (11) ayant une multiplicité de passages de raccordement (22) dans des positions prédéterminées en tant que fonction d'un circuit pneumatique devant être formé, et **en ce que**

des moyens de soupape pneumatiques et/ou électropneumatiques tels qu'une soupape relais pneumatique (RV) sont intégrés dans la structure (3).

2. Unité électropneumatique selon la revendication 1, dans laquelle ladite structure (3) supporte et/ou intègre une multiplicité d'électrovannes (EV1 à EV11), ainsi que des commutateurs de pression (PS1 à PS4) et des régulateurs de pression (PR1 à PR3).

3. Unité électropneumatique selon la revendication 2, dans laquelle ladite structure (3) supporte en outre au moins une soupape pneumatique monostable ou bistable (EVB) utilisable par exemple pour la commande de dispositifs d'actionnement de frein de parc.

4. Unité électropneumatique selon l'une quelconque des revendications précédentes, comportant

- une interface de base de support et pneumatique (2) ayant une multiplicité d'ouvertures d'entrée (il à i3) prévues pour être reliées à au moins une conduite de frein principale et à des moyens d'accumulateur de pression, et une multiplicité d'ouvertures de sortie (o1 à o3) prévues pour être reliées à des dispositifs de freinage pneumatiques ; lesdites ouvertures d'entrée et de sortie (il à i3 ; o1 à o3) étant reliées à des ouvertures de raccordement (a1 à a9 ; b1 à b5) formées dans la face supérieure de ladite base (2) au moyen de raccords à l'intérieur de la base (2) ;

- ladite structure multicouche (3) étant fixée d'une manière démontable sur la base de support (2) et formant des passages et/ou des conduits de raccordement (17 à 25) entre lesdits composants (RV ; EV1 à EV11 ; PS1 à PS4 ; ...) et entre au moins certains de ceux-ci et les ouvertures de raccordement supérieures (a1 à

- a9 ; b1 à b5) de ladite base de support (2) et  
 - un réceptacle (4) sous la forme d'une bassine  
 inversée fixé d'une manière amovible sur la  
 structure multicouche (3), et dans lequel sont  
 logés des moyens de circuit d'alimentation, de  
 traitement, de communication et de commande  
 (30 à 33) reliés au dispositif électropneumatique  
 ou électrique de la structure multicouche (3) ;  
 ledit réceptacle (4) ayant des moyens de rac-  
 cordement électriques (41 à 43) capables de  
 permettre un raccordement desdits moyens de  
 circuit (30 à 33) à un réseau d'alimentation, de  
 communication et de commande du véhicule.
- 5
11. Unité électropneumatique selon l'une quelconque  
 des revendications 4 à 10, dans laquelle la base (2)  
 est fixée sur un panneau de support comprenant des  
 moyens de commande pneumatiques tels qu'un dis-  
 tributeur de commande pneumatique ou une soupape  
 de sécurité.
- 10
5. Unité électropneumatique selon l'une quelconque  
 des revendications précédentes, dans laquelle l'in-  
 terface de base de support et pneumatique (2) sup-  
 porte des moyens de silencieux (6, 7) pour l'échap-  
 pement de composants pneumatiques ou électrop-  
 neumatiques supportés par la structure multicouche  
 intermédiaire (3).
- 15
- 20
6. Unité électropneumatique selon la revendication 4  
 ou la revendication 5, dans laquelle l'interface de  
 base de support et pneumatique (2) supporte des  
 points de mesure de pression (S1 à S7) associés à  
 des raccordements à l'intérieur de ladite base (2).
- 25
7. Unité électropneumatique selon l'une quelconque  
 des revendications 4 à 6, dans laquelle ledit récep-  
 tacle (4) est dans une matière métallique capable  
 d'assurer une protection contre les perturbations  
 électromagnétiques, et contre les agents atmosphé-  
 riques et/ou environnementaux.
- 30
- 35
8. Unité électropneumatique selon l'une quelconque  
 des revendications 4 à 7, dans laquelle la structure  
 intermédiaire (3) a une multiplicité de points de test  
 pour la mesure de la pression pneumatique, et les-  
 dits moyens de circuit (30 à 33) supportés par le  
 réceptacle (4) comprennent des transducteurs de  
 pression électriques reliés aux dits points de test afin  
 d'effectuer un couplage dudit réceptacle (4) à la  
 structure intermédiaire (3).
- 40
- 45
9. Unité électropneumatique selon l'une quelconque  
 des revendications 4 à 8, dans laquelle lesdits  
 moyens de circuit (30 à 33) supportés par le récep-  
 tacle (4) comprennent des connecteurs électriques  
 reliés à des bornes correspondantes de dispositifs  
 électriques ou électropneumatiques de la structure  
 intermédiaire (3) grâce à l'action de couplage dudit  
 réceptacle (4) à la structure intermédiaire (3).
- 50
10. Unité électropneumatique selon l'une quelconque  
 des revendications 4 à 9, dans laquelle la base (2)  
 et ledit réceptacle (4) sont reliés à la structure inter-  
 médiaire (3) au moyen de dispositifs de fixation res-
- 55

FIG. 1

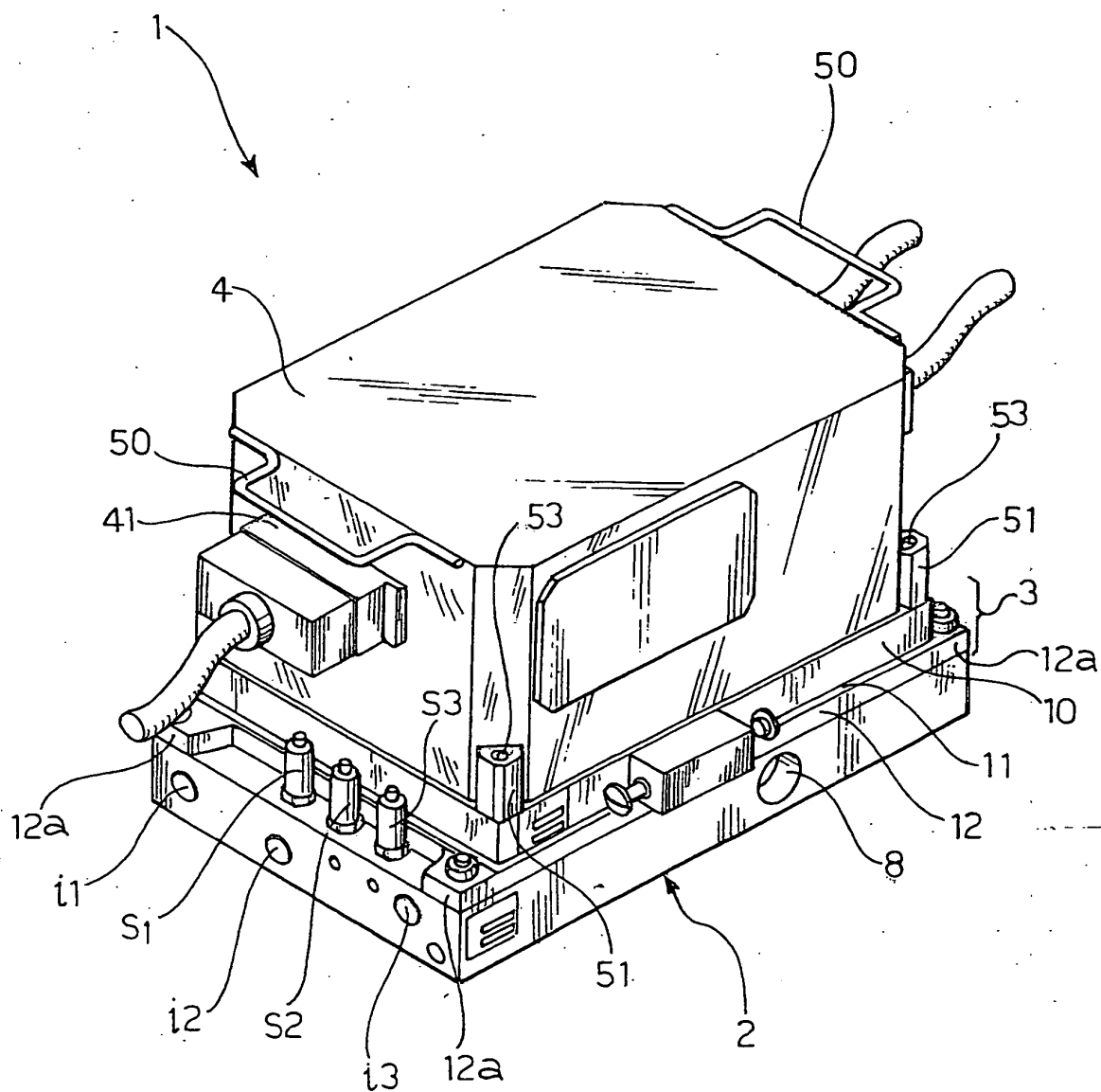
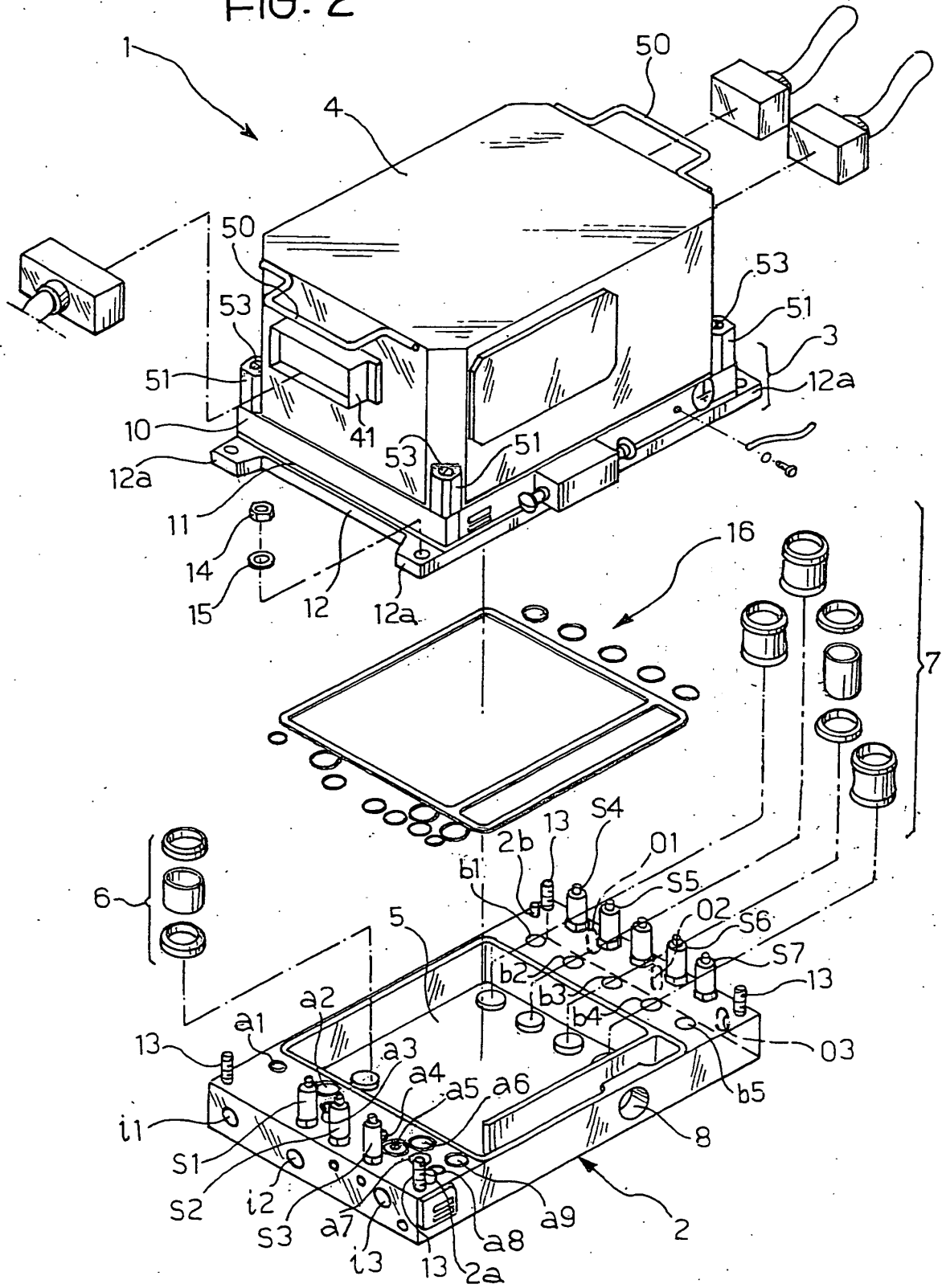




FIG. 2



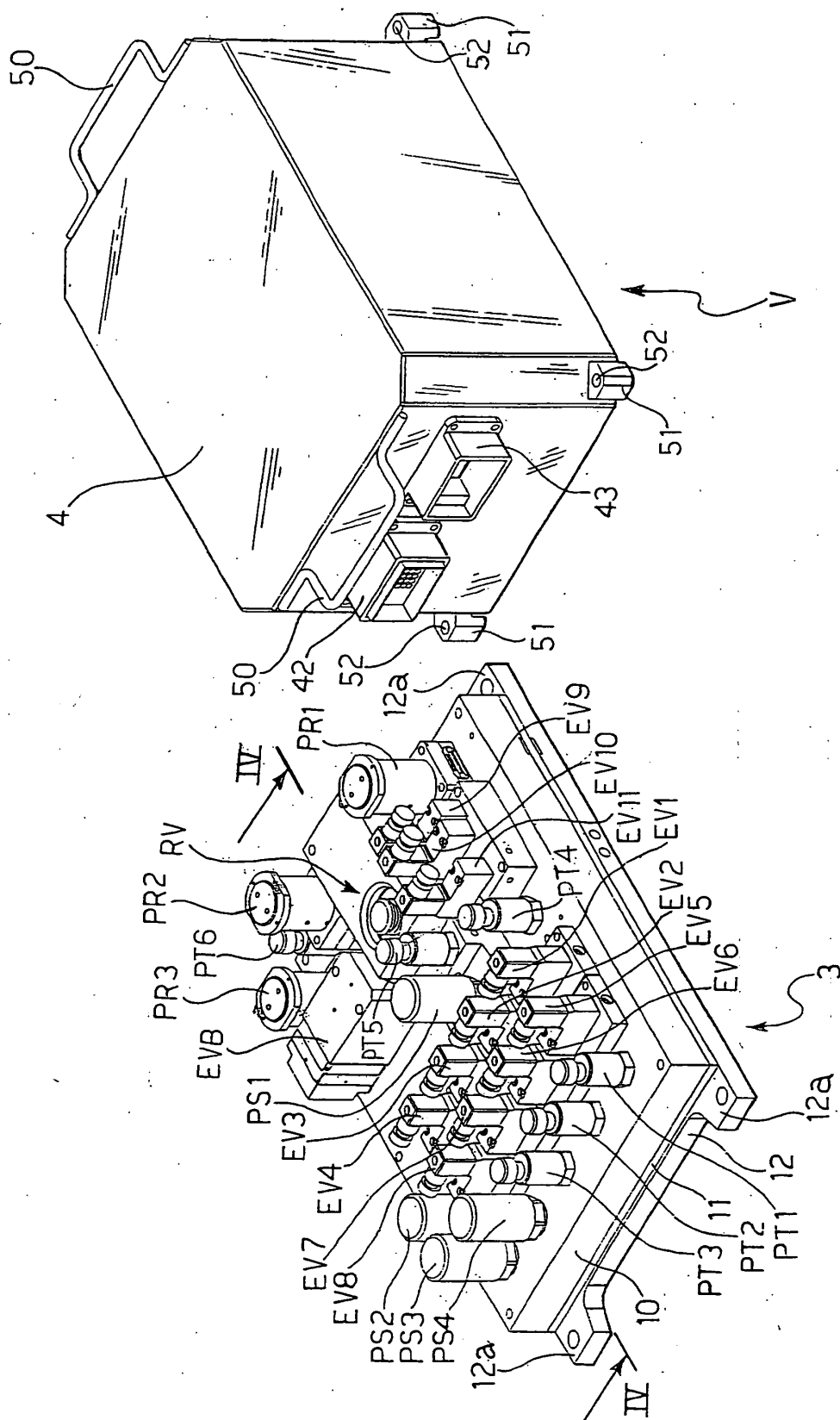


FIG. 4

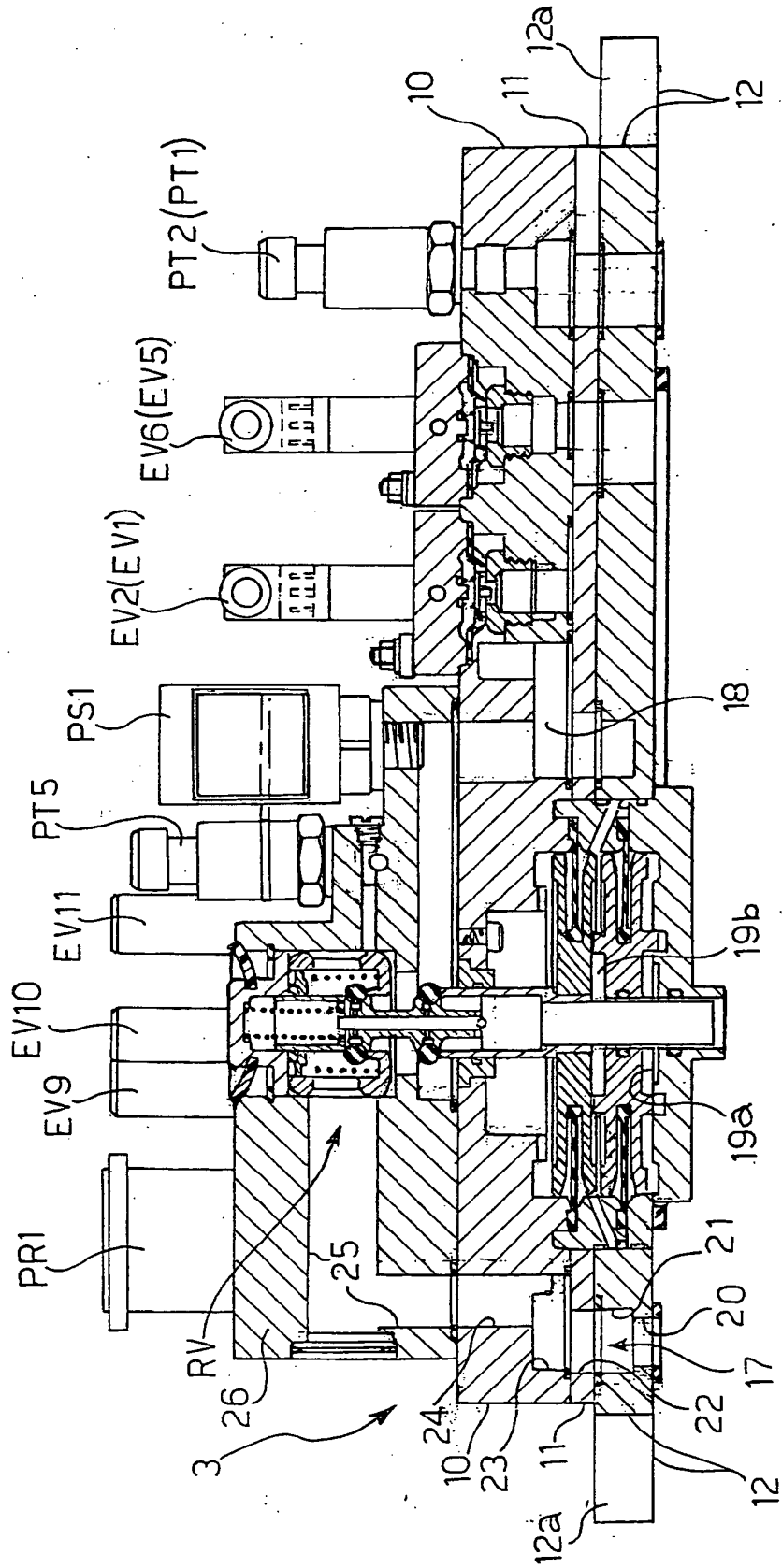


FIG. 5

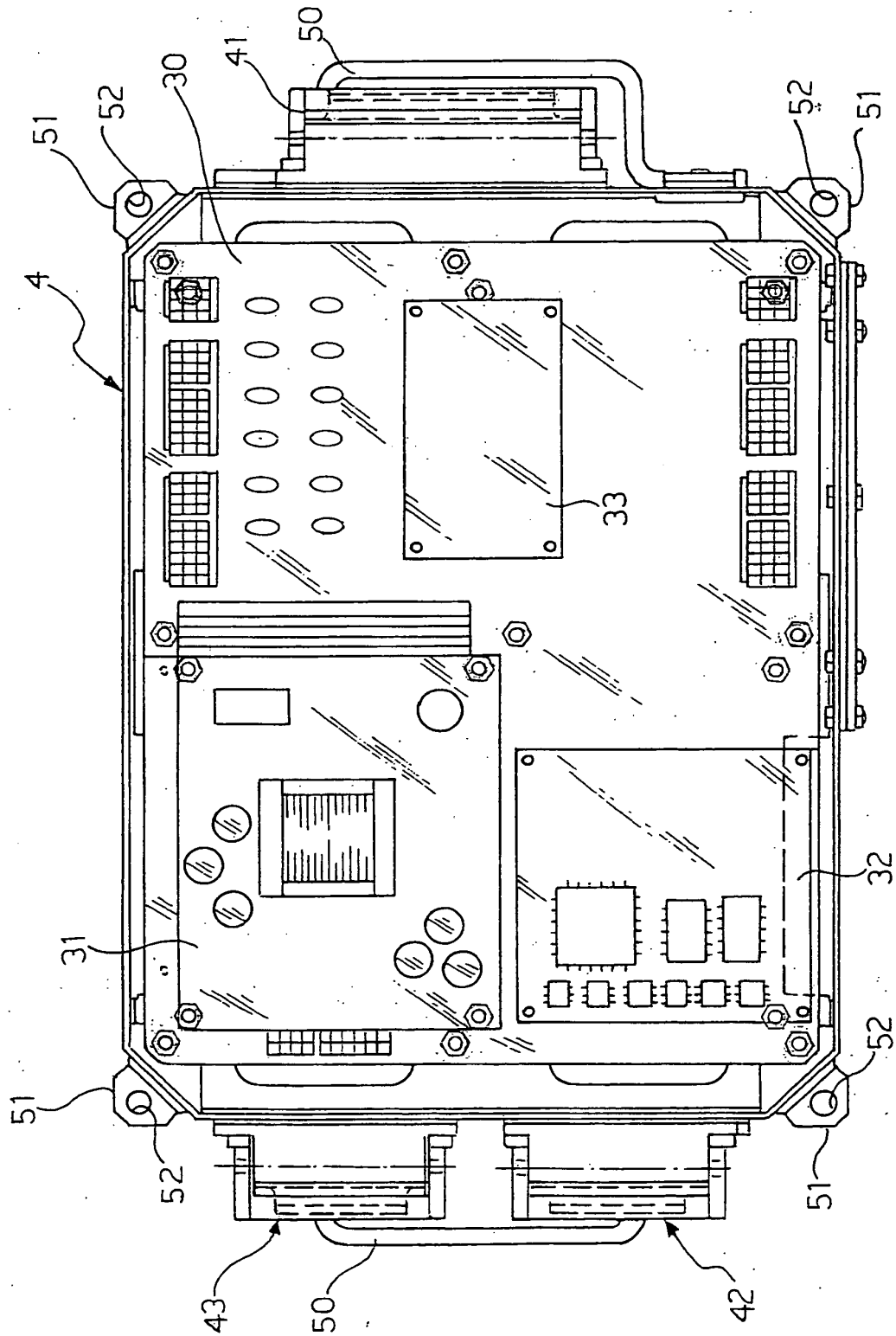


FIG. 6

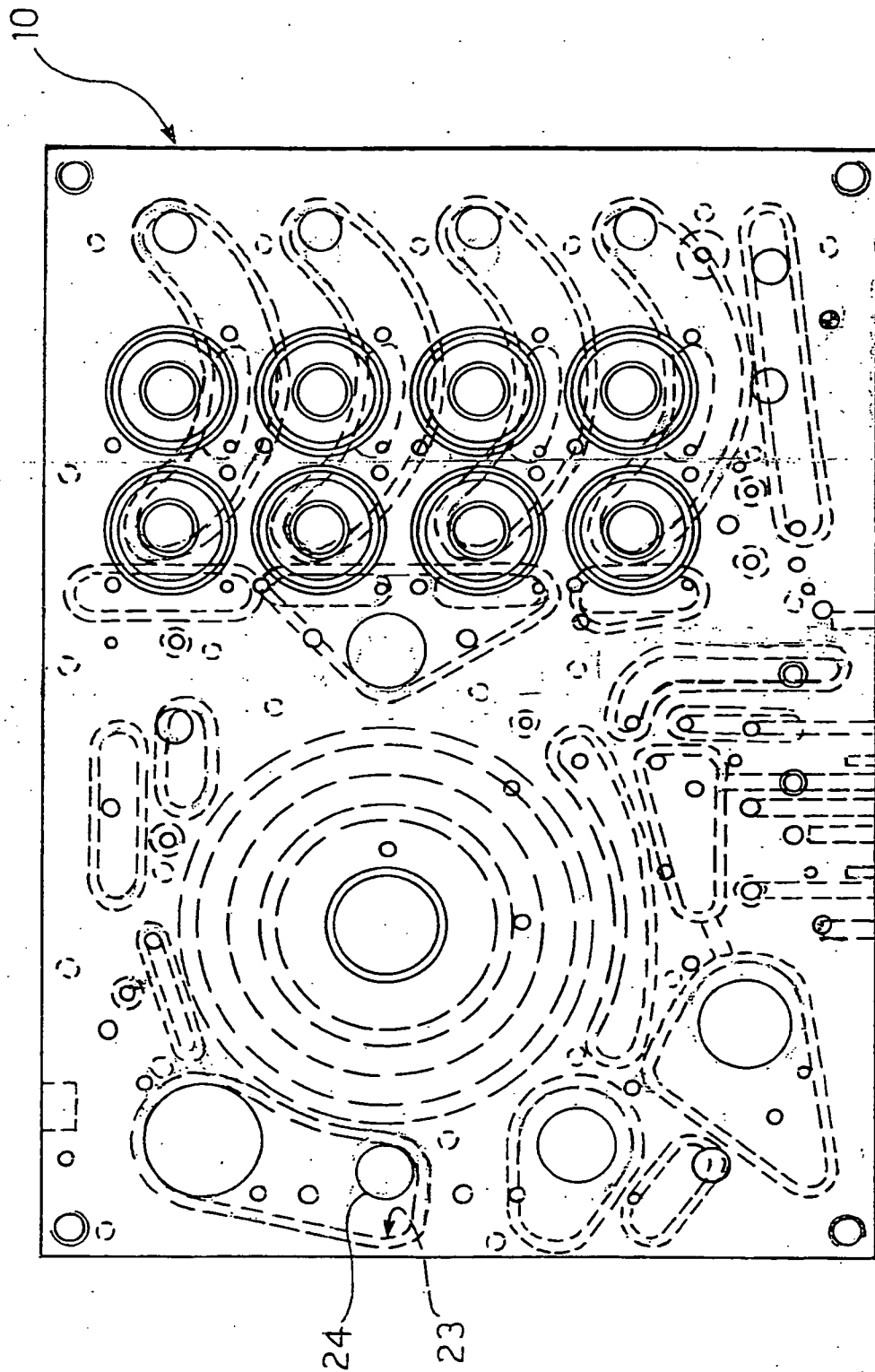
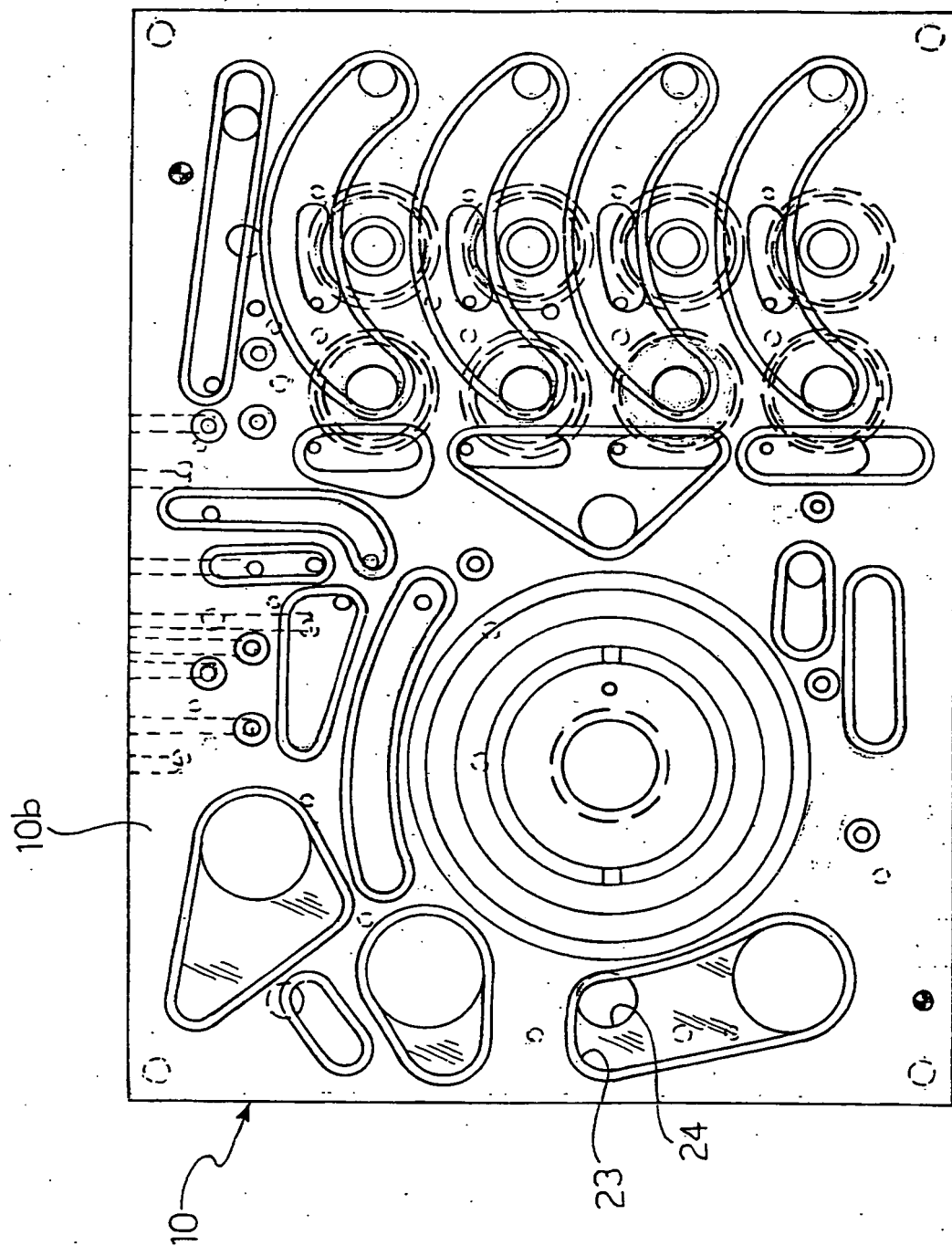


FIG. 7



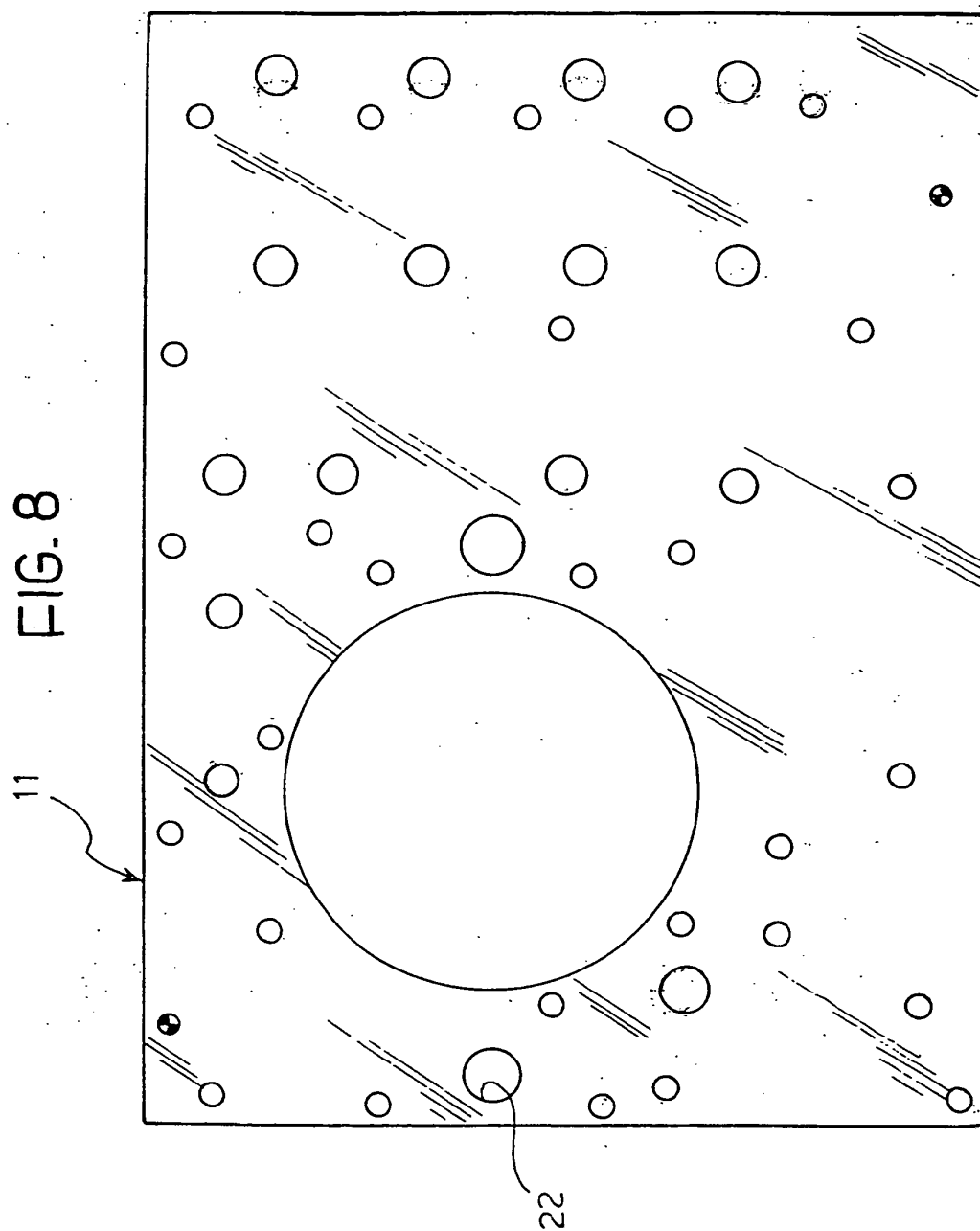


FIG. 9

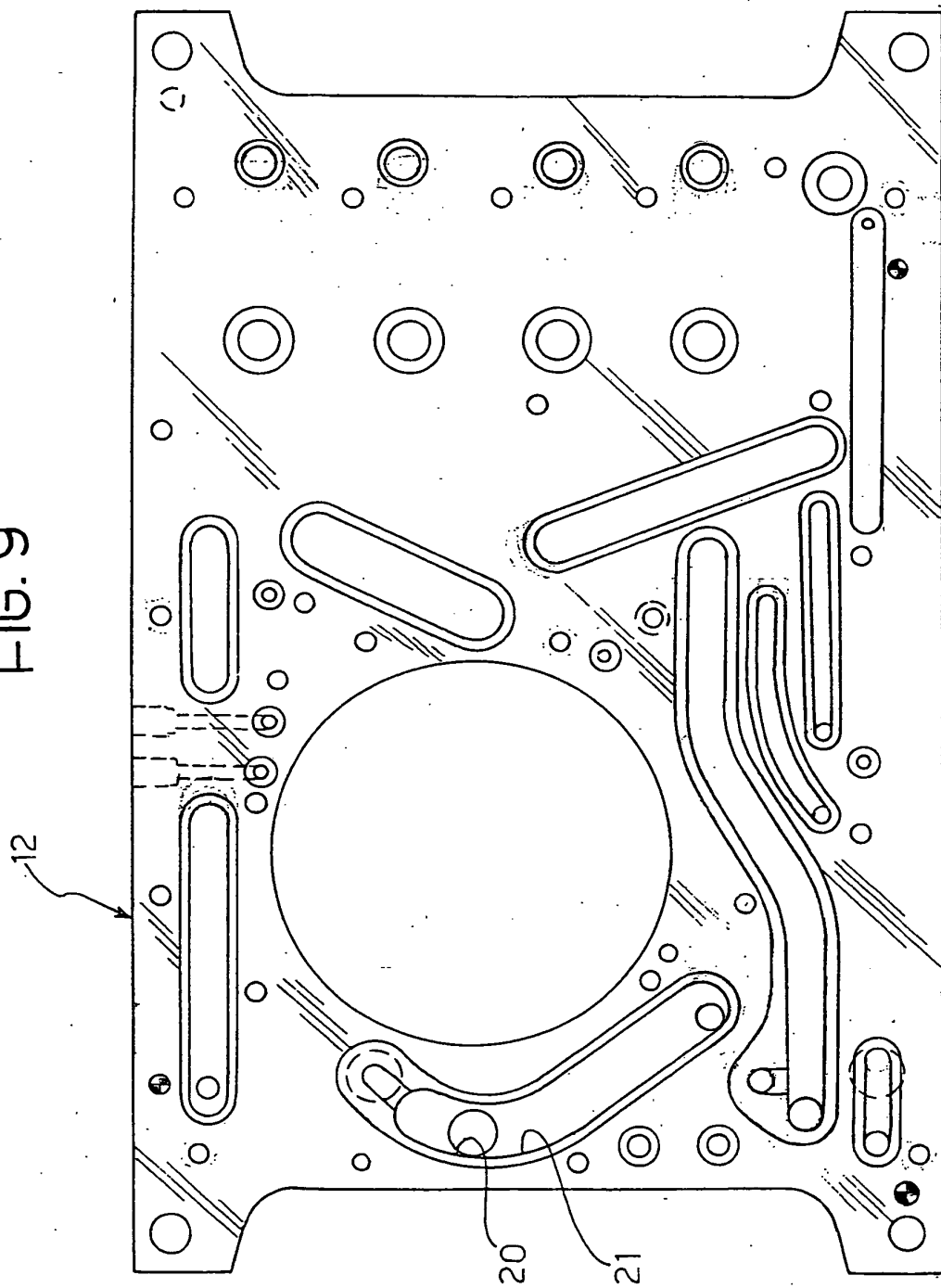




FIG. 10

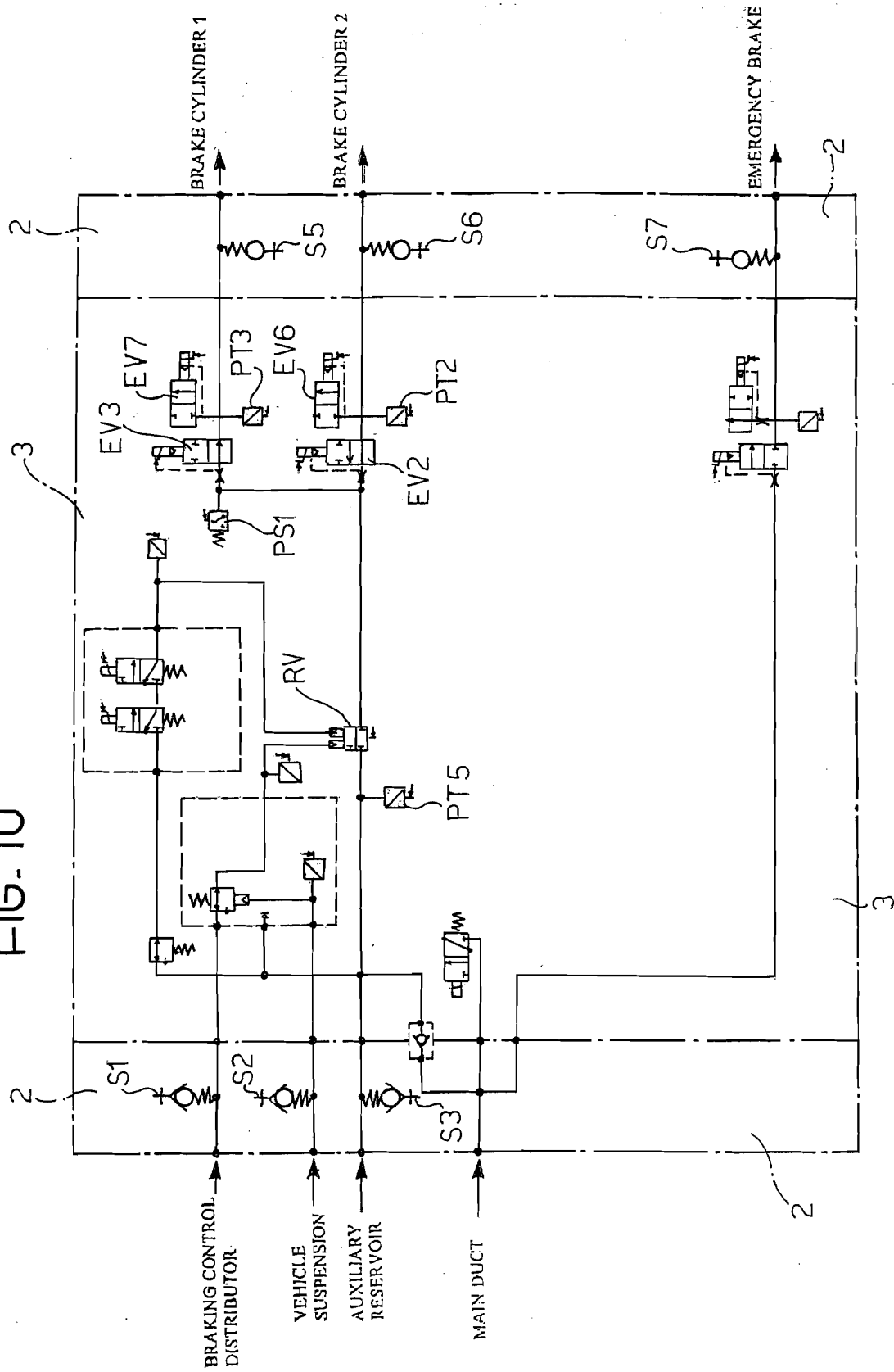


FIG. 11

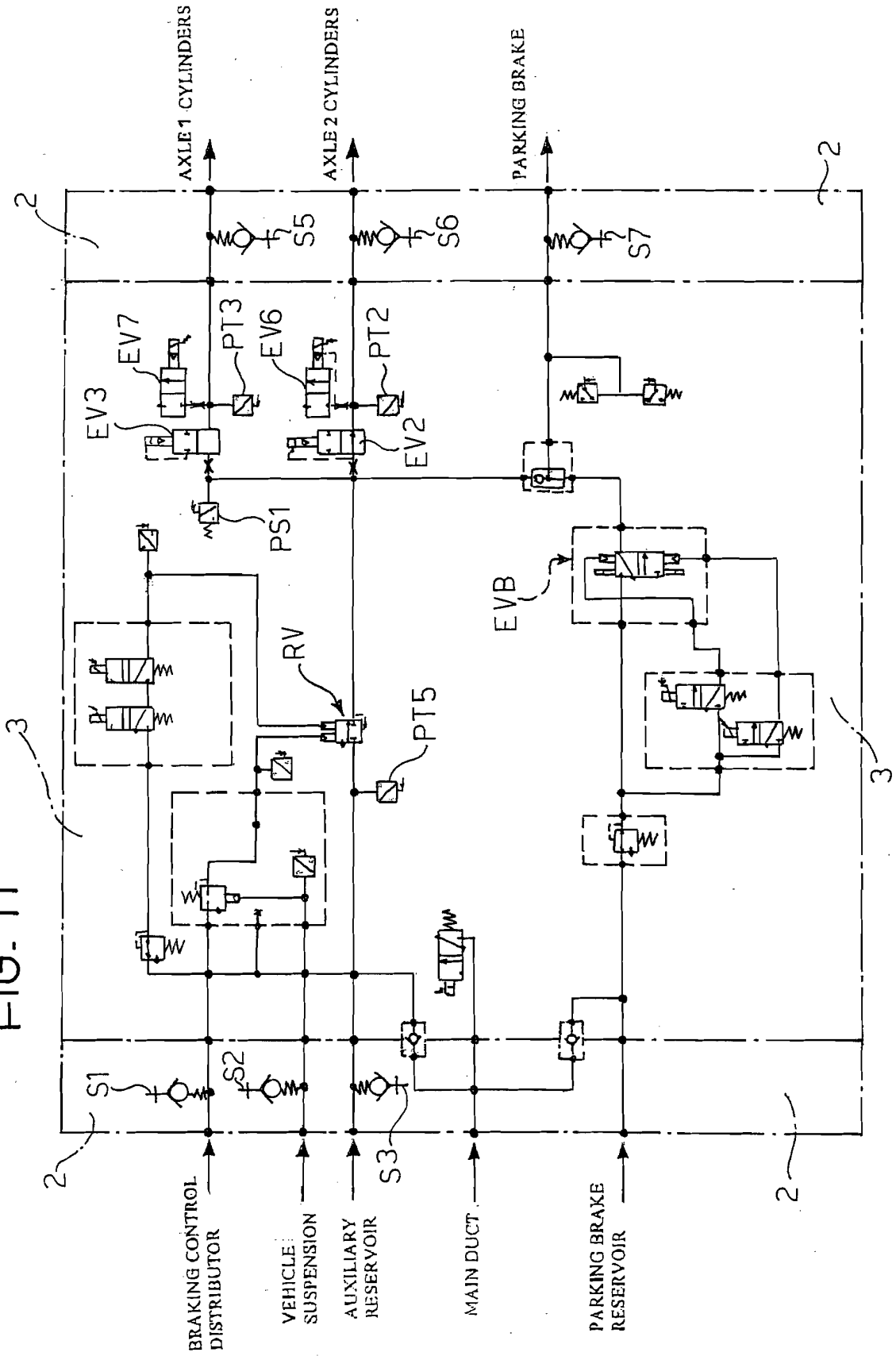
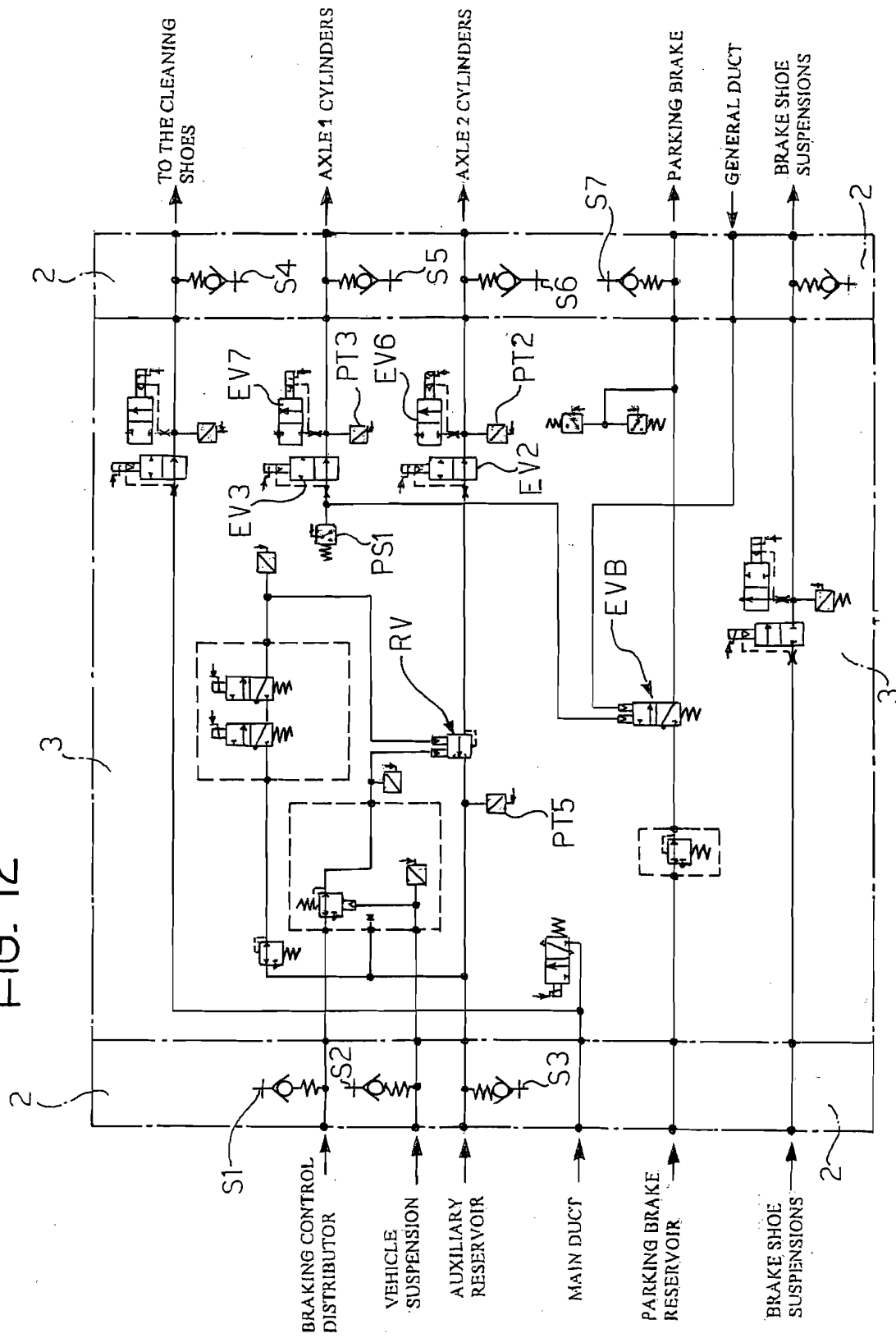


FIG. 12



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- DE 10161497 A1 [0002]
- EP 0958980 A [0003]