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(54) Sliding-door appliance.

(57) A sliding-door construction with door panels (3) provided with permanent magnets (10) at the upper side which serve for the positioning against an upper rail (4).

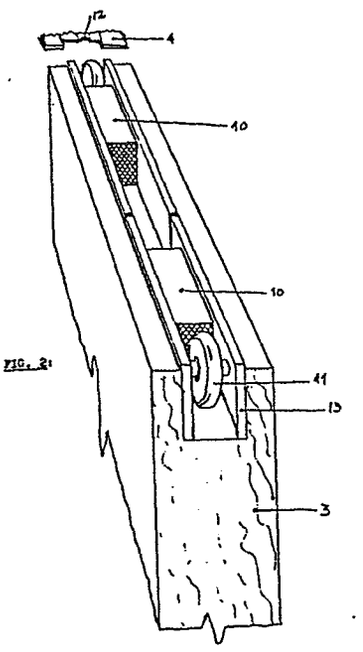

FIG. 2

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A sliding door appliance.

The invention relates to a sliding door construction, which mainly consists of a door element positioned in a frame, which surrounds a doorway opening to which a hollow wall structure is adjacent.
The sliding door can be included with a complete frame into a finished wall or separating structure, whereas the split hollow part together with the wall or separating structure is finished in such a way, that it is not visible, while the doorway opening is bordered by an upper beam and jamb posts.
The present invention aims at the furnishing of a sliding door slipping easily with minimal resistance and carried by means of permanent magnets in combination with a steel strip, which is part of the frame, such that a convenient assembly will be possible, while maintenance and wear are inconsiderable.
According to French Patent 1580187 the use of electric magnetoes at the door panel and at the upper beam for opening and shutting of doors is known.
By an interruption of the voltage intrusions can happen.
The sliding door construction according to the present invention has a frame, wherein the sliding door is positioned, with a passage opening as a conventional doorway, adjacent to a split hollow wall part structure, both sides of which being clad by means of sheet material.
Due to the absence of relatively elevated rail construction, which for conventional sliding doors ought to be attainable by means of removable structures, the sizes of the visible side jambs moreover can be limited as those of a normal doorway jambs structure.
The frame of the doorway passage and the hollow wall part constitute a complete entirety.
The outer thickness of the hollow split wall part is in conformity with the wall size and the sheet material for the erection of said hollow split wall part can be plastered and finished together with the wall.

The construction of the entire device is such that it can be prefabricated and that it can be erected as a whole.

The door construction of the type as described in the introduction is provided according to the present invention with a hanging member, consisting of permanent magnets affixed in a slot at the top of the sliding door panel, serving as a means to keep said door in a steel profile, which is part of the frame.

In order to enable the sliding in the top edge of the door, several rollers or sets of rollers in bearings are provided which are running in a groove in the steel strip, in order to keep on the one side an air cleft between the magnet and the steel, on the other hand to guide the linear movement.

The sliding door appliance in question, as mentioned in the introduction, is characterized according to the present invention in that the upper beam at its lower side is provided with a steel strip having a groove in the centre along its entire length, and that the door at its top side is provided with permanent magnets affixed in one line between two steel slot borders (pole sheets), the field of which extending beyond the door, such that said magnets exert a permanent force of attraction towards the steel strip, while a set of at least two rollers, which extend somewhat at the upper edge of the door and which run in the groove of the steel strip, enable the shifting of the door, while lateral pulling out of the door is prevented by rib-shaped guiding means along the openings for shifting out, at the upper and/or lower edge of the door respectively.

The permanent magnets consist of longitudinal blocks of ferrite, lanthanide-iron or lanthanide-cobalt-alloy, which have been sintered and which are polarized in such a manner that the North and South pole are situated in the horizontal plane opposite to each other between the slot borders (pole sheets).

Preferably the material consists of small blocks of Neodym-iron, samarium-cobalt or samarium-cobalt-iron in fine sintered shape.

Other lanthanides (or rare earth metals) may also be components of the alloy.

Preferably the block-shaped magnets are positioned alternately with mutual reverse poles between the steel slot borders and are divided from each other by smaller permanent magnets, which are magnetized in the horizontal direction and which fill part of the space between the block shaped larger magnets.

The magnetic field is thereby directed in a more elevated way.

The use of the sliding door according to the present invention is facilitated because other mechanical bearing components are missing. The erection of the sliding door appliance is furthermore facilitated according to the invention, because the complete frame can be mounted, immured and finished during the raw construction and building up of a premise, without danger of filthiness of the shifting means.

The sliding door as such can be mounted during the finishing of the premise by introducing it primarily in a diagonal position into the split hollow wall and then lifting it, until the strip will get within the coercive force of the magnets, whereafter the sliding door will remain in the hanging position and will be operational.

In contrast with the conventional sliding door systems the method of placing is entirely in conformity with that of normal door or window frames.

The invention is further explained by showing an example of an embodiment.

In the annexed figures 1-5 the following is shown:

Figure 1 is a partially exploded perspective view of the sliding door construction according to the invention.

Figure 2 shows a manner of positioning of the magnets and of the rollers at the top edge of the door.

Figure 3 is a vertical cross section, wherein magnets and the groove for the guiding rollers are depicted.

Figure 4 is a vertical cross section of the top side of the door at the place of one of the rollers.

Figure 5 shows the manner of positioning of the magnets, which is preferred.

The sliding door construction shown in the figures 1-5 is assembled of a frame with a part (1) for inserting into a hollow split wall and a doorway passage (2), wherein the door panel (3) can be moved linearly to and fro. The frame comprises a steel strip (4) and jamb posts (5) confining the doorway passage (2).

The frame part (1) for the hollow split wall is for example clad at both sides with sheet material (6), which is comprised all around in a metal strip (4) and which is affixed by means of supporting lathings (7).

This construction of supporting lathings and sheet material is for the purpose, that the entire frame will keep its shape and remain in this shape, such that the possibility of premanufacturing exists.

The outer width of the hollow split wall coincides with the width of the wall (8), such that the sheet material (6) can be plastered together with the wall (8) and can be finished with a coating layer (9).

The jamb posts (5) remain visible as a normal doorway frame.
At the top edge of the door panel (3) a groove is fraised wherein permanent paramagnetic elements (10) are positioned between pole sheets (13).
In order to prevent that the magnets (10) at the steel strip could impede the horizontal motion, the magnets are separate and there are at least two rollers or sets (11), which are adjusted in height in such a manner, that horizontal shifting is possible, because a small distance is kept.
In order to maintain the linear motion, the steel strip (4) has a profile such that the rollers are guided in a straight track.
This is effected by means of the groove (12) indicated in figures 2 and 3.
The inner side of the jamb posts (5) is provided with strips of bristles which are adjacent to the sliding door panel such that the sliding door is kept in its vertical position.
A special conducting device can be applied at the underside as well.
For the sliding door (3) a normal commercial door as well as a composition of special constructed door elements, for larger sizes or for particular requirements can be used.
The invention is not restricted to the embodiments as described above.
The magnetic hanging appliance can also be used for other movable separation walls or panels.
The construction can be completed furthermore with an automatic service, for example by means of an electrical motor drive.
The magnetic elements are sintered permanent paramagnetic polarized blocks and they consist preferably of ferrite, samarium-cobalt-or neodym-iron-alloy or of other alloys of lanthanides, cobalt and/or iron.
These materials are available in the shape of bars or profiles (casting mold, sintered and polished).
The following data are given as examples and the invention is not restricted to these.

Weight of commercially available doors, sizes 201 x 83 cm:

light poplar-wood door:	16 to 18.5 kg.
full chip wood door:	45 kg.
fire-retardant door:	50 kg.
noise-insulating door:	50 kg.
X-ray insulating door:	64 kg.
bullet-resistant door:	80 kg.

The tractive force of the magnet should be 10 to 15 kg higher than the weight of the door.

An element of 1 kg neodym-iron has a coercive force such that a tractive force of 120 kg is obtained.

The specific weight is 4.833.

Magnetic material required:

Weight of door:	Tractive force required:	Weight of magnet:	Cost of magnet:
18.5 kg.	33 kg	0.27 kg	f.5.-/7.-
45 kg	60 kg	0.50 kg	f.9.-/14.-

Length of bar: 25.0 or 46.0 cm.

Width of bar: 1.5 cm

Height of bar: 1.5 cm.

With a block length of 80 cm (width x height = 1.5 x 1.5 cm) a door can be carried of 90 kg max. (tractive force = 105 kg).

Claims:

1. A sliding door appliance consisting of a door element (3) kept in a frame, which surrounds a doorway passage at which a hollow split wall part is adjacent, having an upper beam at the top and extending over both parts, characterized in that said upper beam at its lower edge is provided with a steel strip (4), which has a groove (12) in the centre along its entire length, and that the door (3) at its upper edge is provided with block-shaped permanent magnets (10), affixed in one line over the entire length between two steel slot borders, the field of said magnets extending above the door, such that said magnets (10) exert a permanent coercive force at the steel strip, while a set of at least two rollers (11), extending somewhat at the upper edge of the door and running in the groove of said steel strip, enables the shifting of the door, while lateral turning aside is prevented by rib shaped guidance means along the pushing out opening at the upper- and /or lower side of the door respectively.

2. A sliding door appliance according to claim 1, characterized in that the permanent magnets (10) consist of rectangular blocks of ferrite, lanthanide-iron or lanthanide-cobalt-alloy, which are sintered and polarized such that North and South pole in the horizontal level are positioned opposite to each other between the slot borders.

3. A sliding door appliance according to claim 2, characterized in that the material of the magnetic blocks (10) consists of neodym-iron-alloy in sintered form.

4. A sliding door appliance according to claim 2, characterized in that the material of the magnetic blocks (10) consists of Samarium-cobalt-alloy in sintered form.

5. A sliding door appliance according to claim 1, characterized in that the block shaped magnets (10) are positioned between the steel slot borders such that their poles are alternately opposite to each other, and that they are separated by smaller permanent magnets, which are magnetized in the horizontal direction, and which occupy a part of the space between the block-shaped larger magnets.

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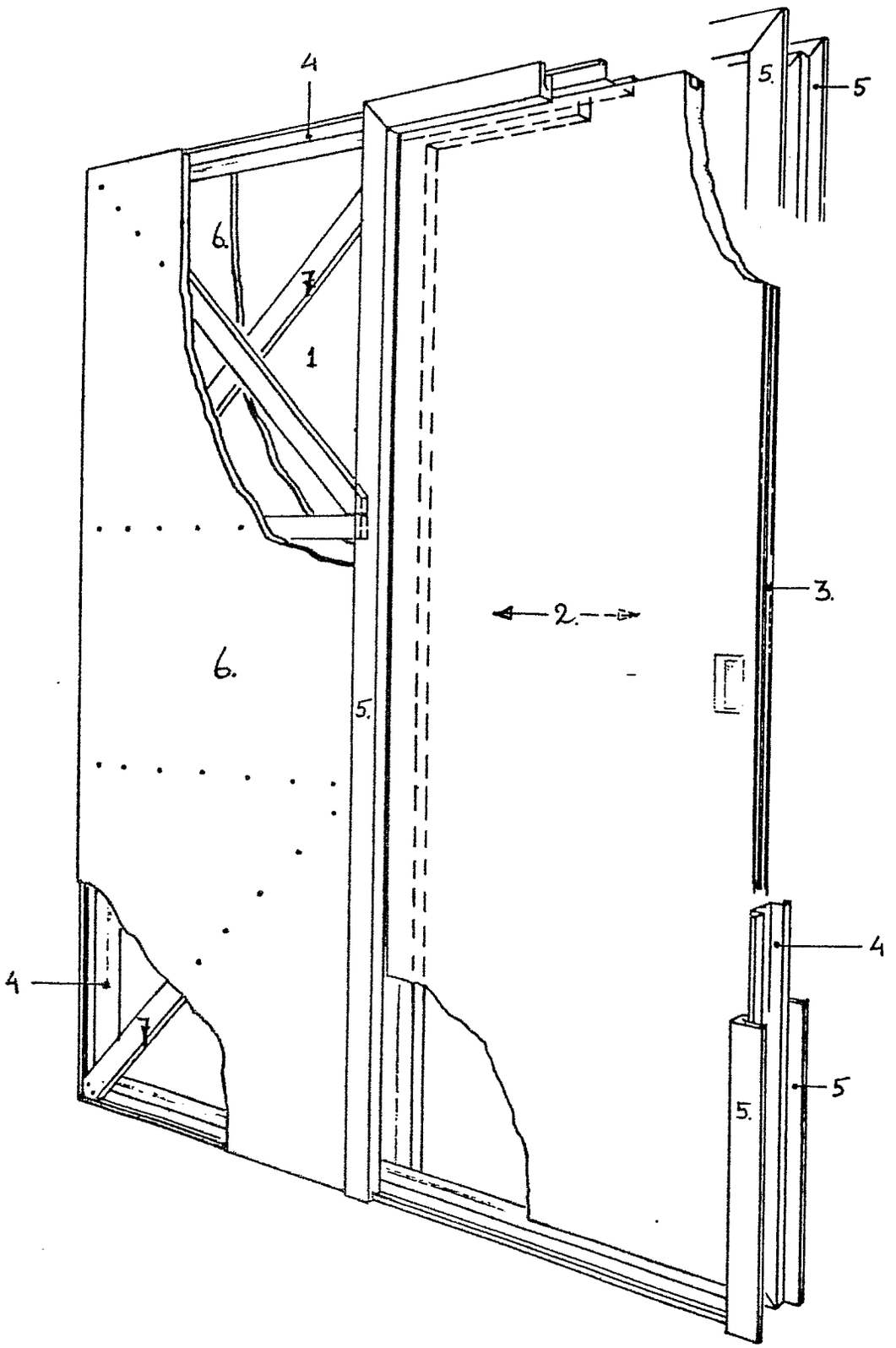
FIGUUR 1:



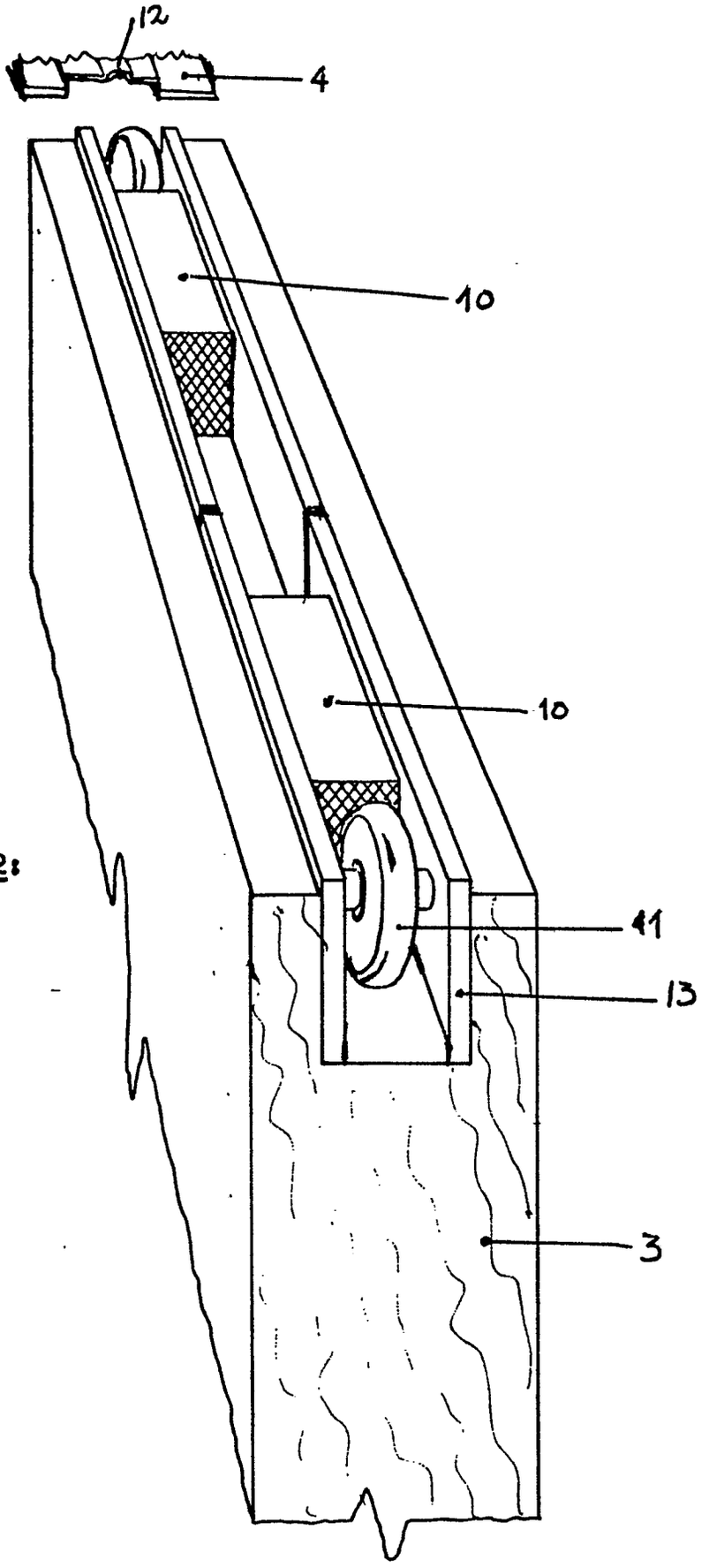
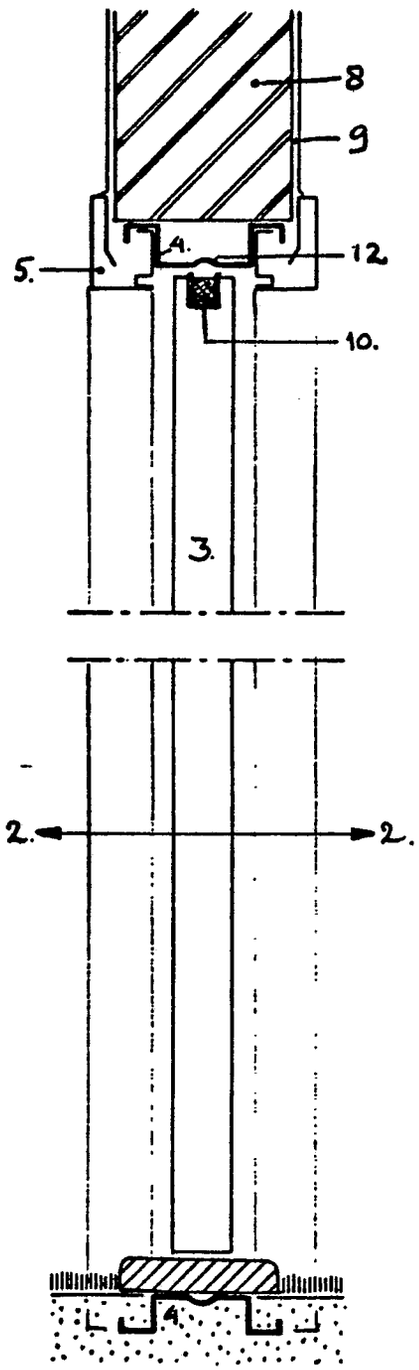
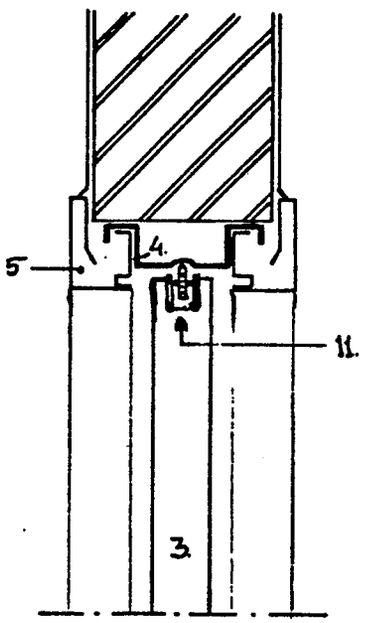


FIG. 2:

FIGUUR 3:



FIGUUR 4:



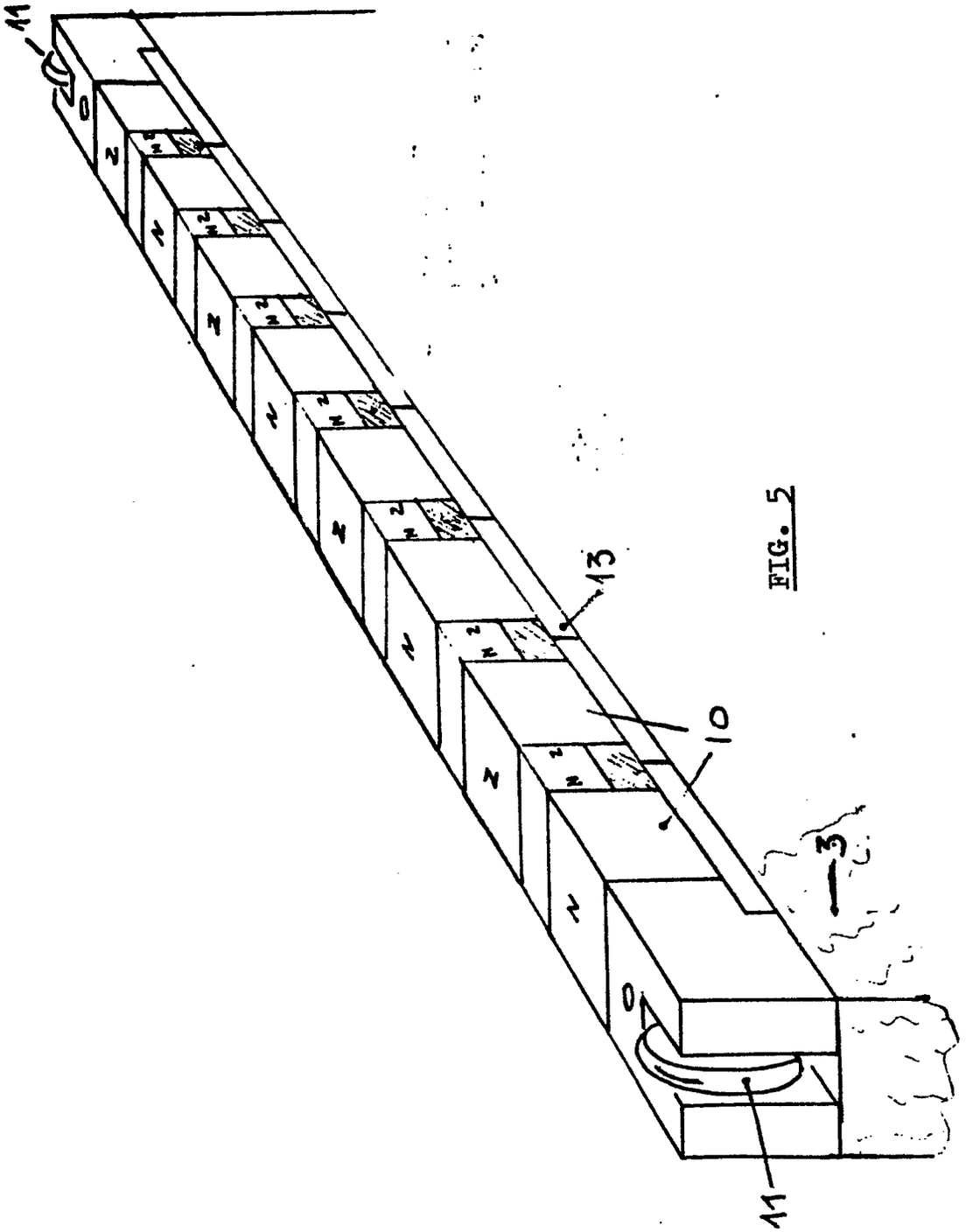


FIG. 5

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EUROPEAN SEARCH REPORT

Application number

EP 87 20 0412

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-3 400 490 (ANDERSON) * Page 1, abstract *	1	E 05 D 15/06
A	US-A-3 334 442 (BOETTCHER) * Column 2, lines 63-72; column 3, lines 1,2; figures 3,4 *	1	
A	GB-A-1 089 605 (WEATHERSEAL) * Figure 7 *	1	
D,A	FR-A-1 580 187 (TUBEST) * Page 1, column 2, paragraph 5; page 2, column 1, paragraphs 1-4; figures 2,4 *	1	
A	GB-A-1 113 008 (SOCIETE D'ELECTRONIQUE ET D'AUTOMATISME) * Page 1, lines 44-86; page 2, lines 1-86 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4) E 05 D
P,X	EP-A-0 195 585 (SHINKO ELECTRIC CO. LTD) * Column 3, lines 45-68; column 4, lines 1-65; column 5, lines 1-19; figures 4,5 *	1	
P,X	EP-A-0 209 812 (SALVARANI) * Page 6, lines 11-26 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11-06-1987	NEYS B.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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