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(71) Applicant: **Ormazabal Y Cia S.L.U.**
48140 Igorre (Bizkaia) (ES)

(72) Inventors:
• **RANEDO TORRES, Luis**
48140 IGORRE (Bizkaia) (ES)
• **SANCHEZ RUIZ, Juan, Antonio**
48140 IGORRE (Bizkaia) (ES)

(74) Representative: **Herrero & Asociados, S.L.**
Cedaceros, 1
28014 Madrid (ES)

(54) **SWITCHGEAR**

(57) Switching device for distribution of electrical power, comprising pairs of fixed contacts (1, 1'), (2, 2'), (3, 3'); a movable contact (4) connecting at least two of the fixed contacts (1, 1'), (2, 2'), (3, 3') with each other; and some input branches (A), (B), (C), corresponding to at least one first fixed contact of each of the pairs (1), (2), (3), and at least some output branches (D), (E), (F), corresponding to at least one second fixed contact of each of the pairs (1'), (2'), (3'). The movement of the movable contact (4) opens or closes an electrical circuit that is selected from at least one input branch (A), (B), (C) and at least one output branch (D), (E), (F), electrically connecting the first fixed contacts (1, 2, 3) with the second fixed contacts (1', 2', 3').

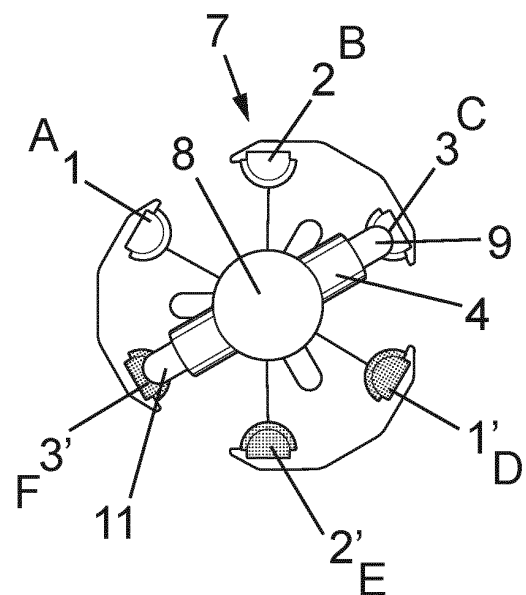


Fig. 1c

Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a switching device for application in power distribution network installations, such as, for example, transformation stations, photovoltaic plants, wind farms, electrical storage charge/discharge management centers, electric vehicle recharging stations, power line switching/transfer centers, etc. The switching device is a device that has several fixed contacts configurable as inputs and outputs, and which can be electrically connected to each other by means of a movable contact, thus providing different applications and configurations to the switching device.

BACKGROUND OF THE INVENTION

[0002] The electrical switchgear used in electrical power distribution networks comprises switching devices, such as, for example, switches, disconnectors, earthing switches, switches, selectors, etc. The actuation of such switching devices is carried out to obtain the desired electric power distribution, to prevent consumers from being without voltage or to guarantee the protection of people and electrical equipment such as, for example, transformers.

[0003] The switching devices, according to their application or function in the power distribution network, and depending on the installation, can even be combined with each other to thus be able to carry out different switching in the network and obtain the desired network configurations. The actuation of the switching devices can be carried out both manually and motorized. The switching devices comprise fixed contacts and movable contacts, so that the actuation of the movable contact supposes the separation or connection of said contact with respect to the fixed contact and therefore the opening or closing of the electrical circuit. There are known switching devices comprising a fixed contact and a movable contact in the case of hinge-type switching devices, or at least one pair of fixed contacts and a movable contact in the case of rotating switching devices, wherein the movable contact establishes the separation or connection between the pair of fixed contacts, thus opening or closing the electrical circuit.

[0004] Usually the electrical switchgear, and therefore also the switching devices, are installed inside modular enclosures or cells that, depending on variables such as the type of installation in question (subscriber or company transformation station, photovoltaic or wind power plants, etc.) or function performed by said electrical switchgear in an installation (protection cell, line cell, riser, etc.), there can be several enclosures or modular cells, each one performing its own function. In this way, by linking different modular cells it is possible to achieve different configurations of electrical diagrams, the extensibility on both sides of the cells and the reduction of the surface occu-

pied at installations, which depending on the type of installation can be reduced, such as for example in wind farms where the electrical switchgear is installed inside the wind turbine towers.

[0005] In a sector, as demanding as the energy sector, today compact architecture and the reduced dimensions of electrical equipment are of great importance. Therefore, the holder of this application perceives the need to achieve greater flexibility in the configuration of electrical diagrams, and also in the smallest possible space, for example, combining or integrating several functions in a single enclosure or cell, to have more space available for possible extensions or new functionalities or applications.

DESCRIPTION OF THE INVENTION

[0006] The switching device object of the present invention solves the problems or needs mentioned above. In this way, the switching device enables the grouping in a minimum space of most of the medium voltage functions that allow the operation of the electrical network, as well as the connection, power supply and protection of distribution transformers, thus obtaining greater flexibility when configuring different electrical diagrams.

[0007] The switching device, which can have at least two switching positions, comprises at least two pairs of fixed contacts and one movable contact that can connect at least two of the fixed contacts to each other, so that the movable contact can comprise at least two ends that can make contact with said fixed contacts. The fixed contacts correspond to different electrical branches, comprising some input branches and other output branches, so that the actuation of the movable contact connects / disconnects at least one pair of fixed contacts and therefore closes / opens an electrical circuit between at least an input electrical branch and at least one output electrical branch. Therefore, the movement of the movable contact opens or closes an electrical circuit that is selected between at least one input branch and at least one output branch, electrically connecting some first fixed contacts with some second fixed contacts to each other.

[0008] In this sense, depending on the number of electrical branches and their corresponding fixed contacts, the switching device can comprise different configurations and therefore different applications, which increases the flexibility in the configuration of electrical diagrams in transformation stations, photovoltaic plants, wind farms, electric storage charge / discharge management centers, electric vehicle recharging stations, power line switching / transfer centers, etc.

[0009] In this way the possibility has been contemplated that the switching device can comprise the following configurations and applications:

- The switching device comprises at least three inputs and three outputs, so that the movement of the movable contact opens or closes the established electri-

- cal circuit between at least three input branches and three output branches, in this case, the switching device can be used as selector of different electrical branches. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
- The switching device comprises at least two inputs and three outputs, so that the movement of the movable contact opens or closes the established electrical circuit between at least two input branches and three output branches, in this case, the switching device can be used as selector of different electrical branches. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
 - The switching device comprises at least three inputs and two outputs, so that the movement of the movable contact opens or closes the established electrical circuit between at least three input branches and two output branches, in this case, the switching device can be used as selector of different electrical branches. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
 - The switching device comprises at least two inputs and two outputs, so that the movement of the movable contact opens or closes the established electrical circuit between at least two input branches and two output branches, in this case, the switching device can be used as selector of different electrical branches. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
 - The switching device comprises at least three inputs and one output, so that the movement of the movable contact opens or closes the established electrical circuit between at least three input branches and a single output branch, in this case, the switching device can be used as a multiplexer. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
 - The switching device comprises at least two inputs and one output, so that the movement of the movable contact opens or closes the established electrical circuit between at least two input branches and a single output branch, in this case, the switching de-

vice can be used as a multiplexer. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.

- The switching device comprises one input and at least three outputs, so that the movement of the movable contact opens or closes the established electrical circuit between a single input branch and at least three output branches, in this case, the switching device can be used as demultiplexer. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
- The switching device comprises one input and at least two outputs, so that the movement of the movable contact opens or closes the established electrical circuit between a single input branch and at least two output branches, in this case, the switching device can be used as demultiplexer. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.
- The switching device can be used as a switch, so that the movement of the moving contact switches two electrical branches that are selected from at least three electrical branches. As another embodiment, the possibility has been contemplated that the movable contact may comprise at least one additional position where it is not connected to any of the fixed contacts, thus not establishing any electrical circuit.

[0010] The movable contact of the switching device of the invention is capable of performing a rotary movement actuated by a rotary axis, which in turn can be actuated manually or motorized. Finally, the possibility that switching device has short-circuit making ability is anticipated. In this way, when the switching device closes the electrical circuit, in those cases in which when closing the circuit a fault is generated, the switching device is able to withstand the increase in the current that passes through the contacts, being able to reach several kA in the closing switching.

DESCRIPTION OF THE DRAWINGS

[0011] To complement the description and in order to help a better understanding of the features of the invention, according to some preferred examples of its practical embodiment, a set of figures is attached as an integral part of said description in which, for illustrative and non-limiting purposes, the following has been represented:

Figures 1a, 1b, 1c.- Show an elevation view of the different switching positions of a first embodiment of the switching device of the invention, configured as a selector and with three inputs and three outputs.

Figure 2a, 2b, 2c.- Show an elevation view of the different switching positions of a second embodiment of the switching device of the invention, configured as a selector and with two inputs and three outputs.

Figure 3a, 3b, 3c.- Show an elevation view of the different switching positions of a third embodiment of the switching device of the invention, configured as a selector and with three inputs and two outputs.

Figure 4a, 4b, 4c.- Show an elevation view of the different switching positions of a fourth embodiment of the switching device of the invention, configured as a selector and with two inputs and two outputs.

Figure 5a, 5b, 5c.- Show an elevation view of the different switching positions of a fifth embodiment of the switching device of the invention, configured as a multiplexer and with three inputs and one output..

Figure 6a, 6b.- Show an elevation view of the different switching positions of a sixth embodiment of the switching device of the invention, configured as a multiplexer and with two inputs and one output.

Figure 7a, 7b, 7c.- Show an elevation view of the different switching positions of a seventh embodiment of the switching device of the invention, configured as a demultiplexer and with one input and three outputs.

Figure 8a, 8b.- Show an elevation view of the different switching positions of an eighth embodiment of the switching device of the invention, configured as a demultiplexer and with one input and two outputs.

Figure 9a, 9b, 9c.- Show an elevation view of the different switching positions of the switching device of the invention, configured as a switch comprising three electrical branches.

PREFERRED EMBODIMENT OF THE INVENTION

[0012] A detailed explanation of a preferred embodiment of the object of the present invention is provided below, with the aid of the aforementioned figures.

[0013] The switching device (10) represented in Figures 1a-9c, comprises some pairs of fixed contacts (1, 1'), (2, 2') and (3, 3') and a movable contact (4) connecting at least two of the fixed contacts (1, 1'), (2, 2'), (3, 3') with each other. The switching device (10) also comprises some input branches (A), (B), (C), corresponding to a first fixed contact of each of the pairs (1), (2), (3), and some output branches (D), (E), (F), corresponding to at least one second fixed contact of each of the pairs (1'), (2'), (3'). In this way, the movement of the movable contact (4) opens or closes an electrical circuit that is selected from at least one input branch (A), (B), (C) and at least one output branch (D), (E), (F), electrically connecting the first fixed contacts (1, 2, 3) with the second fixed con-

tacts (1', 2', 3') of each of the pairs.

[0014] The movable contact (4) of the switching device (10), as shown in the figures 1a-9c, has a rotary movement and is driven by a rotation axis (8), which in turn can be operated manually or motorized. The possibility has also been considered that switching device (10) has short-circuit making capacity. In this way, when the switching device (10) closes the electrical circuit, in those cases in which a fault is generated when closing the circuit, the switching device (10) is able to withstand the increase in current that passes through the contacts, both the fixed pairs (1, 1'), (2, 2'), (3, 3'), and the movable one (4), being able to reach several kA in the closing switching.

[0015] Figures 1a-9c show different representations of the switching device (10), which depending on the number of electrical branches and their corresponding fixed contacts, the switching device (10) can give rise to a plurality of configurations and applications, thus providing greater flexibility when it comes to making different electrical diagrams at the installations where it shall be arranged:

- In a first embodiment, shown in figures 1a-1c, the switching device (10) comprises three input branches (A), (B), (C) and three output branches (D), (E), (F), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B), (C) and the output branches (D), (E), (F). In this case, the switching device (10) may be used as a selector of different electrical branches, so that it has a first (5), a second (6) and a third (7) switching position.
- In a second embodiment, shown in figures 2a-2c, the switching device (10) comprises two input branches (A), (B) and three output branches (D), (E), (F), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the two input branches (A), (B) and the three output branches (D), (E), (F), in this case the switching device (10) may be used as a selector of different electrical branches, so that it has a first (5), a second (6) and a third (7) switching position.
- In a third embodiment, the switching device (10), shown in figures 3a-3c, comprises three input branches (A), (B), (C) and two output branches (D), (E), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the three input branches (A), (B), (C) and the two output branches (D), (E), in this case the switching device (10) may be used as a selector of different electrical branches so that it has a first (5), a second (6) and a third (7) switching position.
- In a fourth embodiment, shown in figures 4a-4c, the switching device (10) comprises two input branches (A), (B) and two output branches (D), (E), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the two

input branches (A), (B) and the two output branches (D), (E), in this case the switching device (10) may be used as selector of different electrical branches, so that it has a first (5), a second (6) and a third (7) switching position. In a fifth embodiment, as shown in the figures 5a-5c, the switching device (10) comprises three input branches (A), (B), (C) and one output branch (D), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the three input branches (A), (B), (C) and the output branch (D), in this case the switching device (10) may be used as a multiplexer, so that it has a first (5), a second (6) and a third (7) switching position.

- In a sixth embodiment of the switching device (10), as shown in the figures 6a and 6b, it comprises two input branches (A), (B) and one output branch (D), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the two input branches (A), (B) and the output branch (D), in this case the switching device (10) may be used as a multiplexer that has a first (5) and a second switching position (6).
- In a seventh embodiment of the switching device (10), as shown in the figures 7a-7c, it comprises one input branch (A) and three output branches (D), (E), (F), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the input branch (A) and the three output branches (D), (E), (F), in this case the switching device (10) may be used as a demultiplexer, that has a first (5), a second (6) and a third (7) switching position.
- In the eighth embodiment, as shown in the figures 8a and 8b, the switching device (10) comprises one input branch (A) and two output branches (D), (E), so that the movement of the movable contact (4) opens or closes the electrical circuit established between the single input branch (A) and the two output branches (D), (E), in this case the switching device (10) may be used as a demultiplexer, that has a first (5) and a second (6) switching position.
- The switching device (10) can also be used as a switch, as shown in the figures 9a-9c, which has a first (5), a second (6) and a third (7) switching position, so that the movement of the movable contact (4) switches two electrical branches that are selected from at least three electrical branches (A), (D), (E).

Claims

1. Switching device for electrical power distribution, comprising:
 - pairs of fixed contacts (1, 1'), (2, 2'), (3, 3');
 - a movable contact (4) connecting at least two of the fixed contacts (1, 1'), (2, 2'), (3, 3') with

each other; and

- input branches (A), (B), (C), corresponding to at least one first fixed contact of each of the pairs (1), (2), (3), and output branches (D), (E), (F), corresponding to at least one second fixed contact of each of the pairs (1'), (2'), (3') being the switching device (10) **characterized in that** the movement of the movable contact (4) opens or closes an electrical circuit that is selected from at least one input branch (A), (B), (C) and at least one output branch (D), (E), (F), electrically connecting together the first fixed contacts (1, 2, 3) with the second fixed contacts (1', 2', 3').

2. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B), (C) and the output branches (D), (E), (F), so that the switching device (10) comprises at least three inputs and three outputs.
3. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B) and the output branches (D), (E), (F), so that the switching device (10) comprises at least two inputs and three outputs.
4. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B), (C) and the output branches (D), (E), so that the switching device (10) comprises at least three inputs and two outputs.
5. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B) and the output branches (D), (E), so that the switching device (10) comprises at least two inputs and two outputs.
6. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B), (C) and the output branch (D), so that the switching device (10) comprises at least three inputs and one output.
7. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B) and the output branch (D), so that the switching device (10) comprises at least two inputs and one output.
8. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branches (A), (B), (C) and the output branch (D), so that the switching device (10) comprises at least three inputs and one output.

terized in that the movement of the movable contact (4) opens or closes the electrical circuit established between the input branch (A) and the output branches (D), (E), (F), so that the switching device (10) comprises one input and at least three outputs.

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9. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) opens or closes the electrical circuit established between the input branch (A) and the output branches (D), (E), so that the switching device (10) comprises one input and at least two outputs. 10
10. Switching device (10) according to claim 1, **characterized in that** the movement of the movable contact (4) switches two branches that are selected from at least three input branches (A), (B), (C) and output branches, (D), (E), (F). 15
11. Switching device (10) according to any of the preceding claims, **characterized in that** the movable contact (4) performs a rotary movement and is driven by a rotational axis (8). 20
12. Switching device (10) according to claim 11, **characterized in that** the movable contact (4) comprises two ends (9, 11) that connect together at least two of the fixed contacts (1, 1', 2, 2', 3, 3'). 25
13. Switching device (10) according to claim 12, **characterized in that** it has short circuit making capacity. 30
14. Switching device (10) according to claim 13, **characterized in that** it can be operated manually or motorized. 35
15. Switching device (10) according to any of the preceding claims, **characterized in that** the movable contact (4) comprises at least one additional position where it is not connected to any of the fixed contacts (1, 1', 2, 2', 3, 3'), thus not establishing any electrical circuit. 40

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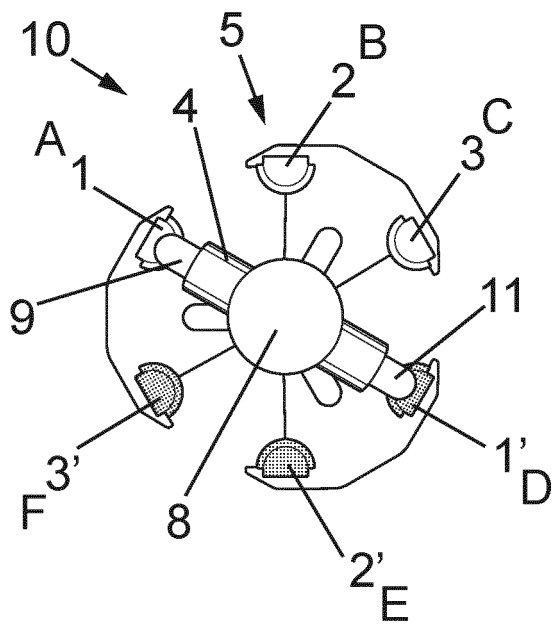


Fig. 1a

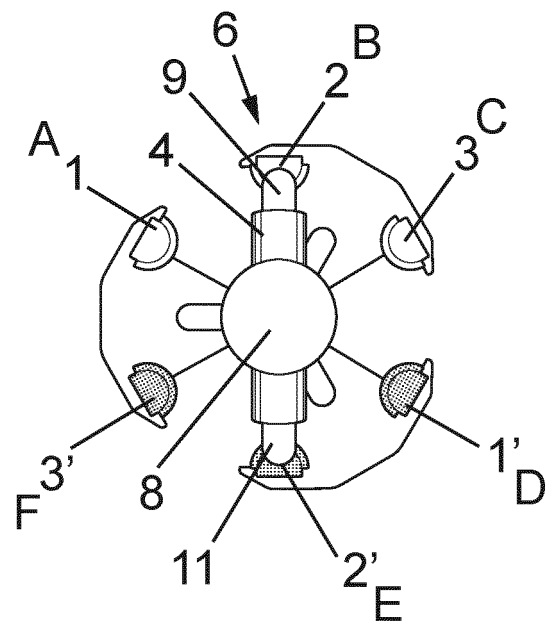


Fig. 1b

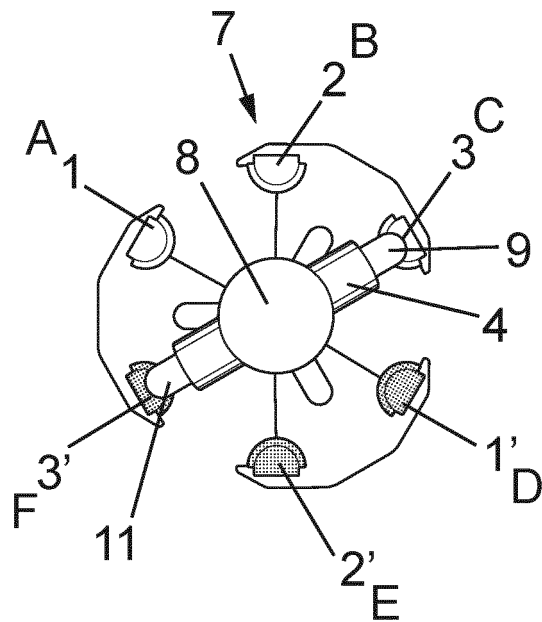


Fig. 1c

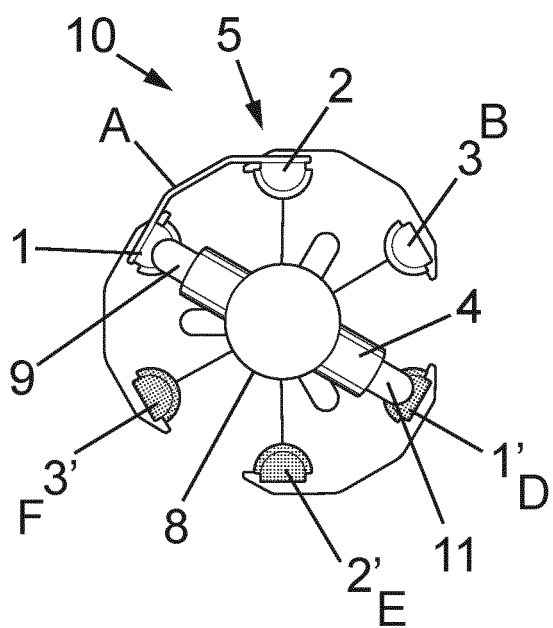


Fig. 2a

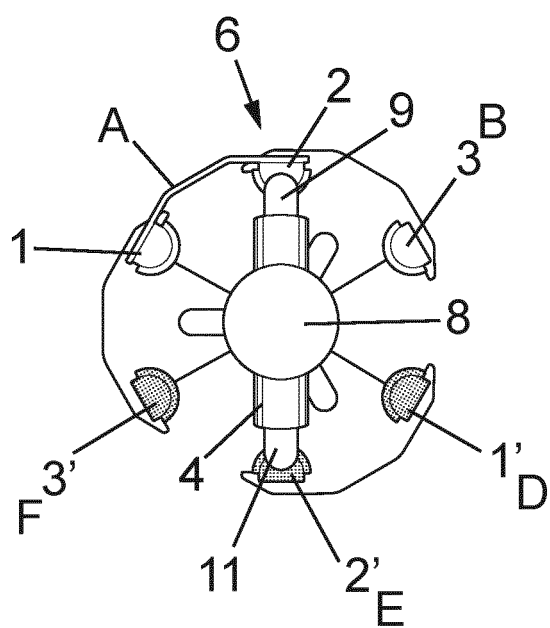


Fig. 2b

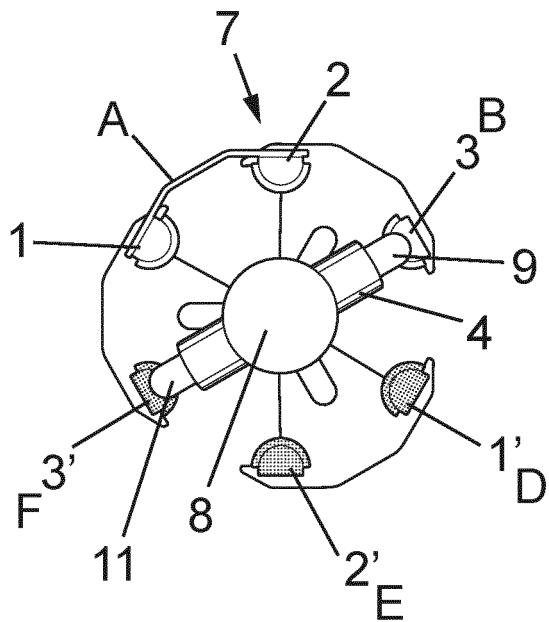


Fig. 2c

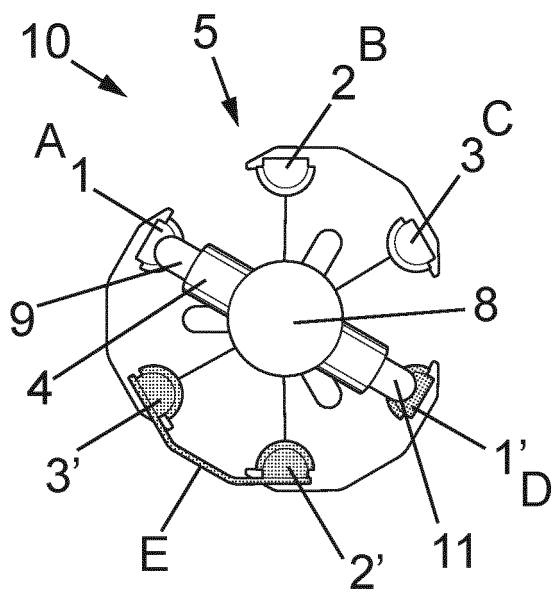


Fig. 3a

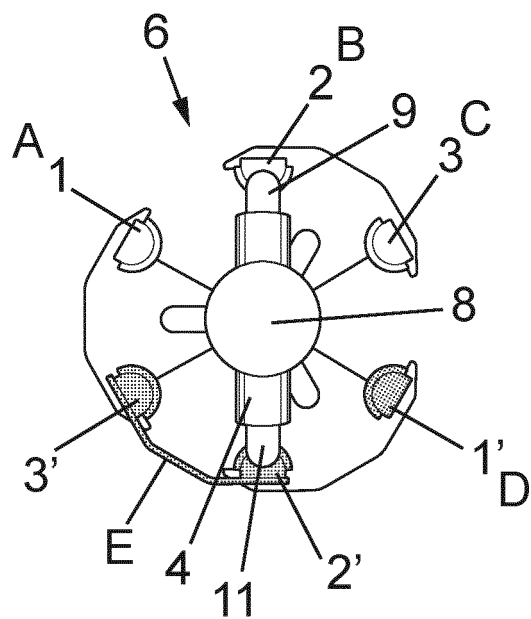


Fig. 3b

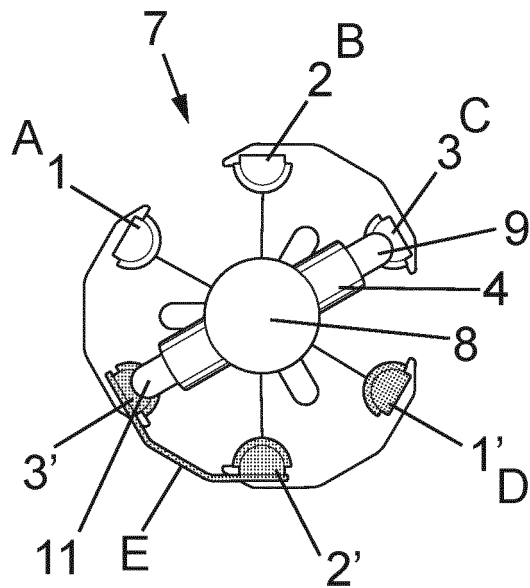


Fig. 3c

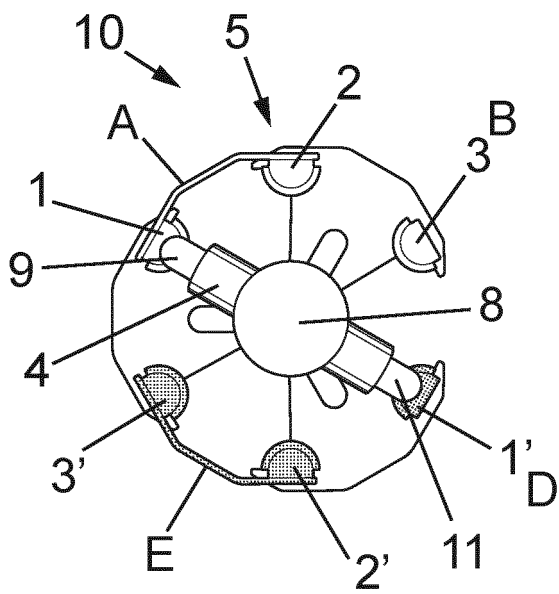


Fig. 4a

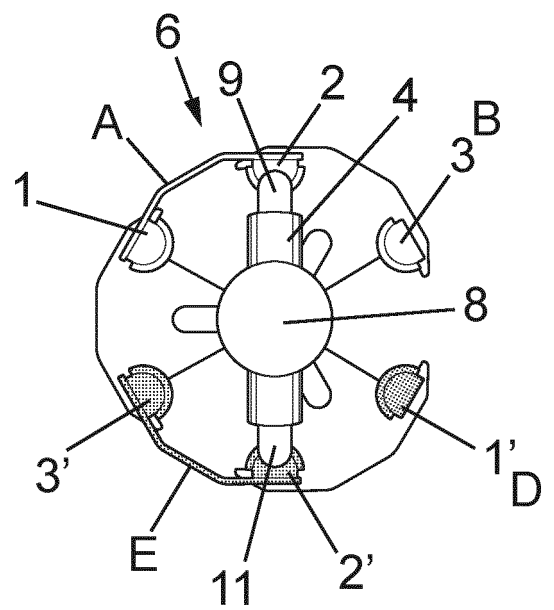


Fig. 4b

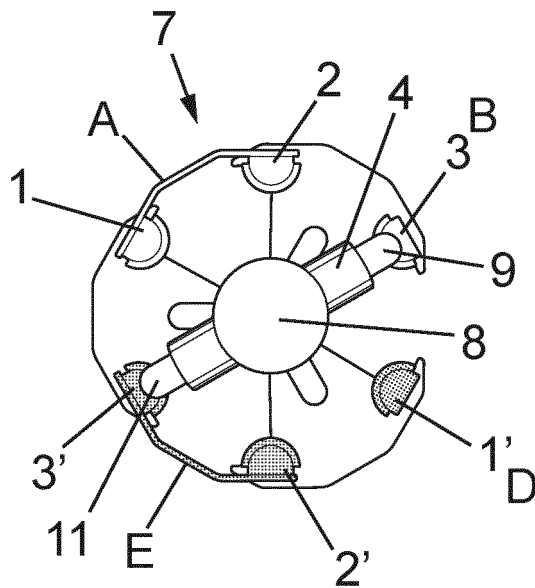


Fig. 4c

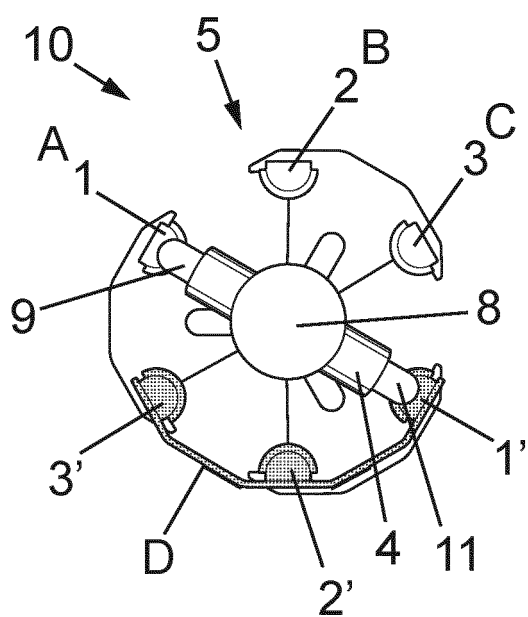


Fig. 5a

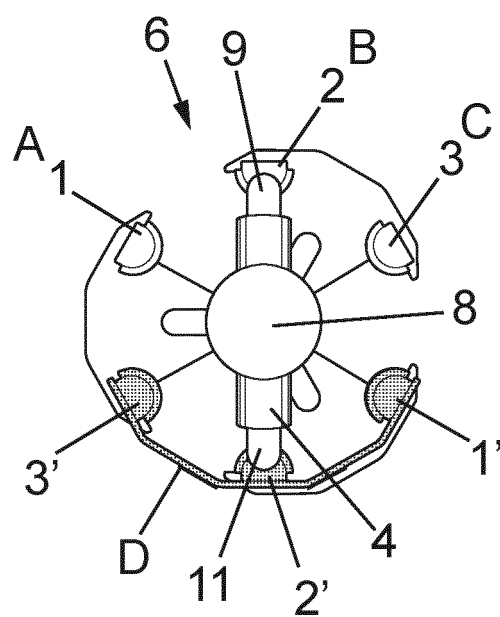


Fig. 5b

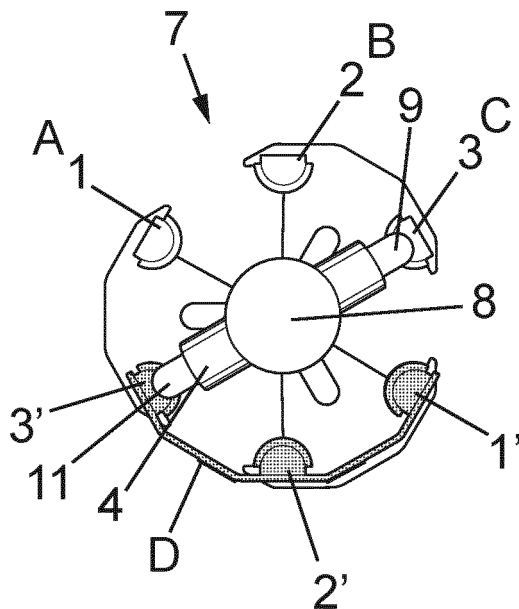


Fig. 5c

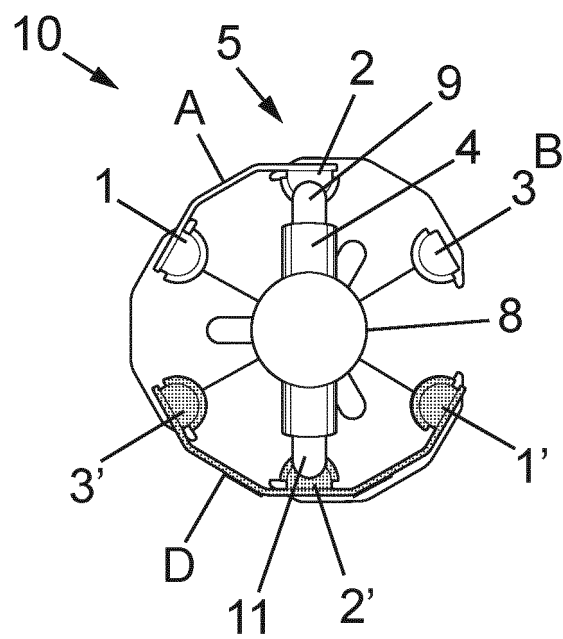


Fig. 6a

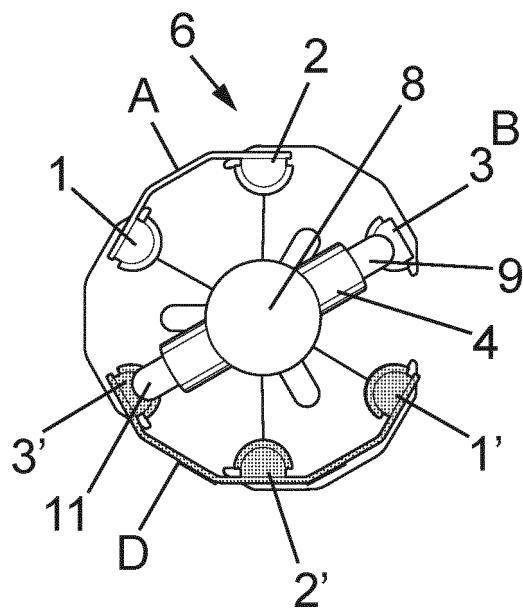


Fig. 6b

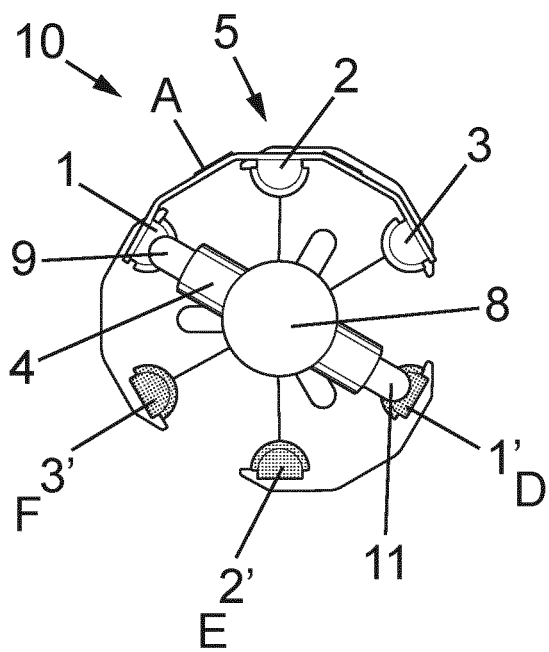


Fig. 7a

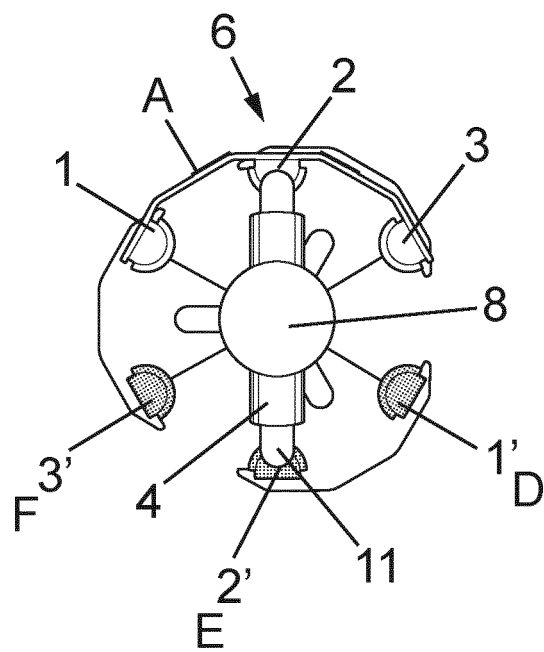


Fig. 7b

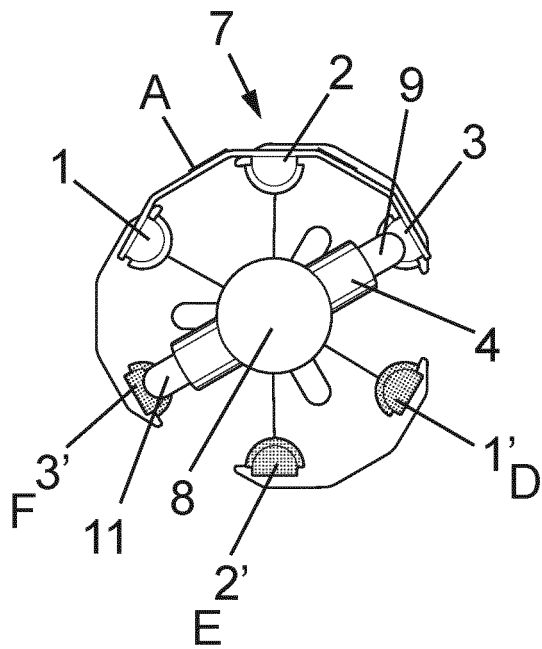


Fig. 7c

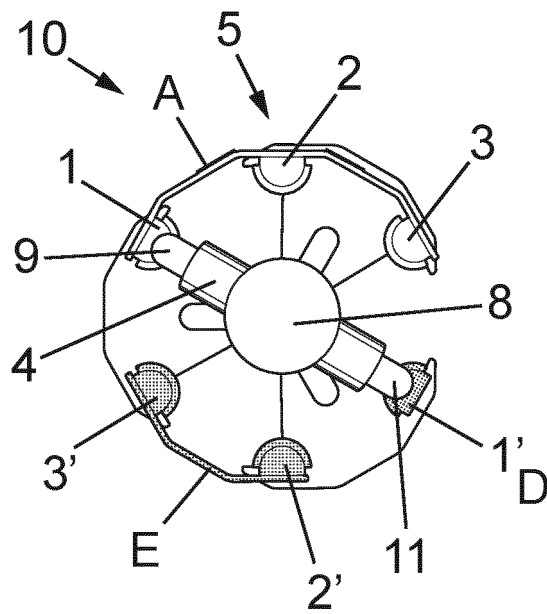


Fig. 8a

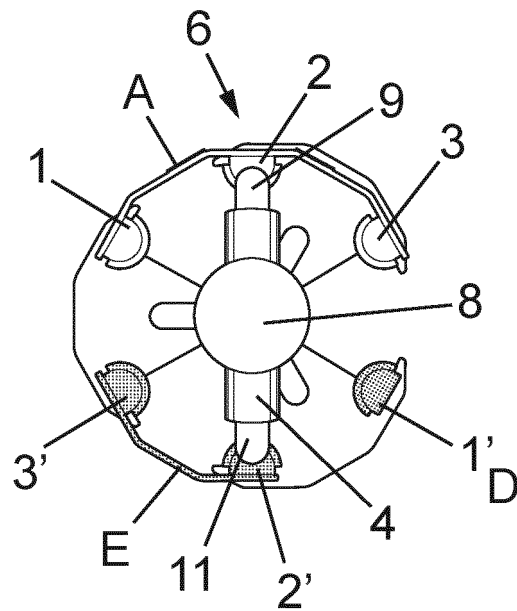


Fig. 8b

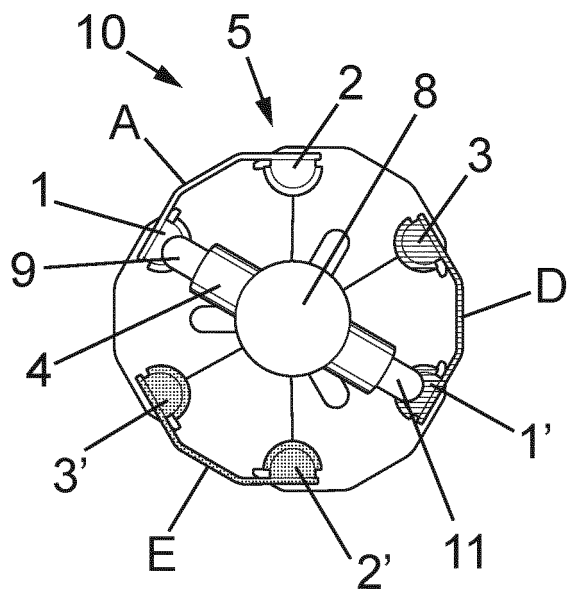


Fig. 9a

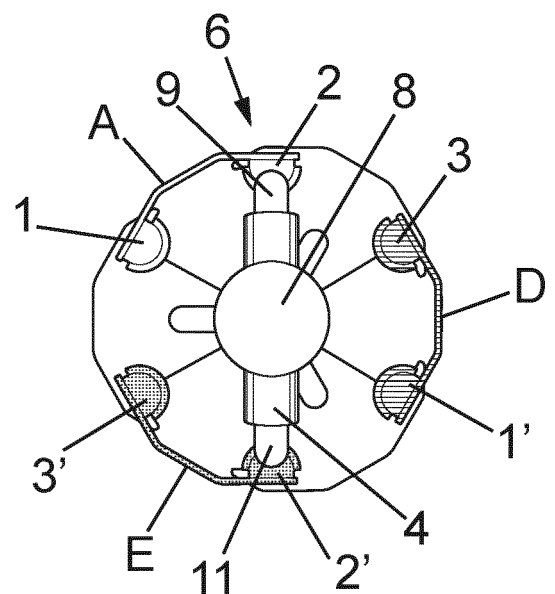


Fig. 9b

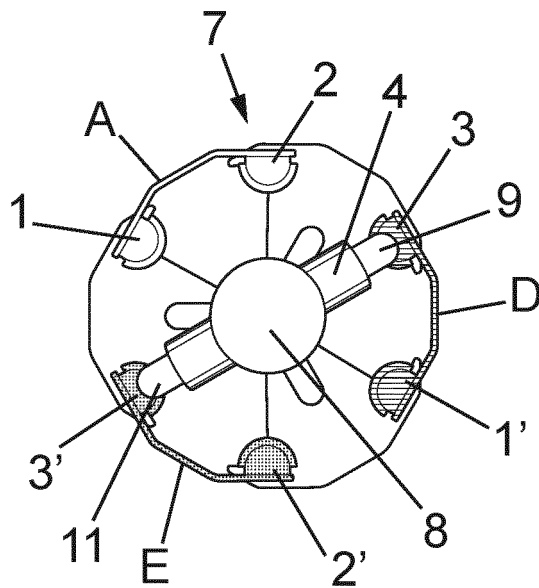


Fig. 9c

INFORME DE BÚSQUEDA INTERNACIONAL

Solicitud internacional N°

PCT/ES2020/070622

A. CLASIFICACIÓN DEL OBJETO DE LA SOLICITUD
 INV. H01H19/46 H01H1/20
 ADD.

De acuerdo con la Clasificación Internacional de Patentes (CIP) o según la clasificación nacional y CIP.

B. SECTORES COMPRENDIDOS POR LA BÚSQUEDA

Documentación mínima buscada (sistema de clasificación seguido de los símbolos de clasificación)

H01H

Otra documentación consultada, además de la documentación mínima, en la medida en que tales documentos formen parte de los sectores comprendidos por la búsqueda

Bases de datos electrónicas consultadas durante la búsqueda internacional (nombre de la base de datos y, si es posible, términos de búsqueda utilizados)

EPO-Internal, WPI Data

C. DOCUMENTOS CONSIDERADOS RELEVANTES

Categoría*	Documentos citados, con indicación, si procede, de las partes relevantes	Relevante para las reivindicaciones N°
X	EP 2 608 240 A1 (LSIS CO LTD [KR]) 26 Junio 2013 (2013-06-26) párrafo (0050) - párrafo (0112) ; figuras 1-15	1-15

☐ En la continuación del Recuadro C se relacionan otros documentos ☒ Los documentos de familias de patentes se indican en el Anexo

* Categorías especiales de documentos citados:	"T"	documento ulterior publicado con posterioridad a la fecha de presentación internacional o de prioridad que no pertenece al estado de la técnica pertinente pero que se cita por permitir la comprensión del principio o teoría que constituye la base de la invención.
"A" documento que define el estado general de la técnica no considerado como particularmente relevante.	"X"	documento particularmente relevante; la invención reivindicada no puede considerarse nueva o que implique una actividad inventiva por referencia al documento aisladamente considerado.
"E" solicitud de patente o patente anterior pero publicada en la fecha de presentación internacional o en fecha posterior.	"Y"	documento particularmente relevante; la invención reivindicada no puede considerarse que implique una actividad inventiva cuando el documento se asocia a otro u otros documentos de la misma naturaleza, cuya combinación resulta evidente para un experto en la materia.
"L" documento que puede plantear dudas sobre una reivindicación de prioridad o que se cita para determinar la fecha de publicación de otra cita o por una razón especial (como la indicada).	"&"	documento que forma parte de la misma familia de patentes.
"O" documento que se refiere a una divulgación oral, a una utilización, a una exposición o a cualquier otro medio.		
"P" documento publicado antes de la fecha de presentación internacional pero con posterioridad a la fecha de prioridad reivindicada.		

Fecha en que se ha concluido efectivamente la búsqueda internacional.
22 Febrero 2021

Fecha de expedición del informe de búsqueda internacional
03/03/2021

Nombre y dirección postal de la Administración encargada de la búsqueda internacional EP

Funcionario autorizado

N° de fax

N° de teléfono

Formulario PCT/ISA/210 (segunda hoja) (Enero 2015)

INFORME DE BÚSQUEDA INTERNACIONAL

Información relativa a miembros de familias de patentes

Solicitud internacional N°

PCT/ES2020/070622

EP 2608240	A1	26-06-2013	CN	103178465	A	26-06-2013
			EP	2608240	A1	26-06-2013
			ES	2534873	T3	29-04-2015
			KR	101250261	B1	04-04-2013
			MY	160797	A	15-03-2017
			US	2013153538	A1	20-06-2013
