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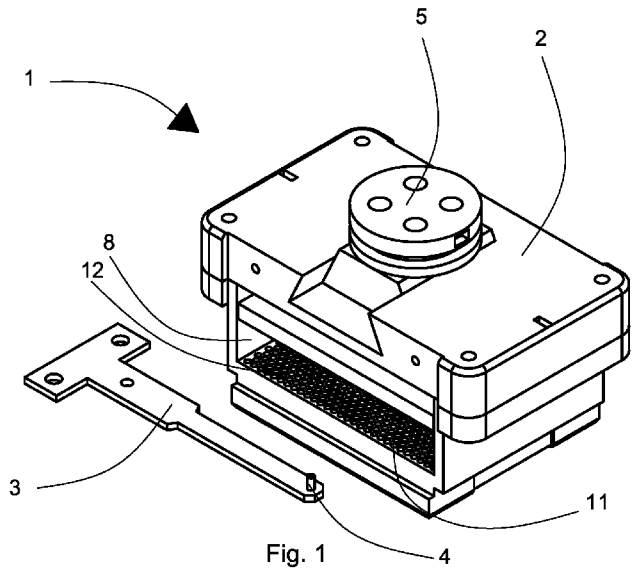

Fig. 1

(57) Abstract: An apparatus (1) for making an antenna (22) for a radio-frequency identifying device, said antenna being made with a flexible wire (6), or a braid of flexible wires in electrically conductive material, comprises: - a forming device (2; 2a; 2b) that can rotate around a rotation axis (A), said forming device (2) being provided with shaping elements (10) that can be moved in a direction parallel to said rotation axis (A); - a guiding device (3) provided with a guiding element (4) for guiding said wire (6), said guiding device (3) being movable in at least one direction (Fl) substantially perpendicular to said rotation axis (A); - at least one gripper device (13, 14) suitable for immobilising a free end (6a) of said wire (6). A method for making an antenna for a radio-frequency identifying device, said antenna being made with a flexible wire (6), or a braid of flexible wires, in electrically conductive material, comprises: - setting up a forming device (2; 2a; 2b) provided with shaping elements (10; 10a; 10b) that are suitable for shaping said wire (6), said forming device (2; 2a; 2b) being suitable for rotating around a rotation axis (A), said shaping elements (10; 10a; 10b) being movable in a direction parallel to said rotation axis (A); - setting up a guiding device (3) for guiding said wire (6), said guiding device (3) comprising a body (3 a) and a guiding element (4) for guiding said wire (6) protruding from said body (3a), said guiding device (3) being suitable for moving along a direction (F1); - guiding said wire (6) by said guiding device (3), to interact with said shaping elements (10; 10a; 10b) so as to shape said wire (6) to obtain an antenna of preset shape, said guiding comprising moving said guiding device along said direction (F1) so as to make said wire (6) interfere progressively with said shaping elements (10; 10a; 10b), without said guiding device interfering with said shaping elements (10; 10a; 10b); - laying down and fixing said antenna on a substrate (S) bringing the substrate (S) into contact with the forming device (2; 2a; 2b).

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Apparatus and method for making antennas for radio-frequency identifying devices

The present invention relates to an apparatus and a method for making antennas for radio-frequency identifying devices, commonly known as RFID transponders, provided with antennas consisting of an electrically conductive wire, or of a braid of flexible wires, for example copper.

The term "flexible" is defined as a wire, or a braid of wires, that cannot maintain a stable configuration without being kept tensioned or without being fixed to a surface.

RFID transponders consist of two essential parts, the aforesaid antenna, made of electrically conductive material and an integrated circuit, or microchip, connected to the two ends of the antenna.

Making the antenna with a thin flexible wire made of electrically conductive material is known, for example a copper wire that is no more than 150μm in diameter, connecting the ends to a module, also called a strap or interposer, which comprises the integrated circuit, or microchip.

Welding is necessary for HF band transponders whereas for UHF transponders the use of an antenna loop is known that comprises the (short range or near field) integrated circuit that is readable at a close distance, to which a second antenna is added in the vicinity without connection that is coupled inductively to form a transponder operating long range or far field.

In the prior art, methods and apparatuses are known for making antennas made of copper wire that form the antenna of the RFID transponders on a substrate laying down and fixing the wire on the substrate used then in the subsequent processes. Nevertheless, these methods and apparatuses take a long time for each production cycle as it is necessary to "make a pattern" of the antenna.

In fact, in order to lay down the wire on the substrate, known apparatuses comprise a plurality of heads, for example six or more heads, each of which, supplied by a coil of copper wire, lays down the wire on the substrate. These heads move, plotting with the wire the pattern of the antenna and connecting the wire to the substrate by a vibrating ultrasonic frequency hammer that follows the movement of the head. The substrate has to be of a material that with the heat generated by the vibrating hammer softens, retaining the wire, like PVC, or has to be coated beforehand with a product that performs the same function.

The heads that are thus constructed are relatively complex and heavy mechanisms. One

apparatus of the type mentioned above is disclosed in international patent application WO 2011/098892.

Forming, using a winding machine, an high frequency band antenna (HF or High Frequency 13.56MHz), is also known, the shape of which is always made up of a spiral, see for example WO 91/16718.

From WO 2013/093826 an apparatus is known for making an antenna for a radio frequency identifying device, said antenna being made with a flexible wire, or a braid of flexible wires, made of electrically conductive material. The apparatus comprises a forming device provided with shaping elements suitable for shaping the wire to obtain an antenna of preset shape, a guiding device provided with a guiding element for guiding the wire and at least one gripper device suitable for immobilising a free end of the wire.

In RFID transponders operating in the UHF (Ultra High Frequency) band, with frequency variable from 860 to 960MHz, depending on the regulations of the various states, the antenna is never in the shape of a spiral but consists of a monopole, a dipole, of a circle formed by a single turn or by a combination of the aforesaid shapes.

For reasons of space or efficiency, the normally rectilinear portions of the monopoles or dipoles can be curved to form bends or meanders.

In all cases, a UHF band antenna can never be manufactured using a winding machine.

The present invention intends to provide an apparatus for making antennas with flexible electrically conductive, for example copper, wire, or a braid of flexible wires, both for HF band RFID transponders and for UHF band RFID transponders provided with an antenna made of electrically conductive wire.

In particular, the present invention proposes providing an apparatus and a method that enables an antenna made of electrically conductive wire to be made completely before the antenna is laid on a substrate on which an RFID device is completed.

The object of the invention is achieved with an apparatus according to claim 1 and with a method according to claim 14.

Owing to the invention, it is possible to make an antenna completely that is made of electrically conductive wire, for example of copper wire, both for HF RFID transponders and for UHF RFID transponders, without necessarily laying down the wire on a substrate during the making of the antenna, the antenna being able to be fixed to a substrate at the end of the making thereof.

The apparatus according to the invention comprises antenna forming means that is simple

to make and of reduced mass.

This enables very high productivity to be obtained, significantly greater than the productivity of known prior-art apparatuses owing to a cycle time for forming the antenna that is extremely reduced.

One non-limiting embodiment of the invention is disclosed below, with reference to the attached drawings, in which:

Figure 1 is a schematic perspective view of a forming device for forming an antenna of the apparatus according to the invention;

Figure 2 is a top view of the device in Figure 1;

Figure 3 is a raised view of the device in Figure 1;

Figure 4 illustrates a guiding device for guiding the electrically conductive wire that forms the antenna, being part of the apparatus according to the invention;

Figure 5 is a raised schematic view of the forming device for forming the antenna and of the guiding device for guiding the wire during forming of the antenna;

Figure 6 is a view like that of Figure 5, at the end of forming of the antenna, which illustrates the laying down of the antenna on a substrate;

Figures 7 to 12 illustrate very schematically the forming of an antenna for an UHF RFID transponder;

Figure 13 illustrates a gripper element for gripping the forming device for forming the antenna, in closed position;

Figure 14 illustrates the gripper element of Figure 13, in open position;

Figure 15 is a perspective partial view, from the bottom of a forming device for forming the antenna, which is suitable for making spiral antennas for HF RFID transponders;

Figure 16 illustrates an immobilising device for immobilising the electrically conductive wire that forms the antenna, being part of the version of the forming device for forming the antenna illustrated in Figure 15, said immobilising device being in closed position;

Figure 17 illustrates the immobilising device for immobilising the wire, in open position;

Figure 18 is a very schematic bottom view of a further version of the forming device for forming the antenna, which is also suitable for making spiral antennas for HF RFID transponders.

In Figures 1 to 14 a forming apparatus 1 according to the invention is disclosed, by means of which it is possible to make antennas for UHF RFID devices. With reference to Figures 1 and 2, the apparatus 1 according to the invention comprises a forming device 2 for

forming an antenna and a guiding device 3 for guiding an electrically conductive wire with which the antenna is formed.

The guiding device 3 is movable in the direction of the double arrow F1 and comprises a body 3a and a guiding element 4 (Figure 4) that protrudes from the body 3a, for example a hollow cylindrical element, arranged perpendicularly to the body 3a, inside which the wire 6 is passed, such that it is guided during forming of the antenna.

The wire 6 is kept tensioned, during forming of the antenna, by a tensioning device 15, being part of the apparatus 1 according to the invention.

The forming device 2 is provided with a connecting flange 5 that can be connected to a driving means, not shown, for example a motor, by means of which the forming device 2 can be rotated around a rotation axis A, in the direction of the double arrow F2. The rotation axis A is substantially perpendicular to the direction of said double arrow F1.

The forming device 2 comprises a cavity 8 inside which, in a direction parallel to said rotation axis A, a supporting plate 9 is movable to which a plurality of shaping elements 10 is fixed, for example in the form of rungs by means of which the antenna is given a desired shape. The number, shape and dimensions of the shaping elements 10 is variable, depending on the shape of the antenna that it is desired to obtain. In Figures 1 to 14, purely by way of non-limiting example, three shaping elements 10 are shown.

The forming device 2 further comprises a guiding plate 11, provided with a plurality of guiding holes 12, distributed, for example, over the entire surface of the guiding plate 11. The guiding holes 12 are used to guide the shaping elements 10 whereas the supporting plate 9 moves in said direction parallel to the rotation axis A. The supporting plate 9 is movable between a first visible lower position, for example, in Figure 5, in which the shaping elements 10 protrude below from the guiding plate 11 and a second visible upper position, for example, in Figure 6, in which the shaping elements 10 do not protrude below from the guiding plate 11. The supporting plate 9 remains in the lower position if an upper thrust is not exerted on the shaping elements 10. The persistence of the supporting plate 9 in the lower position thereof is due to elastic thrust elements that are not shown that push the plate to the lower position thereof or is due to the weight of the plate.

The forming device 2 is provided with a first gripper device 13 and with a second gripper device 14 that are used to immobilise a free end of the wire 6 during forming of the antenna.

Each gripper device 13, 14, comprises a fixed jaw 16, fixed to the forming device 2 and a

movable jaw 17, which can rotate around a rotation axis B with respect to the fixed jaw 16, between an open position, illustrated in Figure 14, and a closed position, illustrated in Figure 13, in which the wire 6 can be immobilised between the fixed jaw 16 and the movable jaw 17. The movable jaw 17 is provided with a cutting element 21, which is intended for cutting the wire 6, when the movable jaw 17 is taken to the closed position.

Forming an antenna with the apparatus 1 according to the invention, and the subsequent laying down and fixing thereof on a substrate S, is disclosed below, in particular with reference to Figures 5 to 12.

The forming device 2 is placed near the substrate S, such that the substrate S is at a distance D from the ends of the shaping elements 10 such as to enable the body 3a of the guiding device 3 to be inserted into the space between the substrate S and the ends of the shaping elements 10.

Subsequently, the wire 6, which is unwound from a coil that is not shown, is passed into the tensioning device 15 and into the guiding element 6 of the guiding device 3, such that a free end 6a (Figure 2) of the wire 6 protrudes from the guiding element 6.

The free end 6a of the wire 6 is then immobilised in one of the gripper devices 13, 14, for example in the first gripper device 13.

After the free end 6a has been immobilised, rotation of the forming device 2 around the rotation axis A (Fig. 8) is started and simultaneously the guiding device 3 is advanced in the direction of the arrow F1 to the forming device 2, until the wire 6 rests on a first shaping element 10 (Figure 9) that protrudes from the guiding plate 11. The body 3a of the guiding device 3 is inserted into the space H, with the guiding element 4 that protrudes beyond the ends of the shaping elements 10, to the forming device 2. This enables the wire 6 to rest on the shaping elements 10, without the body 3a of the guiding element 3 interfering with the shaping elements. Subsequently, the rotation device continues rotating, whilst the guiding device 3 is made to go back in the direction of the arrow F1, but in the opposite direction to the preceding one, such that the wire 6 winds around the first shaping element 10 and comes into contact with a second shaping element 10 (Figure 10). At this point, whilst rotation of the forming device 2 continues, the guiding device 3 is again advanced in such a manner that the wire 6 winds around the second shaping element 10 (Figure 11). Lastly, the guiding device 3 is again made to go back, in such a manner as to emerge completely from the space H whilst the forming device 2 continues rotating until it reaches a portion rotated by 180° with respect to the initial position, in which the wire 6 is

wound around the third forming element 10, completing forming of the antenna 22, and is inserted between the fixed jaw 16 and the movable jaw 17 of the second gripper device 14. In this position

At this point, the movable jaw 17 of the second gripper is rotated in the closed position, such that the cutting element 21, cuts the wire 6, separating the antenna 22 formed by the rest of the wire and retaining the free end 6a of the wire protruding from the guiding element 4.

Whilst the second gripper device 14 closes, the substrate S is pushed against the guiding plate 11, pushing upwards the shaping elements 10 and pushing upwards the supporting plate 9, overcoming the elastic force of the elastic thrust elements, or the weight of the supporting plate 9. Whilst the substrate S comes into contact with the guiding plate 11, the antenna 22 comes into contact with the substrate S, on which an adhesive substance is spread, which makes the antenna 22 adhere to the substrate S, whilst the first gripper device 13 opens to free the antenna.

Lastly, the substrate S is removed from the forming device 2, which can start forming of a subsequent antenna 22, repeating the movements disclosed previously.

The substrate S can be pushed against the guiding plate 11 moving the substrate S upwards, or moving the forming device 2 downwards.

It should be noted that positioning of the wire to start forming of the subsequent antenna occurs automatically, at the end of forming of the preceding antenna, when the second gripper device 14 has closed, cutting the wire 6 and retaining the free end 6a of the wire.

The two gripper devices 13 and 14 alternate in retaining the free end 6a of the wire during forming of the antennas, in other words, the gripper device that retains the free end 6a of the wire changes with each forming of a new antenna 22. Only at the start of the forming cycle of the antennas, i.e. when the first antenna has to be formed, the free end 6a of the wire 6 in one of the gripper elements is immobilised manually.

In Figures 15, 16 and 17 a forming device 2a is illustrated that constitutes a version of the forming device 2 illustrated in Figures 1 to 14.

The forming device 2a is used to make spiral-shaped antennas for HF RFID transponders.

The forming device 2a comprises a guiding plate 11a, that is used to guide the shaping elements 10 when the plate 9 to which said shaping elements 10 are fixed, moves parallel to the rotation axis A.

The shaping elements 10 are, in this case, four in number and are arranged at the vertices

of a rectangle such as to define, during forming of the antenna, the four sides of the spiral shape of the antenna.

In the guiding plate 11a four slits 19 are made, through each of which a respective locking element 18 protrudes that can rotate around a respective rotation axis C, between an operating position, illustrated in Figure 16 and a non-operating position illustrated in Figure 17. Each locking element 18 comprises a tooth 20 the function of which is to maintain the wire 6 immobilised against the surface of the guiding plate 11a during forming of the antenna, when the locking element 18 is in the operating position. In this position, between the tooth 20 and the surface of the guiding plate 11a a space 21 remains that has dimensions such as to enable the wire 6 to be inserted into the space 21 with minimum clearance along the direction indicated by the arrow F3, such that the wire 6 can be retained in the space 21 by the tooth 20, until the locking element 18 is rotated in the non-operating position. This occurs when the substrate S on which the formed antenna has to be placed is brought into contract with the guiding plate 11a and the wire 6, shaped as a spiral antenna, comes into contact with the surface of the substrate S to which it adheres.

The antenna is formed in the same manner as disclosed with reference to Figures 1 to 14, by rotating the forming device 2a around the rotation axis A and moving the guiding device 3 along the direction identified by the double arrow F1, such that the wire 6 winds in a spiral formation around the shaping elements 10, as already disclosed in detail with reference to Figures 1 to 14.

It should be noted that the locking elements 18 act as further shaping elements, by means of which the turns of the antenna can be arranged in a compact formation, as can be seen in Figures 16 and 17.

In Figure 18 a forming device 2b is illustrated that constitutes a further version of the forming device according to the invention.

The forming device 2b comprises a guiding plate 11b, that is used to guide the shaping elements 10, 10a, 10b when the plate 9 to which said shaping elements 10, 10a, 10b are fixed moves parallel to the rotation axis A.

The shaping elements 10, 10a, 10b are, in this case, arranged in groups, at the vertices of a rectangle. In each vertex of the rectangle, each of said groups comprises a plurality of shaping elements 10, 10a, 10b arranged substantially aligned in the direction of a diagonal of the rectangle that terminates in said vertex. The number of shaping elements 10, 10a, 10b in each group can be any number, each group preferably comprises three shaping

elements 10, 10a, 10b.

During forming of the antenna the groups of shaping elements 10, 10a, 10b define the four sides of the spiral shape of the antenna.

The antenna is formed in an identical manner to what is disclosed with reference to Figures 1 to 17, by rotation of the forming device 2b around the rotation axis A and by movement of the guiding device 3 along the direction identified by the double arrow F1, such that the wire 6 winds in a spiral formation around the shaping elements 10, 10a, 10b.

Initially, the guiding device 3 is inserted into the space H and moved towards the inside of the aforesaid rectangle, such that the wire 6, during rotation of the forming device 2b, is wound on the innermost shaping elements 10 of each group of shaping elements 10, 10a, 10b, to make the first turn of the spiral configuration of the antenna.

After the first turn of the spiral configuration of the antenna, the guiding device 3 is moved outside said rectangle, such that the wire 6 can be wound on the shaping elements 10a immediately adjacent to the innermost shaping elements 10 of each group 10, 10a, 10b, to complete a second turn of the spiral formation of the antenna.

After the second turn of the antenna is completed, the guiding device 3 moves further to the exterior to make a further turn of the antenna, until the guiding device 3 reaches a position that enables the wire 6 to wind around the outermost shaping elements 10b of each group of shaping elements, such as to make the last turn of the antenna and complete forming of the antenna.

CLAIMS

1. Apparatus (1) for making an antenna (22) for a radio-frequency identifying device, said antenna being made with a flexible wire (6), or a braid of flexible wires in electrically conductive material, comprising:
- a forming device (2; 2a; 2b) provided with shaping elements (10) that are suitable for shaping said wire to obtain an antenna of preset shape;
- a guiding device (3) provided with a guiding element (4) for guiding said wire (6);
- at least one gripper device (13, 14) suitable for immobilising a free end (6a) of said wire (6),
characterised in that said forming device (2; 2a; 2b) can rotate around a rotation axis (A), that said shaping elements (10) can be moved in a direction parallel to said rotation axis (A) and that said guiding device (3) is movable in at least one direction (F1) substantially perpendicular to said rotation axis (A).

2. Apparatus (1), according to claim 1, wherein said guiding element (4) protrudes from a body (3a) of said guiding device (3).

3. Apparatus (1) according to claim 1, or 2, wherein said shaping elements (10) are fixed to a supporting plate (9) that can move in a direction that is substantially parallel to said rotation axis (A).

4. Apparatus (1) according to claim 3, wherein said forming device (2; 2a; 2b) is provided with a guiding plate (11; 11a; 11b), provided with a plurality of guiding holes (12) suitable for guiding said shaping elements (10), whilst said supporting plate moves along said direction that is substantially parallel to said rotation axis (A).

5. Apparatus (1) according to any preceding claim, wherein said at least one gripper device (13, 14) is fixed to said forming device (2; 2a; 2b).

6. Apparatus (1) according to claim (4), wherein a first gripper device (13) and a second gripper device (14), located on opposite sides of said forming device (2; 2a)

are fixed to said forming device (2; 2a; 2b).

7. Apparatus (1) according to any preceding claim, wherein said forming device (2; 2a; 2b) is provided with a connecting flange (5) by means of which the forming device (2; 2a; 2b) can be connected to a driving means.

8. Apparatus (1) according to any one of claims 1 to 7, wherein said shaping elements (10) are arranged at the vertices of a rectangle.

9. Apparatus (1) according to claim 8, wherein in said guiding plate (11a) four slits (19) are made through each of which a respective locking element (18) protrudes that can rotate around a respective rotation axis (C), between an operating position and a non-operating position.

10. Apparatus (1) according to claim 9, wherein each of said locking elements (18) comprises a tooth (20) arranged in such a manner that when a locking element (18) is in the operating position, between said tooth (20) and said guiding plate (11a) a space (21) is defined having dimensions such as to enable said wire (6) to be inserted thereinto with minimum clearance and to be retained therein by said tooth (20).

11. Apparatus (1), according to claim 8, wherein said forming elements (10) are arranged in groups, at the vertices of said rectangle, each of said groups comprising a plurality of said shaping elements (10, 10a, 10b) arranged substantially aligned in the direction of a diagonal of said rectangle that ends in said vertex.

12. Apparatus according to any one of claims 4 to 11, wherein said at least one gripper element (13, 14) is provided with a cutting element (21).

13. Method for making an antenna for a radio-frequency identifying device, said antenna being made with a flexible wire (6), or a braid of flexible wires, in electrically conductive material, characterised in that it comprises:
- setting up a forming device (2; 2a; 2b) provided with shaping elements (10; 10a;

10b) that are suitable for shaping said wire (6), said forming device (2; 2a; 2b) being suitable for rotating around a rotation axis (A), said shaping elements (10; 10a; 10b) being movable in a direction parallel to said rotation axis (A);

- setting up a guiding device (3) for guiding said wire (6), said guiding device (3) comprising a body (3a) and a guiding element (4) for guiding said wire (6) protruding from said body (3a), said guiding device (3) being suitable for moving along a direction (F1) substantially perpendicular to said rotation axis (A);
- guiding said wire (6) by said guiding device (3), to interact with said shaping elements (10; 10a; 10b) so as to shape said wire (6) to obtain an antenna of preset shape, said guiding comprising moving said guiding device along said direction (F1) so as to make said wire (6) interfere progressively with said shaping elements (10; 10a; 10b), without said guiding device interfering with said shaping elements (10; 10a; 10b);
- laying down and fixing said antenna on a substrate (S) bringing the substrate (S) into contact with the forming device (2; 2a; 2b).

14. Method according to claim 13, further comprising setting up on said forming device (2; 2a; 2b) at least one gripper device (13; 14) to keep said wire (6) tensioned during forming of said antenna.

15. Method according to claim 14, further comprising setting up on said forming device two gripper devices (13, 14) that alternate in keeping said wire (6) tensioned during forming of said antenna.

16. Method according to any one of claims 13 to 15, further comprising setting up further shaping elements (18) each of which is suitable for rotating around a respective rotation axis (C).

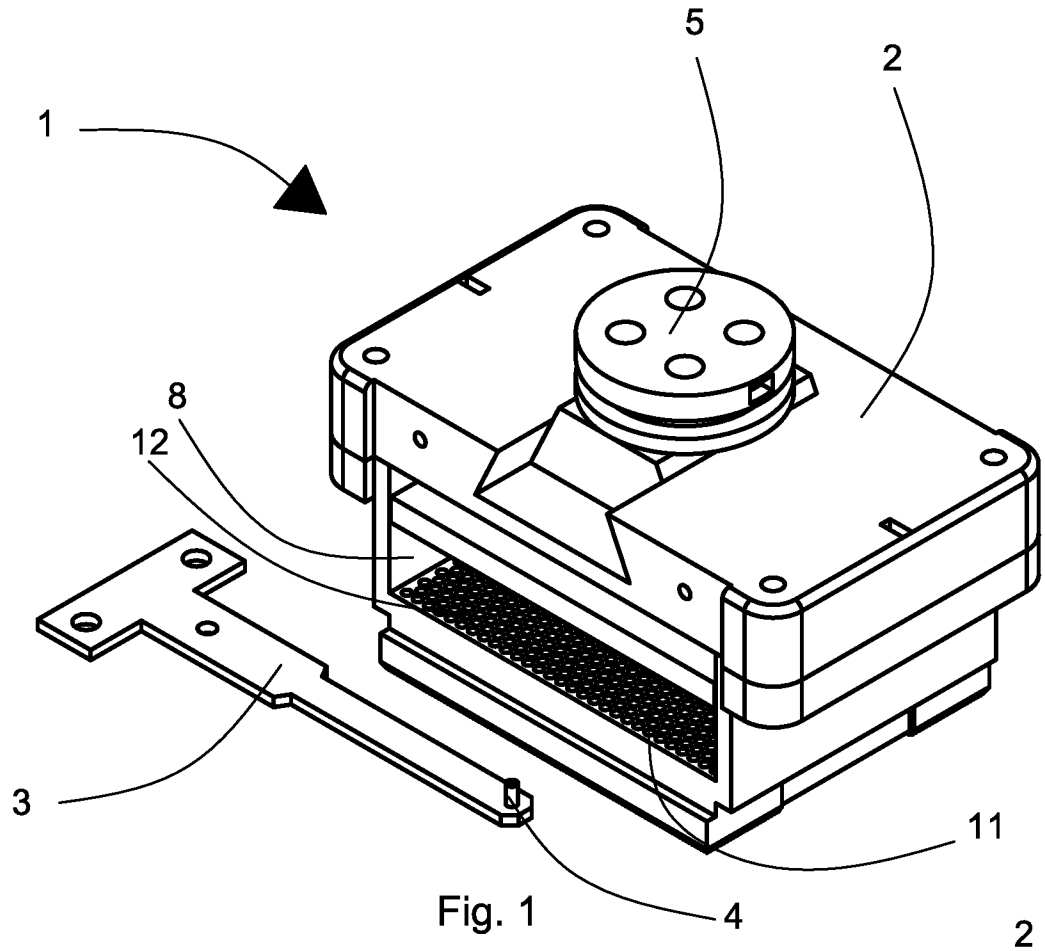


Fig. 1

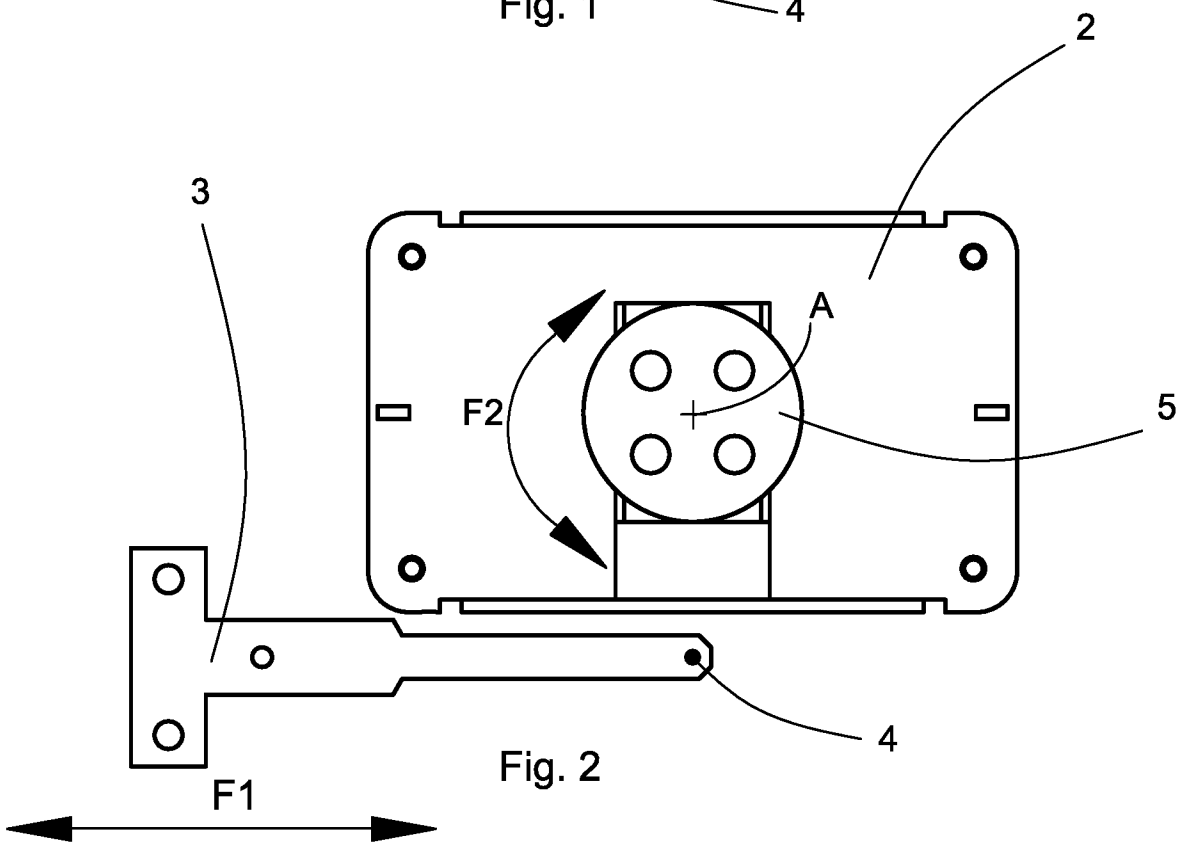


Fig. 2

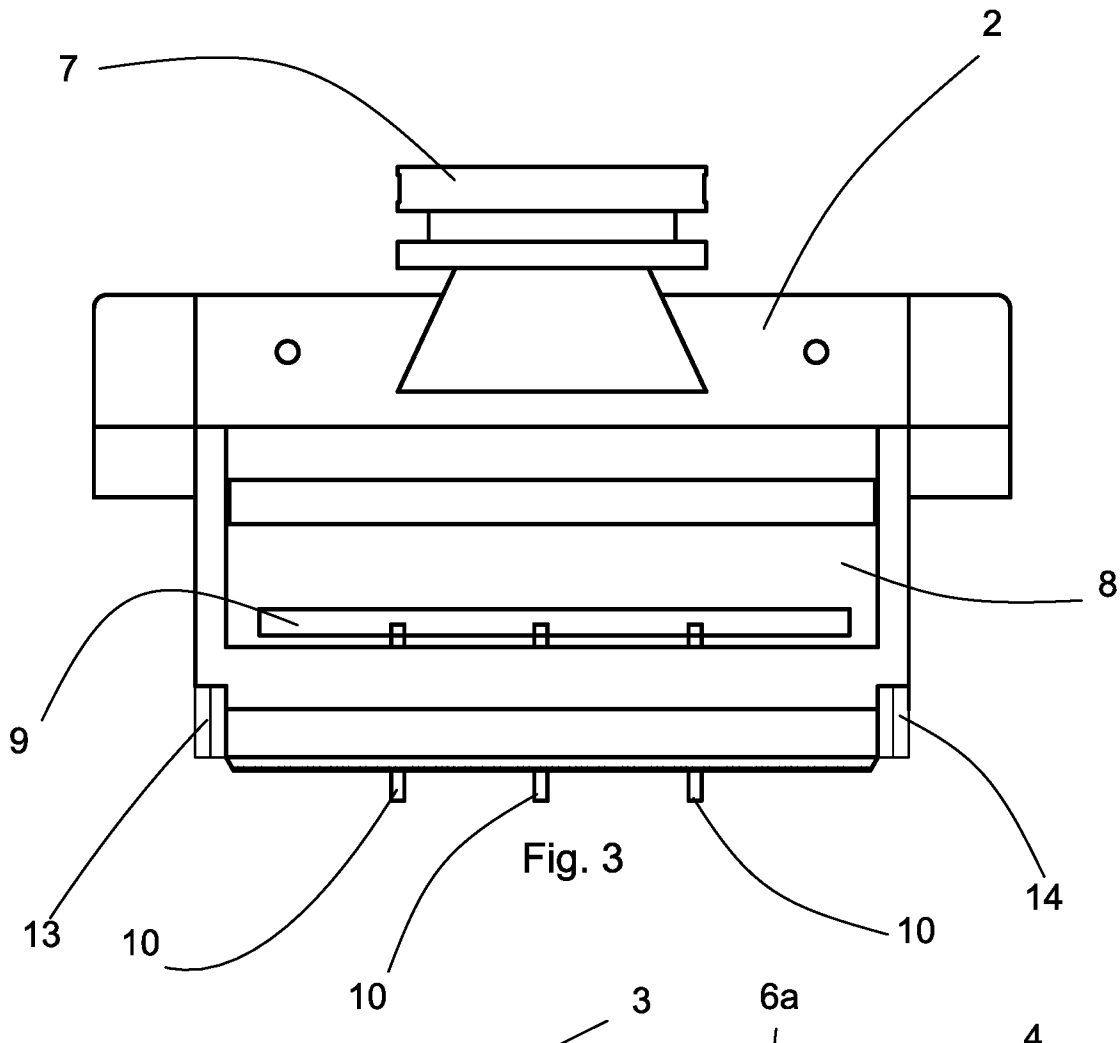


Fig. 3

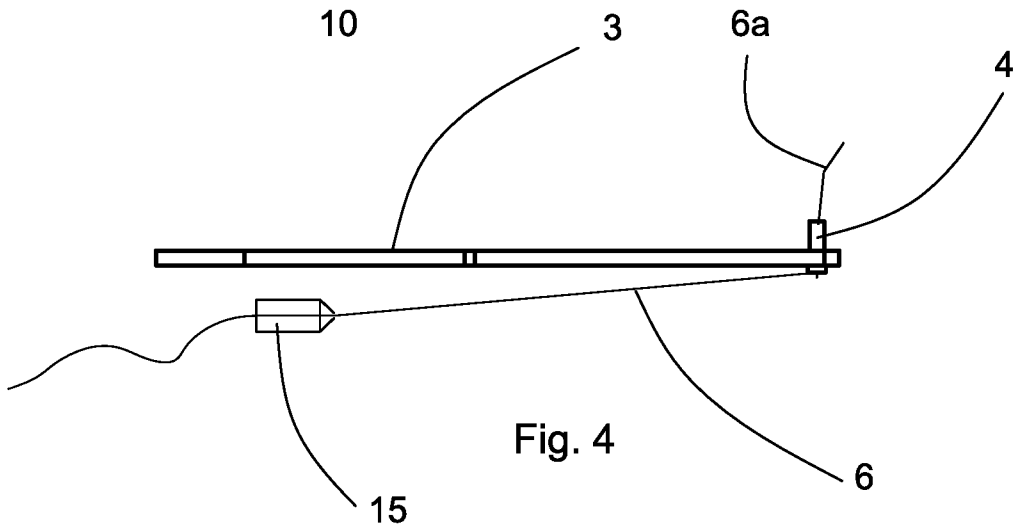


Fig. 4

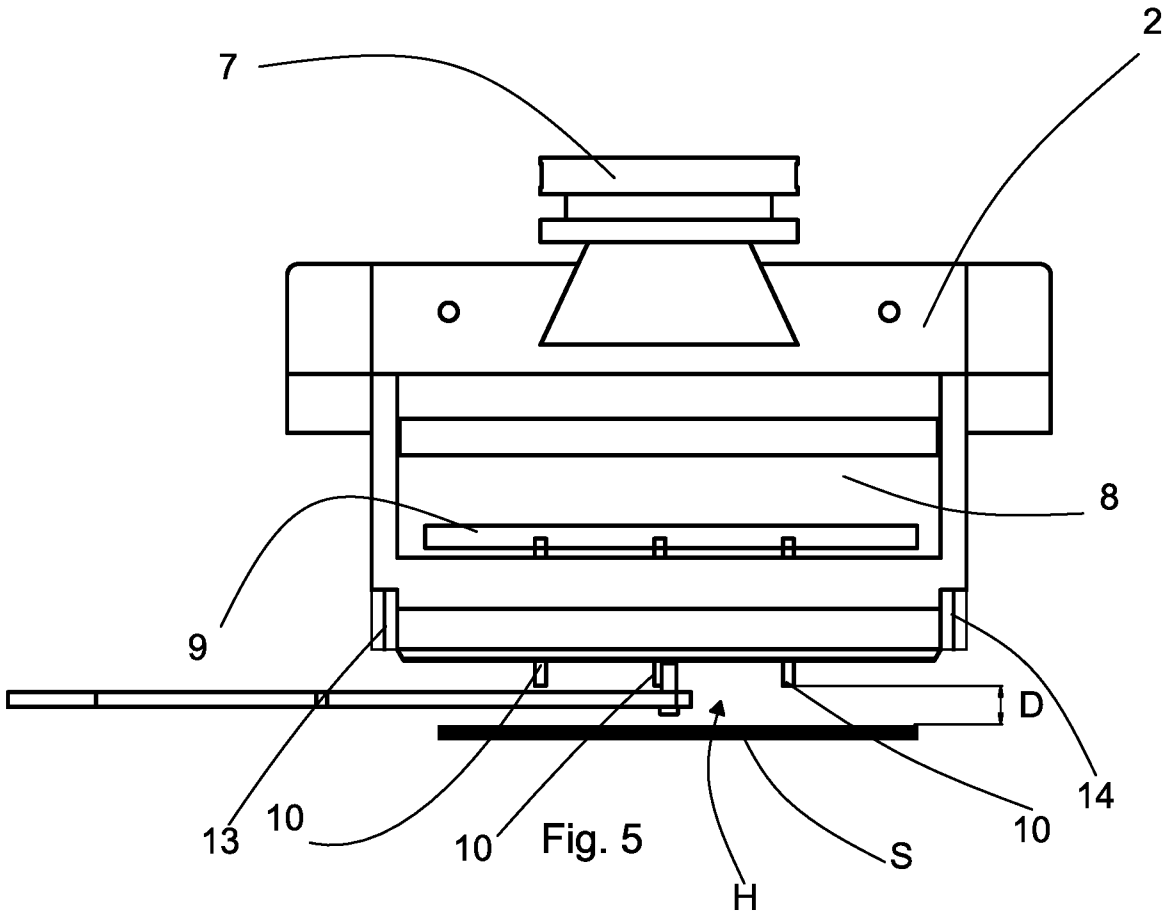


Fig. 5

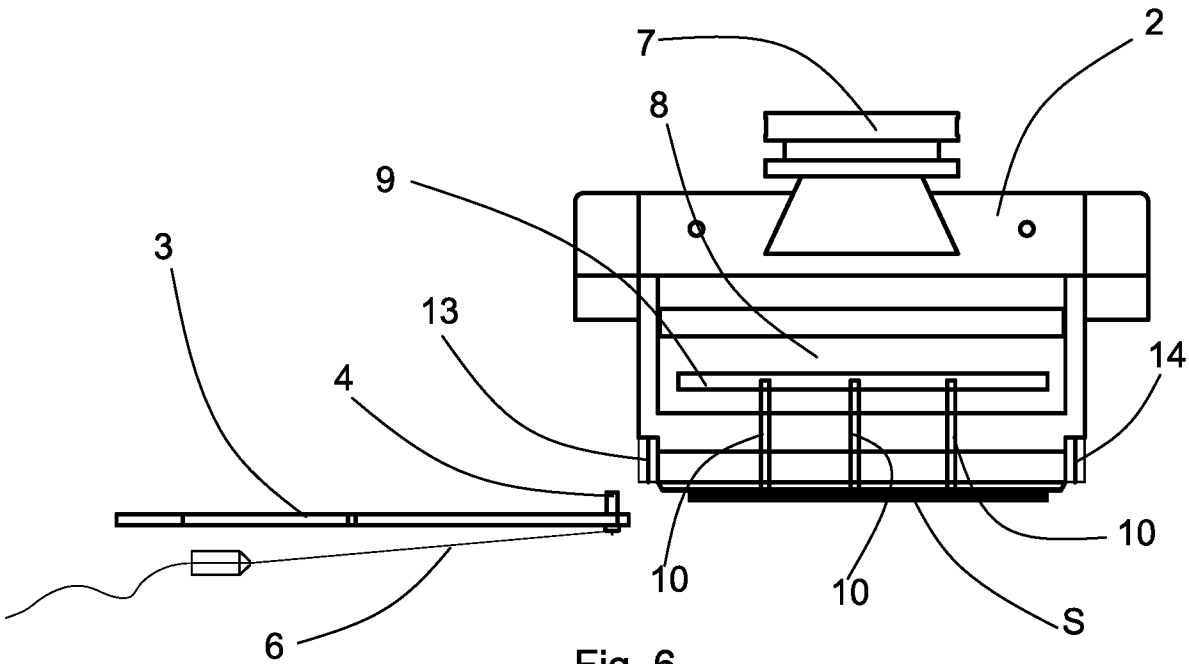


Fig. 6

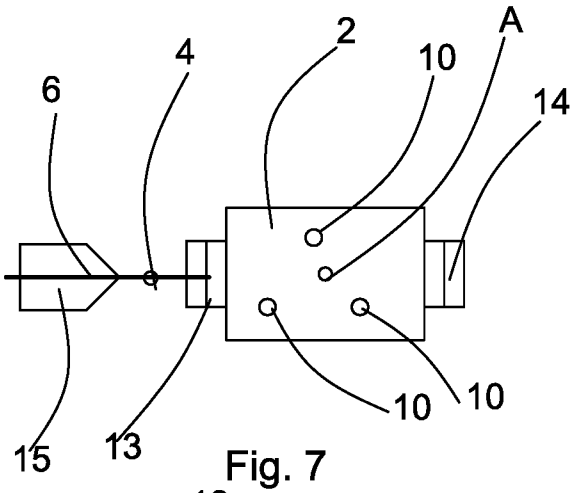


Fig. 7

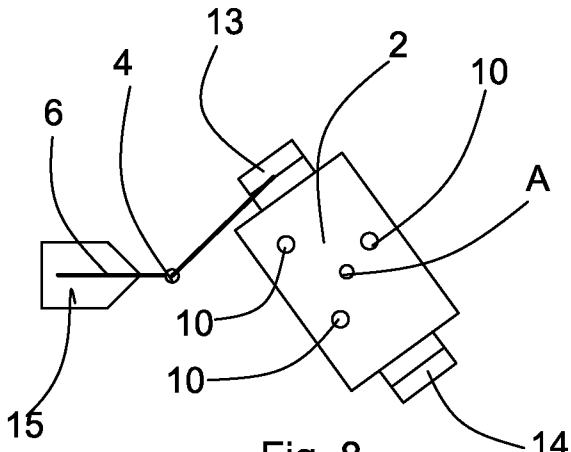


Fig. 8

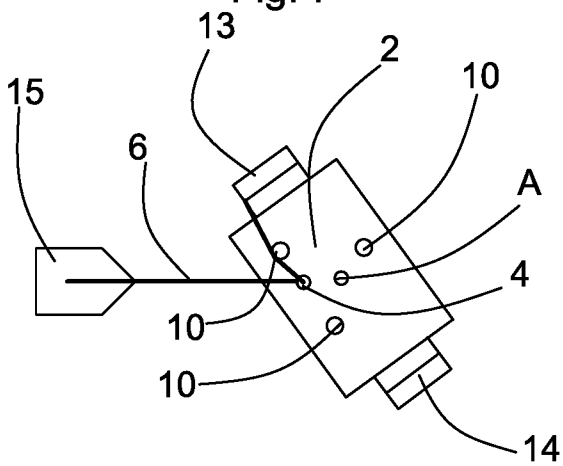


Fig. 9

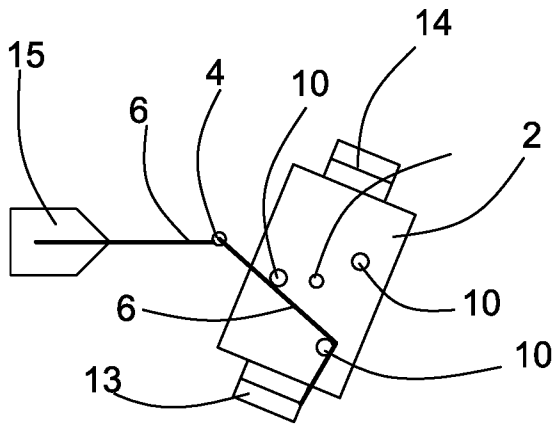


Fig. 10

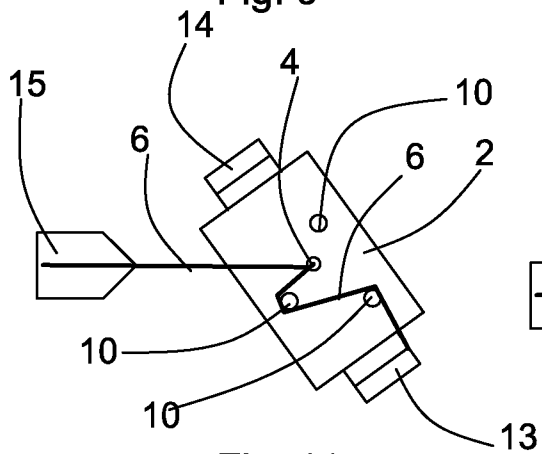


Fig. 11

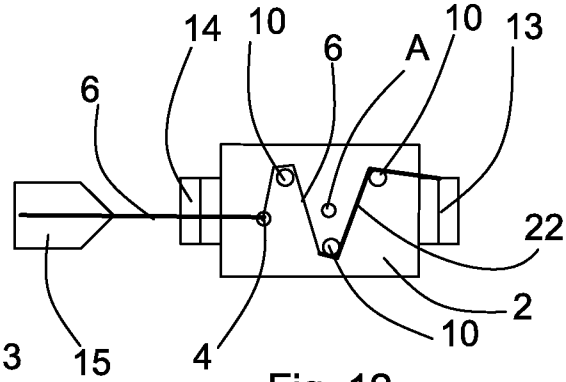


Fig. 12

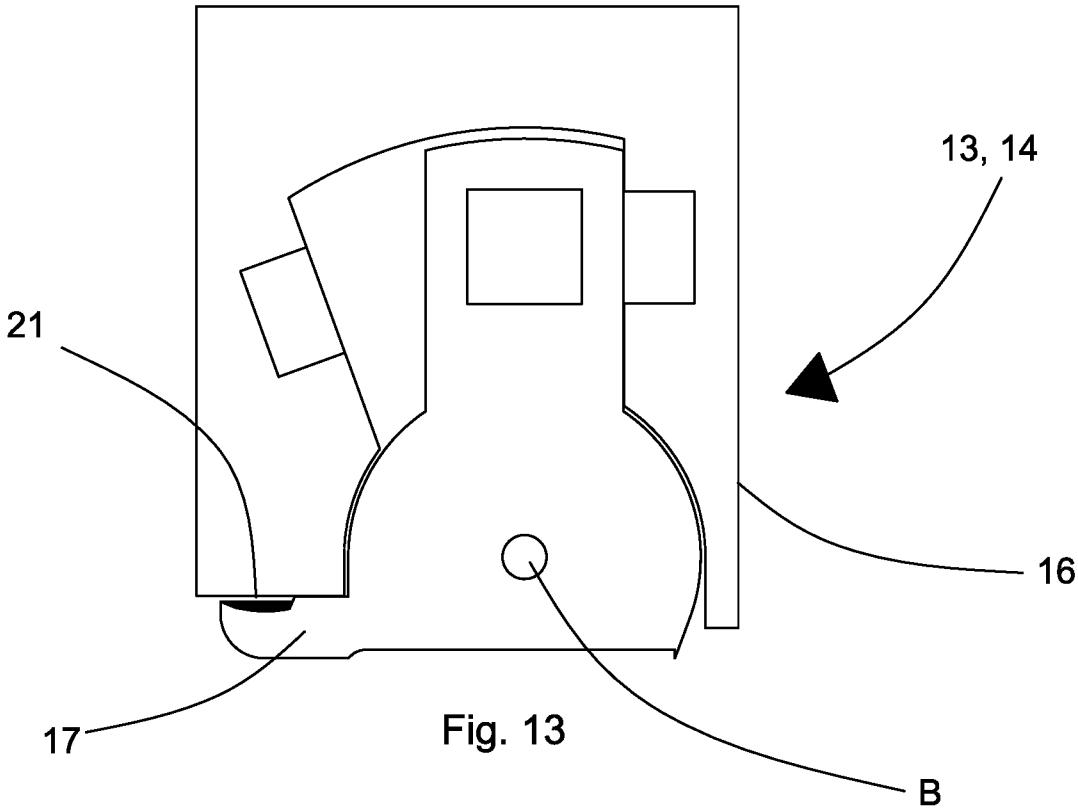


Fig. 13

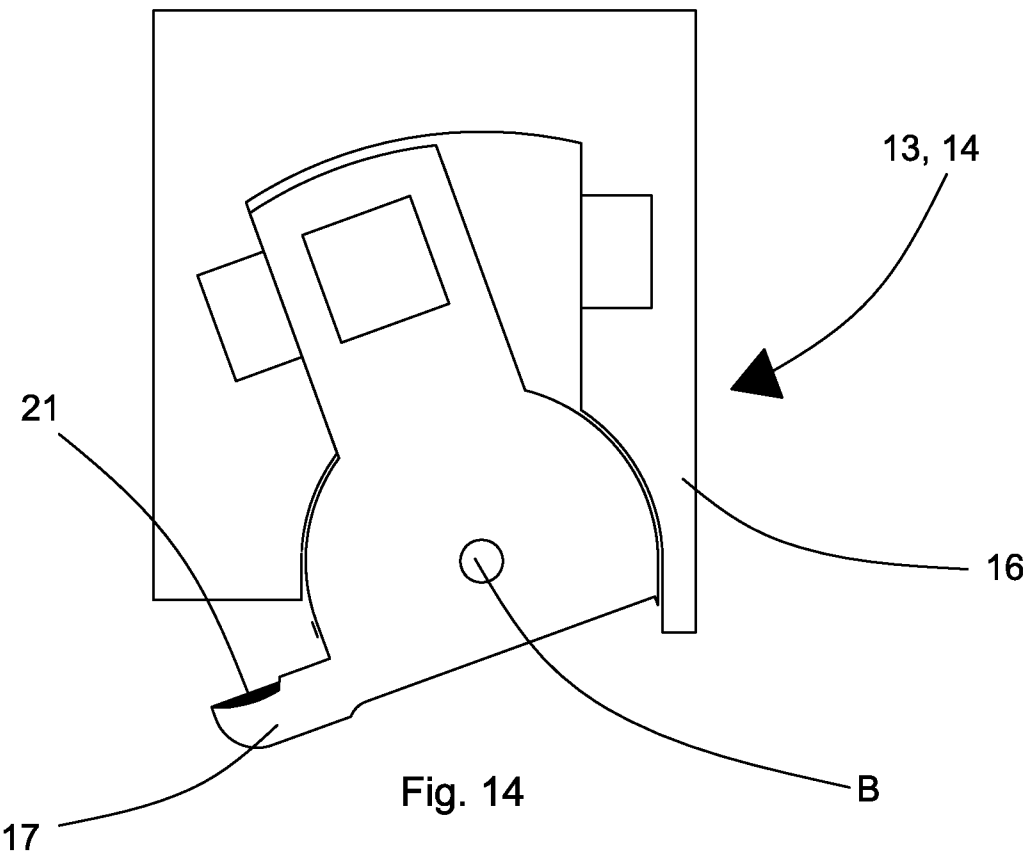


Fig. 14

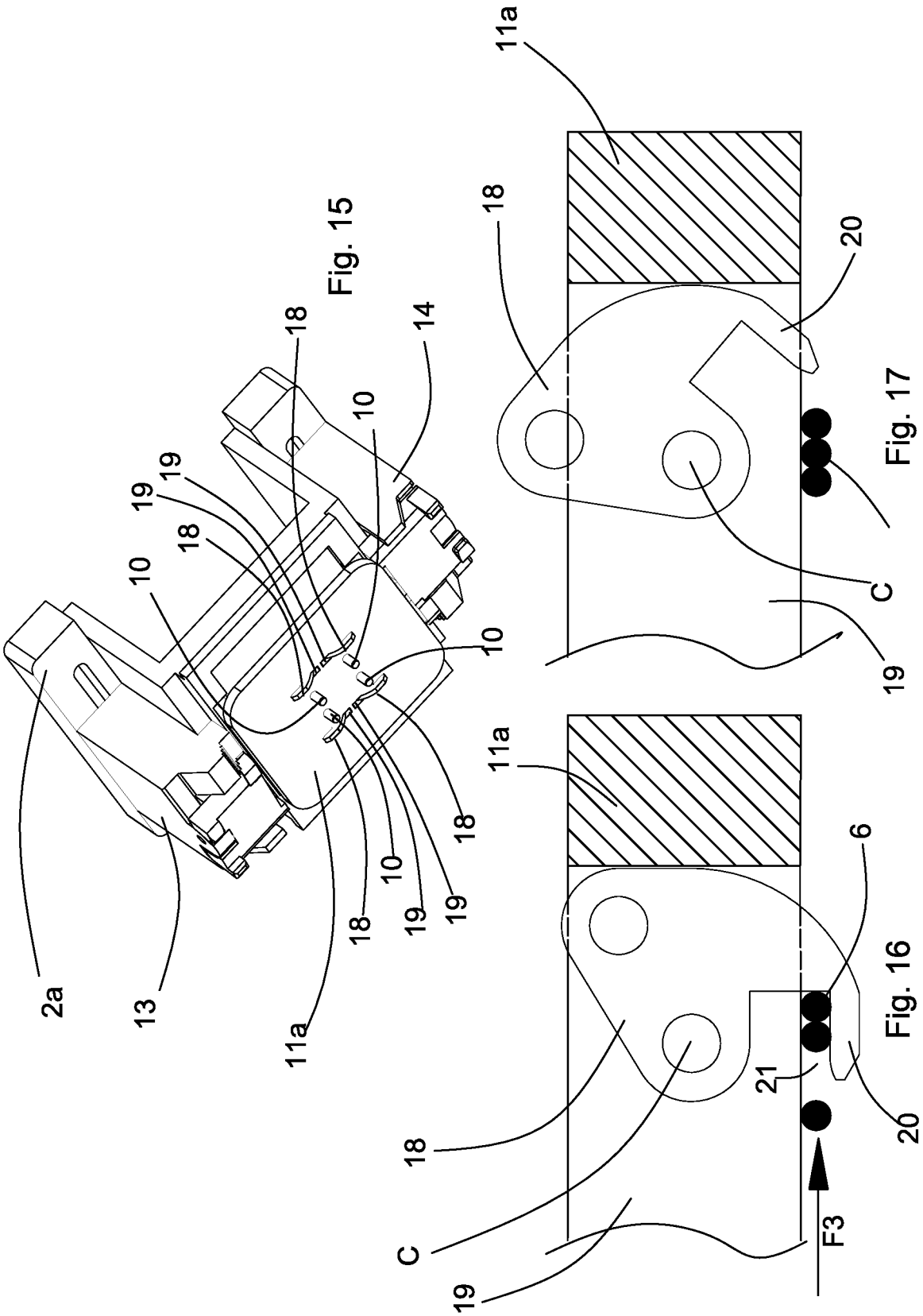
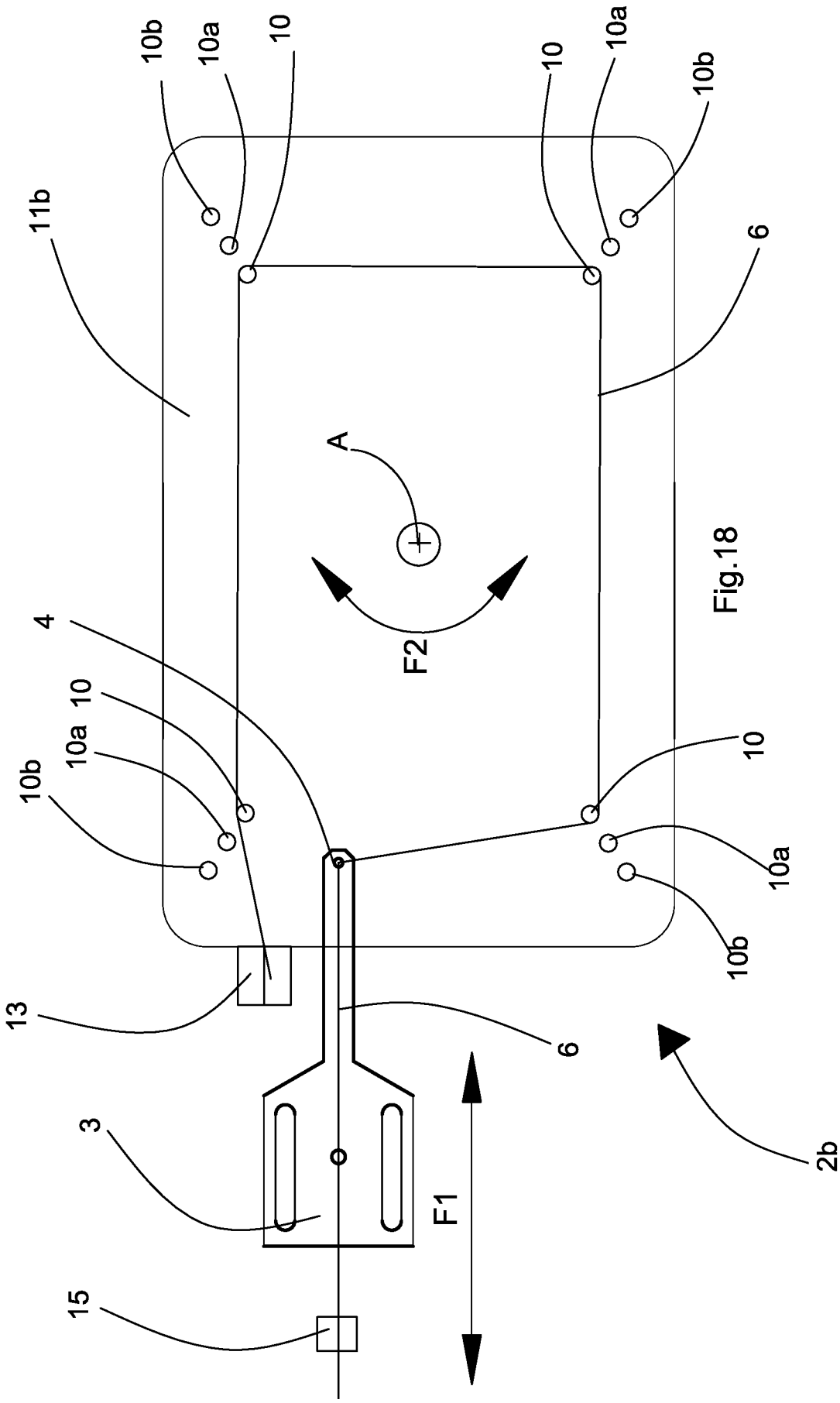


Fig. 15

Fig. 16

Fig. 17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10b
11b
6
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10a
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10b
13
6
3
F1
2b
15

Fig.18

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/053561

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01F41/082 H01Q1/22 H05K3/10
ADD.

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)
H01F H01Q H05K

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 practicable, 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.
A	WO 2013/093826 A1 (FABELE S R L [IT]) 27 June 2013 (2013-06-27) abstract; figures 1,6 pages 1, 4, 5	1-16
A	EP 1 793 326 A2 (VUE TECHNOLOGY INC [US]) 6 June 2007 (2007-06-06) paragraph [0002]; figure 14 paragraph [0161] - paragraph [0171]	1-16
A	US 2001/011413 A1 (YAMAGUCHI SHIGEO [JP] ET AL) 9 August 2001 (2001-08-09) abstract; figures 1-3 paragraph [0002]	1-16

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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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
28 September 2016	14/10/2016

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, Fax: (+31-70) 340-3016	Tano, Valeria

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/053561

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2011/098892 A1 (LOLLI M) 18 August 2011 (2011-08-18) cited in the application figures 1-3 page 1, line 3 - line 15 page 3, line 10 - page 5, line 9 -----	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2016/053561

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