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(71) Applicant: **World Jet S.r.l.**
41049 Sassuolo (Modena) (IT)

(72) Inventor: **Diciocia, Angelo**
42013 CASALGRANDE (REGGIO EMILIA) (IT)

(74) Representative: **Gagliardelli, Fabrizio**
Bugnion S.p.A.
Via M. Vellani Marchi 20
41124 Modena (IT)

(54) **A DEVICE FOR CLEANING PRINTHEADS**

(57) A device (1) for cleaning printheads, comprising a main unit (10) provided with a housing (100) for at least one printhead (2) which comprises an array (21) of nozzles, said housing (100) being provided with a slot (12) for the passage (41) of the printing ink, which slot (12) is provided for facing an array (21) of nozzles of the printhead (2).

Within the housing (100) one or more draw openings (13) are defined suitable for being put into flui-dynamic communication with a suction source.

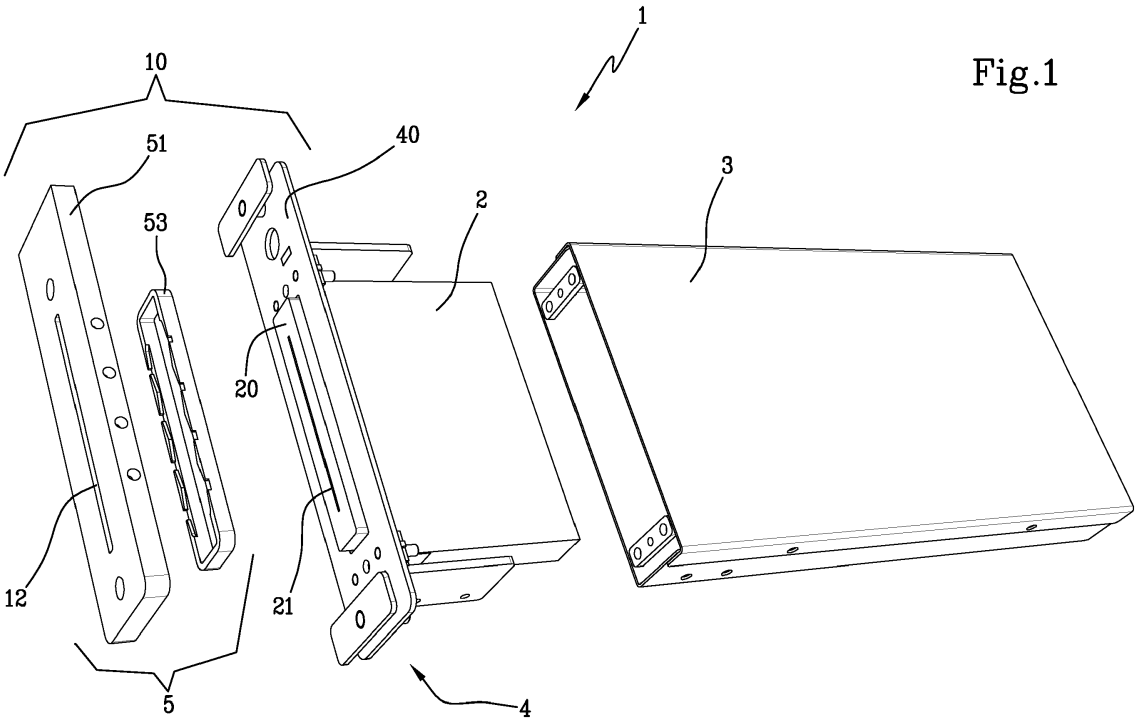

Fig.1

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Description

[0001] The invention discloses a device for cleaning ink-jet printheads.

[0002] The invention is particularly intended for use in the field of industrial printing, particularly for the marking of packaging, without excluding however other types of use, by way of example, within domestic or employment environments.

[0003] There are known ink-jet printing apparatuses, used in industrial field for printing texts, bar codes, logos or the like, on porous or semi-porous surfaces such as the carton the box-shaped packaging are made of; however, such devices are also suitable for printing on non-porous surfaces.

[0004] The packaging, or other objects to be printed, are carried horizontally along a conveyor next to which the printing apparatus is arranged. Such apparatuses include a printing member which comprises at least one printhead contained in a special housing together with the control electronics and exhibiting an opening to allow the nozzles array of the printhead to face outwards thus enabling the printing.

[0005] It is also known that such printheads must be cleaned periodically to remove any air bubbles that may have formed therein or any dirt aggregates which usually form inside the nozzles due to the accumulation of dust which mingle with the ink inside the nozzles.

[0006] Over time, the dirt tends to clog the nozzles.

[0007] The cleaning is performed via a so called purging operation, during which the ink is caused to pass through the nozzles without performing any printing, thereby allowing escape of air bubbles and discharge of dirt. Systems have been devised for automatically collecting and recovering the purging ink so as to prevent the latter, which comes out from the printhead, from dirtying the printing member, the conveyor, the packaging and the floor.

[0008] However any systems are currently available on the market which can be effectively applied to those apparatuses predisposed for the printing on horizontal surfaces.

[0009] Indeed, within such apparatuses, the nozzles array is disposed on a horizontal plane above the printing conveyor so that the printing can be performed on top of the packaging (or the like).

[0010] The system of the known type applied to the apparatuses herein, provides first and foremost to stop printing operations when a purging cycle is being performed.

[0011] At this point, the printing member, which contains the printhead, is moved from its operational position wherein it substantially surmounts the transit line of the packaging, to a position in which it is placed above a collection tray.

[0012] The purging procedure is activated and the purge ink falls into the tray. Then, a removal element intervenes mechanically to remove the residual patina of purge ink.

[0013] Having to stop the production line each time a purge cycle occurs is the major drawback of the prior art, in that it causes a continuous decrease in productivity resulting in a costs increase.

[0014] In addition, the system of the known type does not allow to recover or rather, to re-use the purge ink.

[0015] The technical task at the base of the present invention is to provide a device for the cleaning of printheads which overcomes the drawbacks listed hereinabove.

[0016] An object of the invention within this aim, is to propose a cleaning device which enables the effective removal of purge ink regardless of the spatial orientation of the printhead and particularly of the nozzle array thereof.

[0017] A further object of the invention herein is to make available a device which allows recovery of the purge ink.

[0018] Another object of the invention is to make available a device for protecting the printhead from impacts, scratches, or dust.

[0019] The technical task mentioned and the aim specified are attained by the device according to claim 1.

[0020] Further characteristics and advantages of the present invention will become more apparent from the indicative, and therefore non-limiting, description of non-exclusive embodiments of the cleaning device herein disclosed, as illustrated in the accompanying drawings in which:

- Figure 1 is an exploded view of a printing member on which the device of the invention is implemented;
- Figure 2 is an axonometric view of a main unit of the device of the invention;
- Figures 3 and 4 are isometric views of the main unit of a first embodiment of the invention;
- Figure 5 is a plan view of an outer coverage body of the first embodiment;
- Figure 6 and Figure 7 are two axonometric views of the main unit of two further embodiments of the invention;
- Figures 8 and 9 are plan views of two versions of the external body which can be used in the two embodiments of Figures 6 and 7;
- Figure 10 is an axonometric view of the main unit of a third embodiment; and
- Figure 11 is a plan view of the external body of the third embodiment. With reference to the above figures, by 1 it is overall indicated the device for the cleaning of printheads 2 of the invention herein.

[0021] The device 1 proposed has been devised for cleaning the ink jet printheads 2 of the type comprising a nozzles array which may be like the ones already briefly described in the explanation of the prior art. However, the invention does not only concern the use in the industrial sector, with particular reference to the marking or

printing on labels for which it may also find application in domestic or working environments. As it will become clear in the description of the invention, the device 1 enables to perform the above purge cycles of the printhead 2, thereby cleaning effectively the latter without dirtying the surrounding environment or interrupting the production.

[0022] The device 1 can be implemented within a printing apparatus 2, 3, 10, whose printing member is represented in its essential parts in Figure 1. The printhead 2 of the example shown in Figure 1 is of the type solidly constraint with the control logic and exhibits one printing face 20, preferably planar, at the free end of a projecting portion, which includes the array of nozzles 21 from which the ink is ejected, for example via a technology of the piezoelectric type or of other known systems.

[0023] The array 21 preferably has a substantially linear shape.

[0024] The device 1 proposed, in its most general form, includes first of all a main unit 10 provided with a housing 100 for a printhead 2.

[0025] In detail, the housing 100 preferably defines a concavity substantially prismatic, so as to receive part of said projecting portion of the printhead 2, which is typically substantially polygonal.

[0026] The printing member may comprise a containment and protection housing 3, provided for holding the printhead 2, which housing is closed on one side by the main unit 10 of the device 1, to define a unitary block (see Figure 1).

[0027] The printing member is in turn part of a printing apparatus which can also be of the known type, apart from the device 1 of the invention. Preferably, the housing 100 of the main unit 10 includes an inlet 11 conformed so as to fit to size the aforementioned projecting portion of the printhead 2, which issue will be better detailed in a later section. According to an important aspect of the invention, the housing 100 is provided with a passing slot 12, for example in the form of a slit, which is destined to face the array of nozzles 21 of the printhead 2, so as to allow the passage of the printing ink.

[0028] In practice, when in use, the printhead 2 is coupled to the main unit 10 of the device 1 in such a manner that the array 21 is placed directly in front of the slot 12, thereby allowing the jet of the ink to be directed outwards the device 1, towards the article to be marked or printed.

[0029] Advantageously, one or more draw openings 13 are defined within the housing 100, which draw openins (13) are adapted to be put into fluid-dynamic communication with a suction source (see figure 2).

[0030] Given that, during the cleaning cycles, the purge ink that flows from the nozzles is found immediately in the housing 100, then it appears clear how, by operating the suction source, the same can be removed via the openings prior to escaping from the printing member, thus being the risk of dirtying the surrounding environment totally prevented.

[0031] The way in which this occurs, will be better detailed upon explanation of the working principles of the invention.

[0032] In the embodiments illustrated in the appended drawings, the draw openings 13 are placed substantially in the plane in which said array of nozzles 21 lays, thereby intercepting the purge ink as soon it flows out from the printhead 2.

[0033] Preferably, the draw openings 13 are placed on two opposite sides of the housing 100, being therefore arranged on opposite sides of the printing face 20 of the printhead 2 and therefore of the array 21 of nozzles. Generally the projecting portion of the printhead 2 is substantially parallelepiped, for which reason also the housing 100 is generically parallelepiped.

[0034] However, in all configurations exhibiting an elongated housing 100, the draw openings 13 are arranged along the longest sides of the housing 100, which sides are destined, in use, to flank the array 21 of nozzles. The purge ink flows away from the housing 100 and from the main unit 10 of the device 1 via one or more conduits 14 which extend between at least one outlet 15 being formed on the perimeter of the unit 10, and the draw openings 13.

[0035] The outlet 15 is connectable to the suction source which can be, by way of example, a pump or a depression source of the type with compressed air. Here below there are described some preferential constructive aspects of the main unit 10 of the invention.

[0036] It should be appreciated that the device 1, as illustrated in the appended figures, comprises a support bracket 4 to which the printhead 2 can be removably fastened.

[0037] The support bracket 4 may comprise a plate-shape wall 40 equipped with a passage 41 in which the projecting portion of the printhead 2 can be inserted, so that the above mentioned printing face 20 can cross therethrough and then be arranged within the housing 100.

[0038] Preferably, as shown in figure 1, the passage 41 of the support bracket 4 substantially matches to the profile of the printing face 20, and the projecting portion, so as to fit to size, as already described above.

[0039] This allows to use the suction source more efficiently.

[0040] In other words, the passage 41 can be substantially rectangular. The device 1 provided herein, also comprises a covering element 5 provided with a cavity 50, which cavity 50 partially defines said housing 100, at the bottom of which cavity 50, aforementioned slot 12 is fashioned. The covering element is applied, for example glued, to said plate-shaped wall 40 of the support bracket 4, so as to define the main unit 10 of the device 1.

[0041] In practice, the shaped passage 41 of the support bracket 4 defines said mouth of the housing 100, which housing 100 is internally defined by the cavity 50, within said housing 100 being inserted the printing face 20 of the cartridge.

[0042] In detail, the covering element may comprise

an external body 51, for example, a plate-shaped body, intended for contact with the article to be printed, inside of which said conduits (see Figures 5, 8, 9 and 11), are obtained.

[0043] The external body 51 is provided with a recess 510 which defines the bottom of the housing 100, which recess 510 is provided with inlet holes 520 being in direct communication with the conduits.

[0044] In some embodiments, the device 1 proposed also includes an interposition member 53, preferably annular, inserted into the recess 510 of the external body 51, so as to define with it aforesaid covering element 5.

[0045] The interposition member 53, where present, laterally defines the cavity 50 of the covering element 5 and thus also that of the housing 100 which is obtained following the connection between the support bracket 4 and the covering element 5.

[0046] The interposition member 53 is provided to be arranged between the bottom of the recess 510 and the wall 40 of the support bracket 4 provided with the passage 41.

[0047] In detail, the member 53 of interposition fits to size in the recess 510, opposite and preferably in contact with the inner wall 40 having same thickness of the recess 510.

[0048] There are now described some preferred embodiments of the device 1, which do not exhaust all possible embodiments of the invention herein.

[0049] A first embodiment is shown in Figures 3, 4 and 5.

[0050] In this embodiment, several shaped elements 54 originate from the bottom of the recess 510 of the external body 51.

[0051] Such shaped elements are placed upstream relative to said inlet holes 520 along the fluid-dynamic path followed by the purge ink from the housing 100, along the conduits, up to the outlets.

[0052] In the example shown, the shaped elements 54 are arranged opposite to the largest sides of the recess 510.

[0053] In this embodiment, each draw opening is defined between two shaped elements 54 following application of the external body 51 to the support bracket 4.

[0054] In detail, each draw opening is defined and bounded by the bottom of the recess 510, the aforementioned wall 40 of the support bracket 4 and two moulded elements.

[0055] The elements 54 may have a triangular shape so as to define a passageway for facilitating the suction of the purge ink. Said elements 54 may also have a conical, elliptical, circular, oval and half-moon shape.

[0056] In the example shown, such first embodiment exhibits a useful aspect which is applicable to the printing of particularly large codes and/or writings or in case of a four-color printing.

[0057] Indeed the outlets of the conduits are formed only on an outer edge with longitudinal end, that is to say on one of the outer short sides.

[0058] In this manner, the use of printing members can be provided wherein the device 1 of the invention includes more main units 10 arranged side by side relative to the long side.

[0059] The further embodiments join the aspect of providing an interposition member 53 which conforms the shaped elements 55, having the function of defining the draw openings 13, as the moulded elements 53 described hereinabove.

[0060] In this case, however, the shaped elements 55 are formed in the inner side of the interposition member 53, which comes into contact with the bottom of the recess 510, with which it defines the draw openings 13 exactly through the shaped elements 55.

[0061] In the second embodiment, shown in Figure 6, the interposition member 53 exhibits shaped elements 55 which are conformed likewise the shape elements of the external body 51 as described in the first embodiment, thereby defining a sort of passageway of the type mentioned above.

[0062] In this embodiment, the holes 520 are arranged opposite the draw openings 13, that is, opposite the shaped elements 55.

[0063] This aspect is also applicable to the third embodiment shown in Figure 7 which differs from the second embodiment due to the fact that the shaped elements 55 thereof have a parallelepiped shape.

[0064] Said shaped elements 55 may also have a conical, elliptical, circular, oval and half-moon shape.

[0065] The figure 8 and figure 9 represent variants of an external body 51 which can be used both in relation to the first and second embodiment of the device 1.

[0066] In one case, the internal conduits of the body 51 lead to respective openings (see figure 8), located on the peripheral edge.

[0067] In a second case, the conduits are also joined by a cross connection leading to an outlet 15 arranged at the planar surface which is distanced from the edges.

[0068] In both versions, the inlet holes 520 also open into the outlet 15, this time on the edge of the longest side.

[0069] Based on application needs, some of said holes 520 can be plugged and the remaining ones are connected to the suction source.

[0070] In this manner, the invention versions described above can also be applied to the four-color or large size printing.

[0071] In the last embodiment, the shaped elements 55 formed on the interposition member 53, unlike the previous embodiments, do not completely protrude therefrom.

[0072] In detail, in this embodiment, the external body 51 preferably exhibits two holes 520 opposed one to another, arranged by way of example, in a median position on the respective side, and each longest side of the interposition member 53 has two shaped elements 55 placed side by side which together form a triangular shaped element converging towards the respective hole 520.

[0073] The hole can exhibit its own exit 15 on the outer edge of the longer side of the body 51 which can be plugged or connected to the suction source.

[0074] The various embodiments described hereinabove join the aspect providing the presence of several shaped elements 54, 55 being spaced one from another so as to define draw openings 13, said shaped elements 54, 55 being arranged between the bottom of the recess 510 and the planar wall 40 of the support bracket 4.

[0075] The disclosed device operates as follows.

[0076] The printing member is arranged such that the slot 12 of the outlet 15 of the ink jet is facing towards the zone of passage of the surfaces to be printed.

[0077] For example, where it is necessary to perform printing on horizontal surfaces, such as the top of packaging passing along a linear conveyor, the slot 12 can be faced downwards.

[0078] A processing unit 10 periodically controls a purging cycle during which, as explained, the purge ink is made to pass through the printhead 2 and then comes out of the array 21 of nozzles.

[0079] As soon as the purge ink comes out of the printhead 2, the same remains temporarily in the housing 100 of the device 1.

[0080] Given that, at each purging cycle, the suction source is activated, then, the purge ink is taken from inside the housing 100 and made to exit by the main unit 10 of the printing member via the aforementioned outlet opening, 15 prior to leaking through the slot 12.

[0081] In detail, the ink bleed is sent to a filter, which traps any impurities, from which then comes to a manifold.

[0082] The collector is connected by pneumatic means to the tank of the printhead 2 so that the ink can be reused.

[0083] As it can be appreciated, upon applying the invention herein, neither the production line is to be stopped, nor the printing member needs to be moved aside and repositioned, as it happens today by employing the systems of the prior art.

[0084] Following each purging cycle, both the array 21 of nozzles and the surface of the printing face 20 are free of any residual ink and the surrounding environment, particularly the conveyor and the articles to be marked or printed, did not become dirty so that printing can be smoothly continued.

[0085] Furthermore, unlike the prior art, the purge ink is not wasted but re-used.

Claims

1. A device (1) for cleaning printheads, comprising a main unit (10) having a housing (100) for at least one printhead (2) which comprises an array of nozzles (21), said housing (100) being provided with a slot (12) for passage (41) of the printing ink and destined to face said array of nozzles (21) of the printhead (2), the device (1) being **characterized in that** one or more draw openings (13) are defined in said housing (100), said openings (13) being able to be put into fluid-dynamic communication with a suction source.

2. The device (1) according to the preceding claim, wherein said draw openings (13) are substantially arranged in the plane in which said array (21) of nozzles lies.

3. The device (1) according to at least one of the preceding claims, wherein said draw openings (13) are located at least on two opposite sides of the housing (100).

4. The device (1) according to the preceding claim, wherein the housing (100) is elongated and said opposite sides are the longer sides which are destined to flank said array (21) of nozzles.

5. The device (1) according to at least one of the preceding claims, wherein said unit (10) includes at least one conduit (14) that extends between at least one outlet (15), which is connectable to said suction source, and the draw openings (13).

6. The device (1) according to at least one of the preceding claims, comprising a support bracket (4) to which a printhead (2) can be fastened, said support bracket (4) being provided with a passage (41) in which there can be inserted a printing face (20) of the printhead (2) at which the array (21) of nozzles is arranged.

7. The device (1) according to the preceding claim, wherein said passage (41) is substantially shaped complementarily to said printing face (20).

8. The device (1) according to at least one of the preceding claims, comprising a covering element (5) having a cavity (50) for receiving a printing face (20) of the printhead (2) at which an array (21) of nozzles is arranged, said cavity (50) comprising a bottom wherein said slot (12) is provided.

9. The device (1) according to the two preceding claims, wherein said covering element (5) is applied to said bracket (4) so as to define said main unit (10).

10. The device (1) according to claim 7 or claim 8, wherein said covering element (5) comprises an external body (51), wherein said conduit is provided, said body (51) also having a recess (510), on the bottom of which the slot (12) is afforded.

11. The device (1) according to the preceding claim, wherein said recess (510) is provided with holes

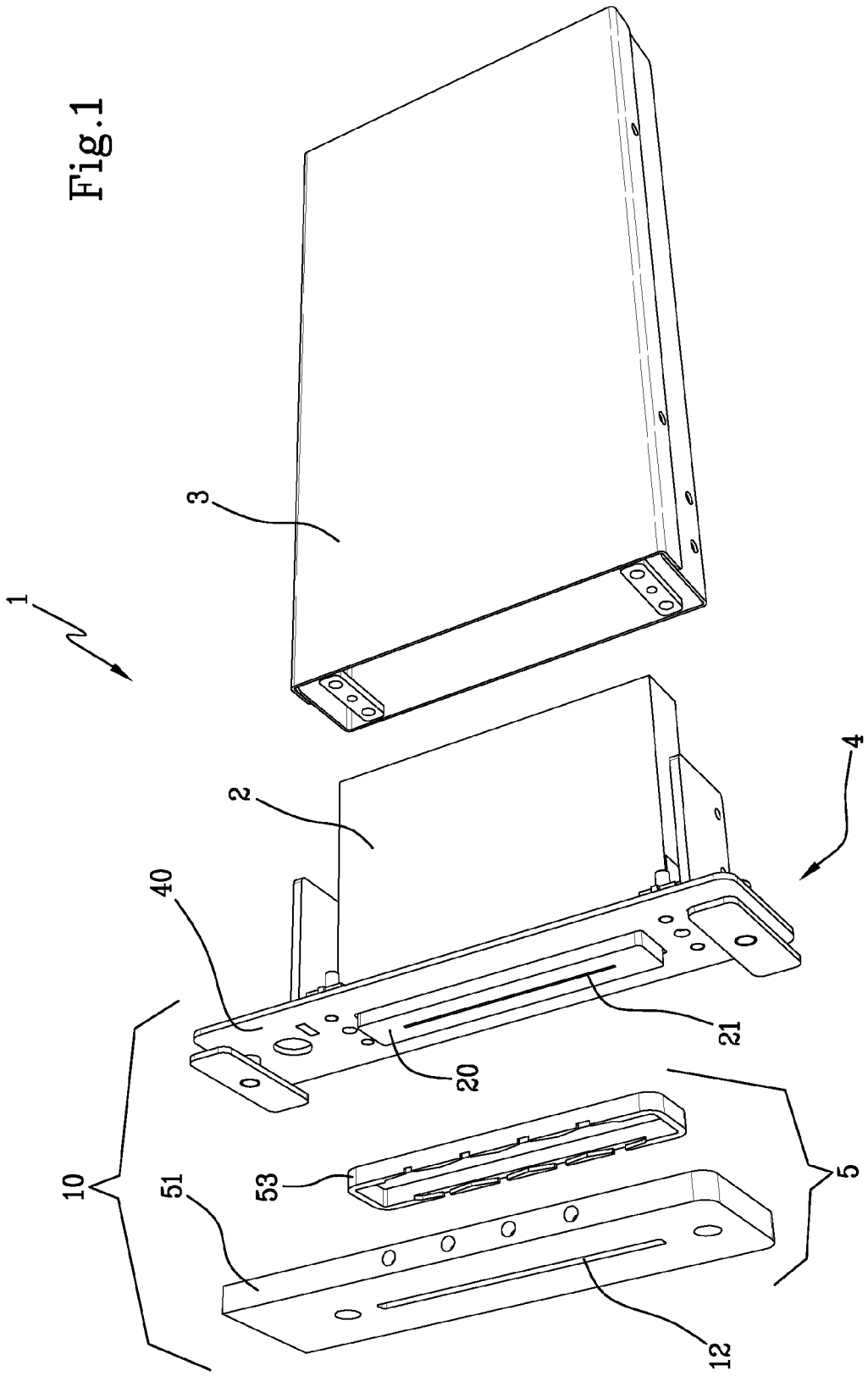
(520) in communication with said conduit (14).

12. The device (1) according to claim 10 or claim 11, wherein, between the bottom of the recess (510) and a wall (40) of the support bracket (4) in which the passage is afforded (41), a number of shaped elements (54, 55) are arranged, between which the draw openings (13) are defined (13).

13. The device (1) according to the preceding claim, wherein the shaped elements (54) originate from the bottom of the recess (510), each draw opening being defined and delimited by the bottom of the recess (510), by said wall (40) of the support bracket (4) and by two shaped elements.

14. The device (1) according to claim 13, wherein said main unit (10) comprises at least one interposition member (53) inserted in said recess (510) of the external body (51) so as to define therewith said covering element (5), the interposition member (53) shaping said elements (55).

Fig.1



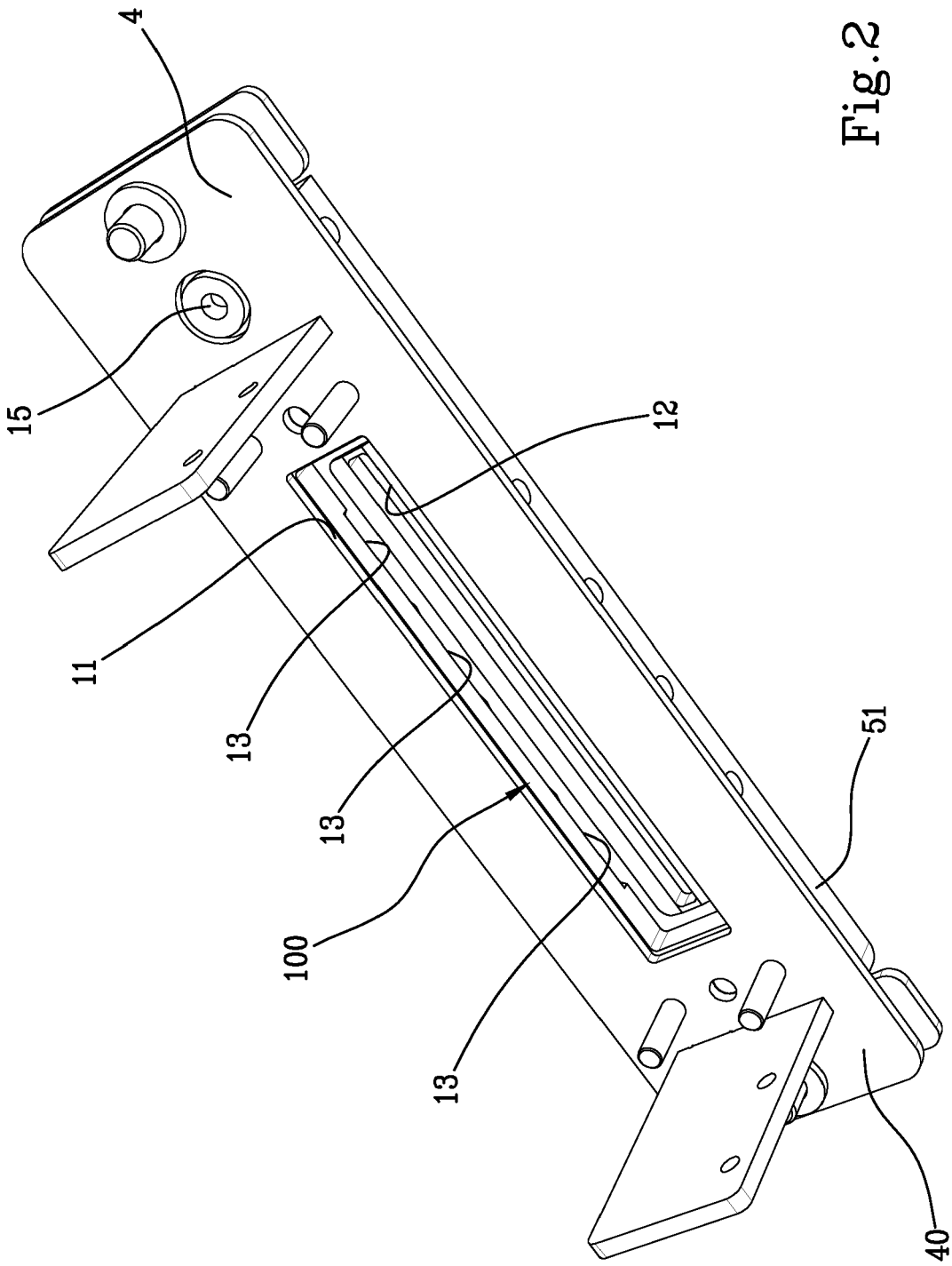


Fig.2

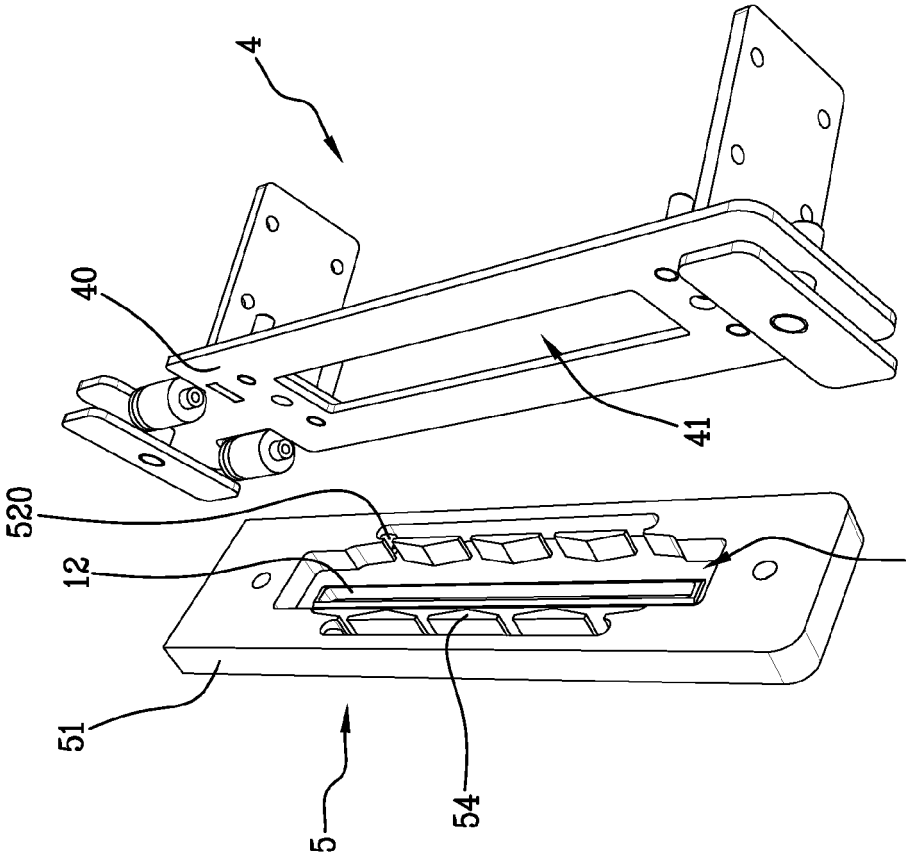


Fig.4

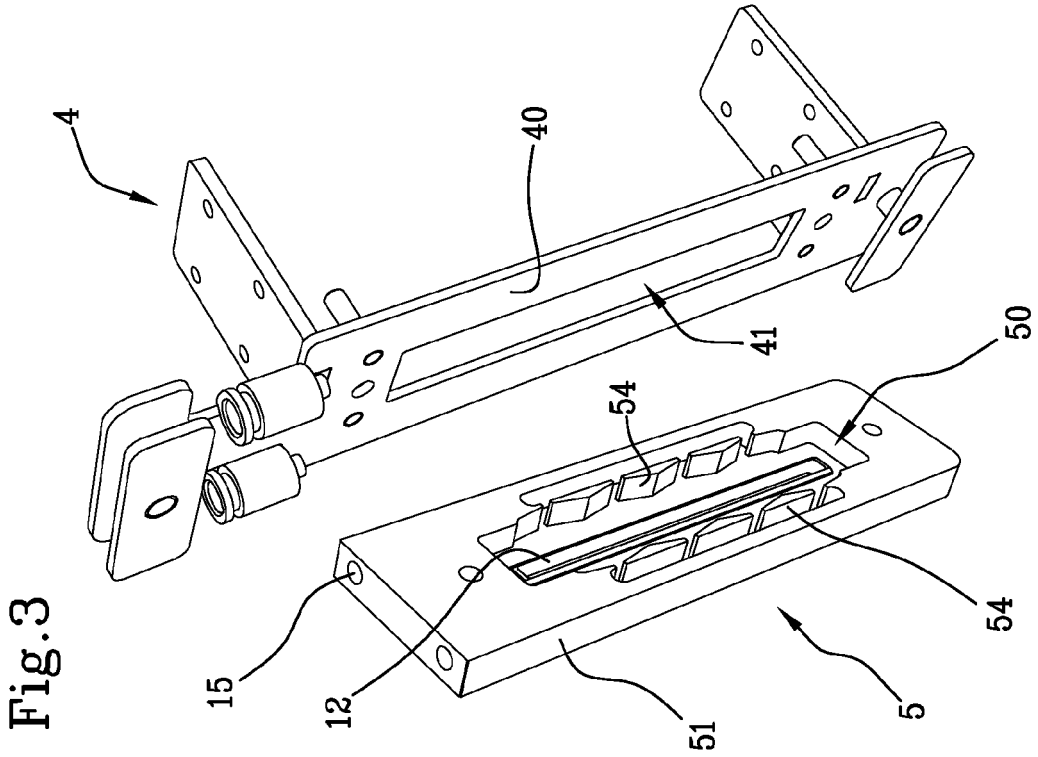


Fig.3

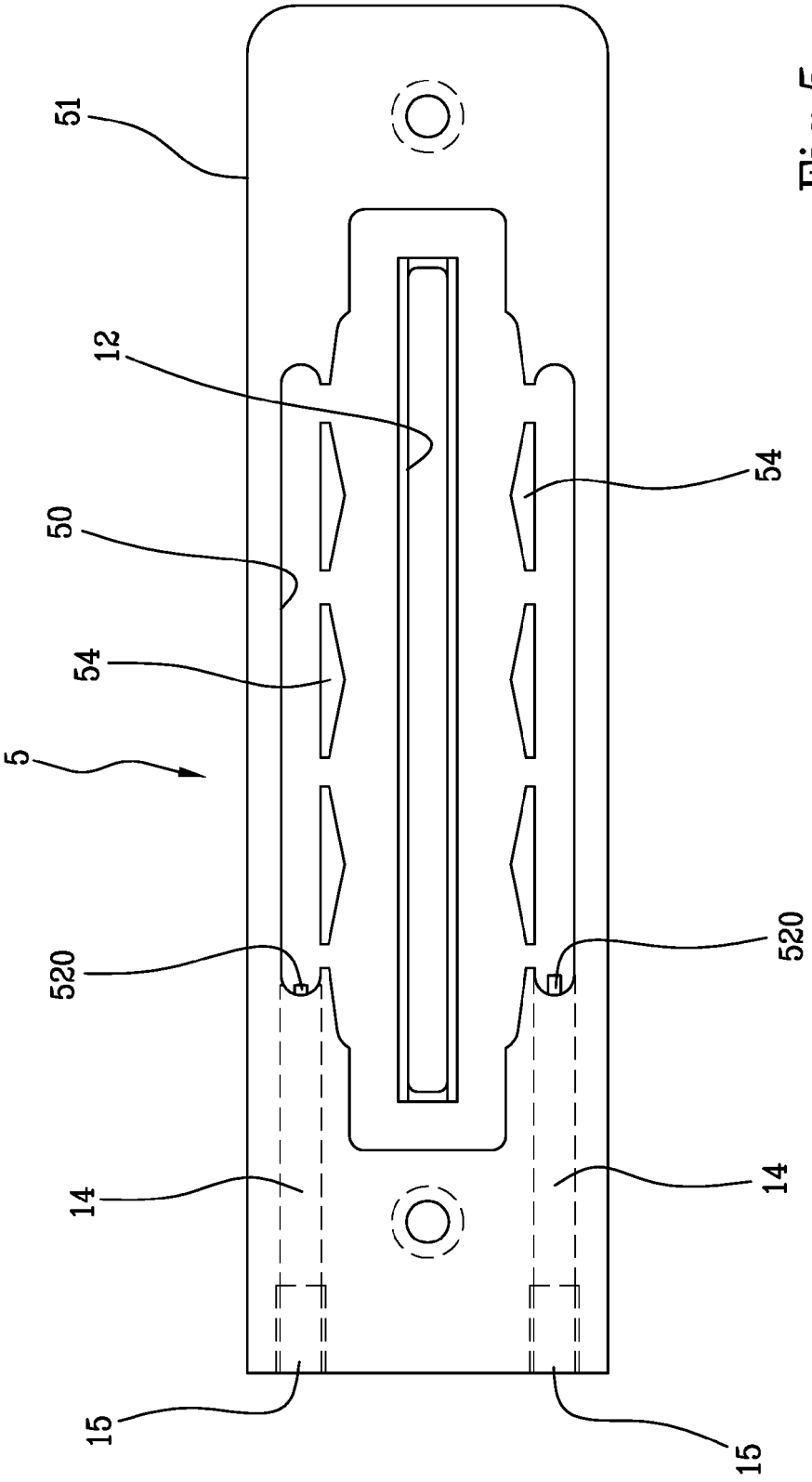


Fig.5

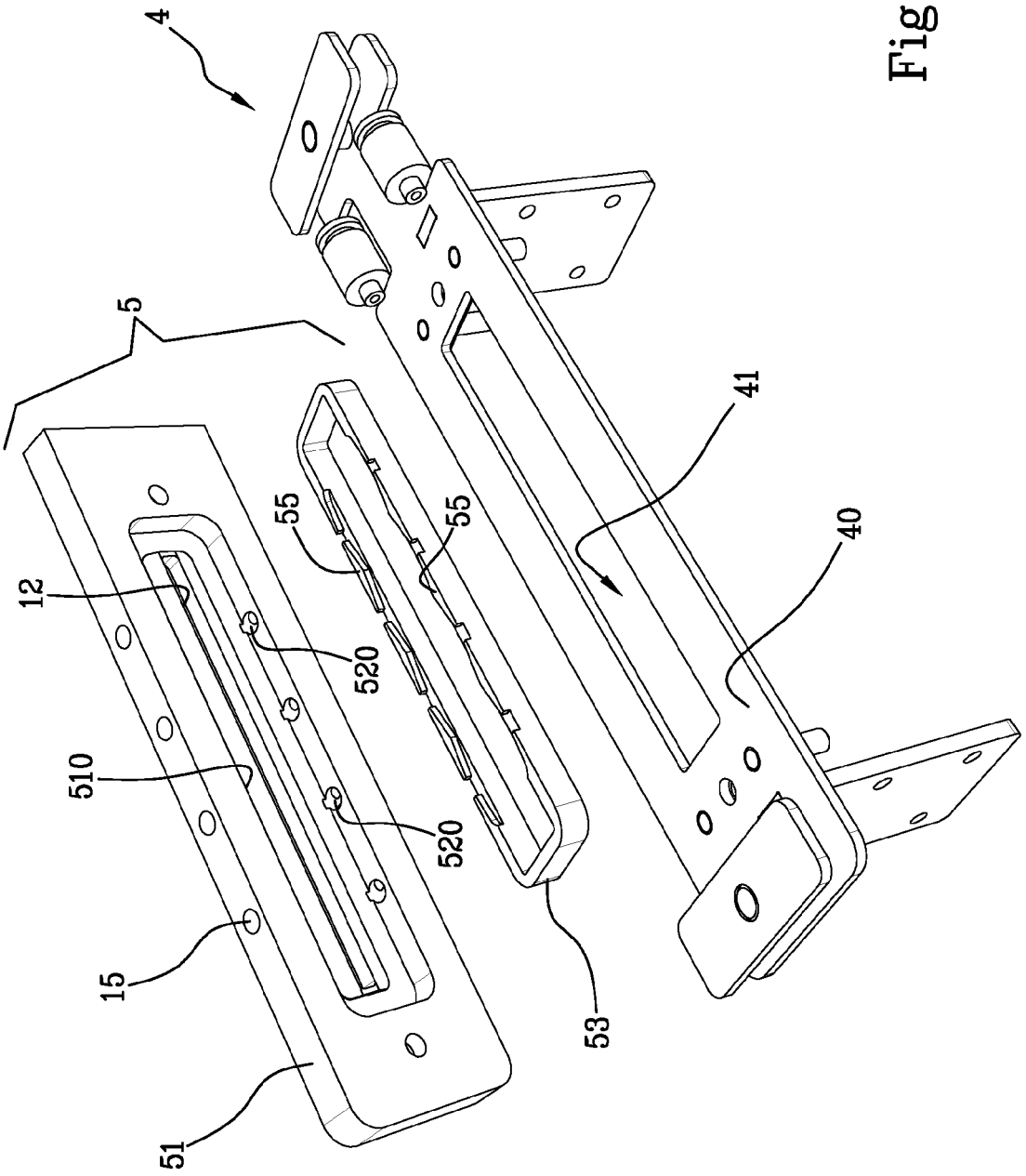


Fig.6

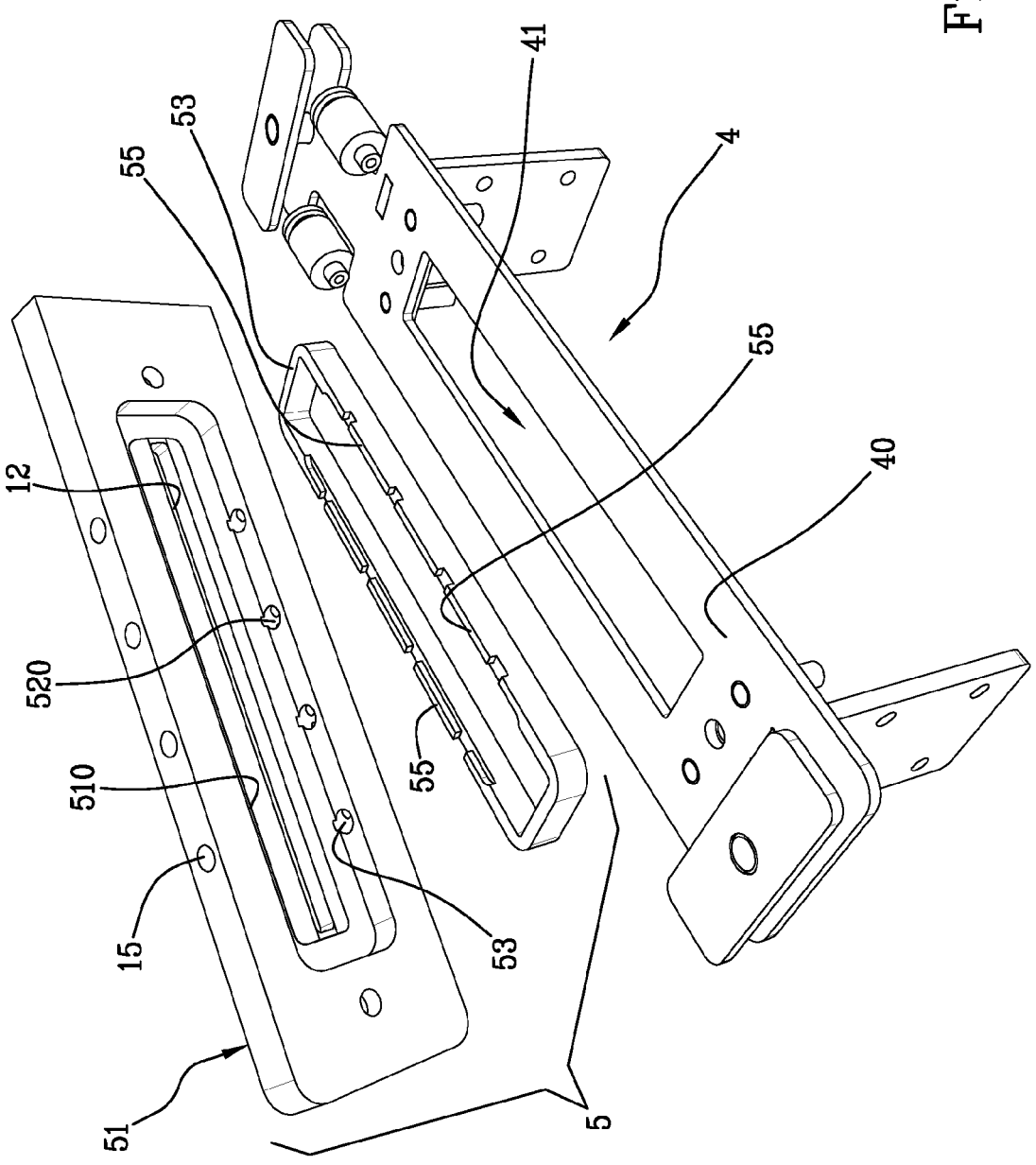
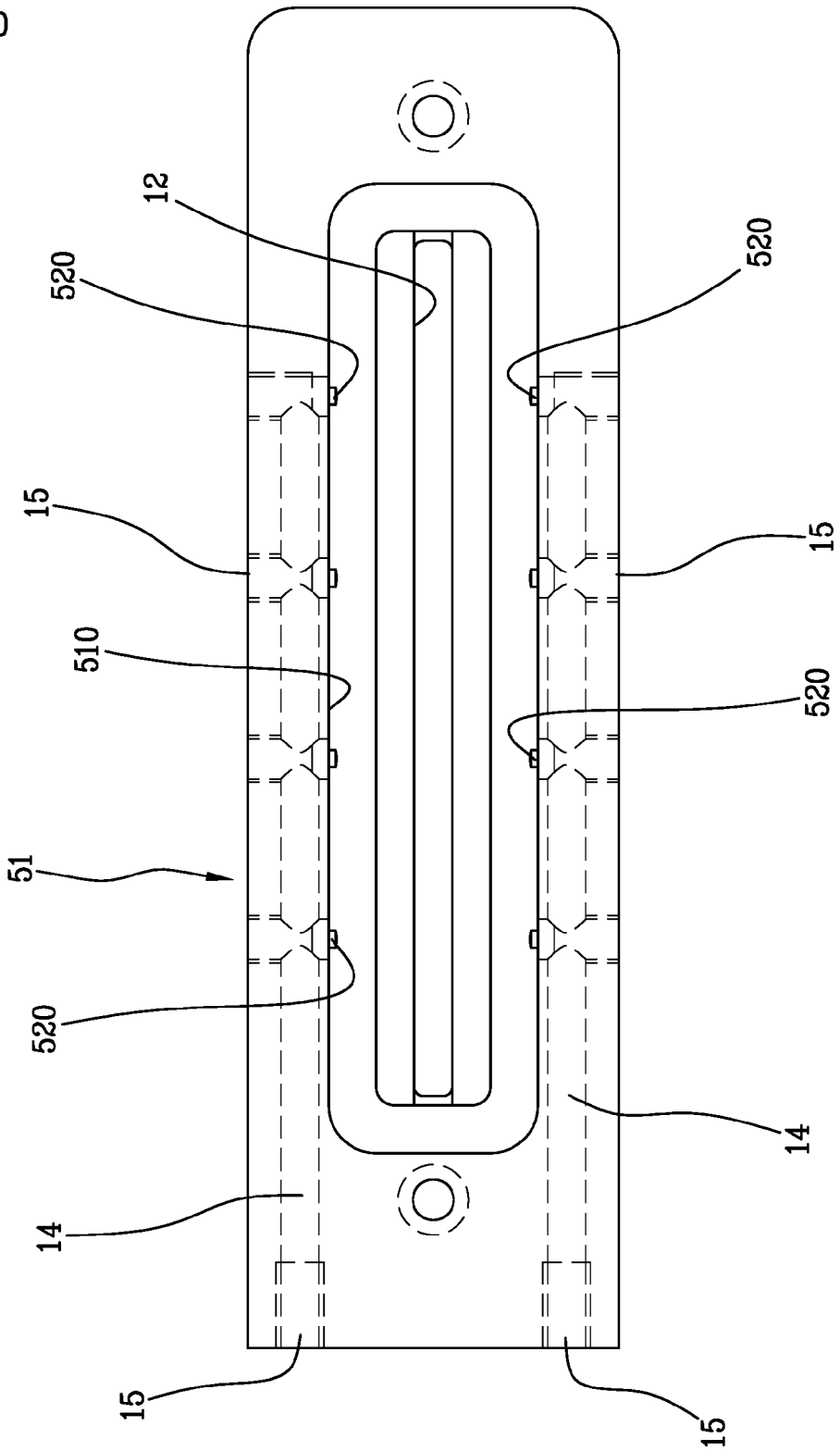


Fig.7

Fig.8



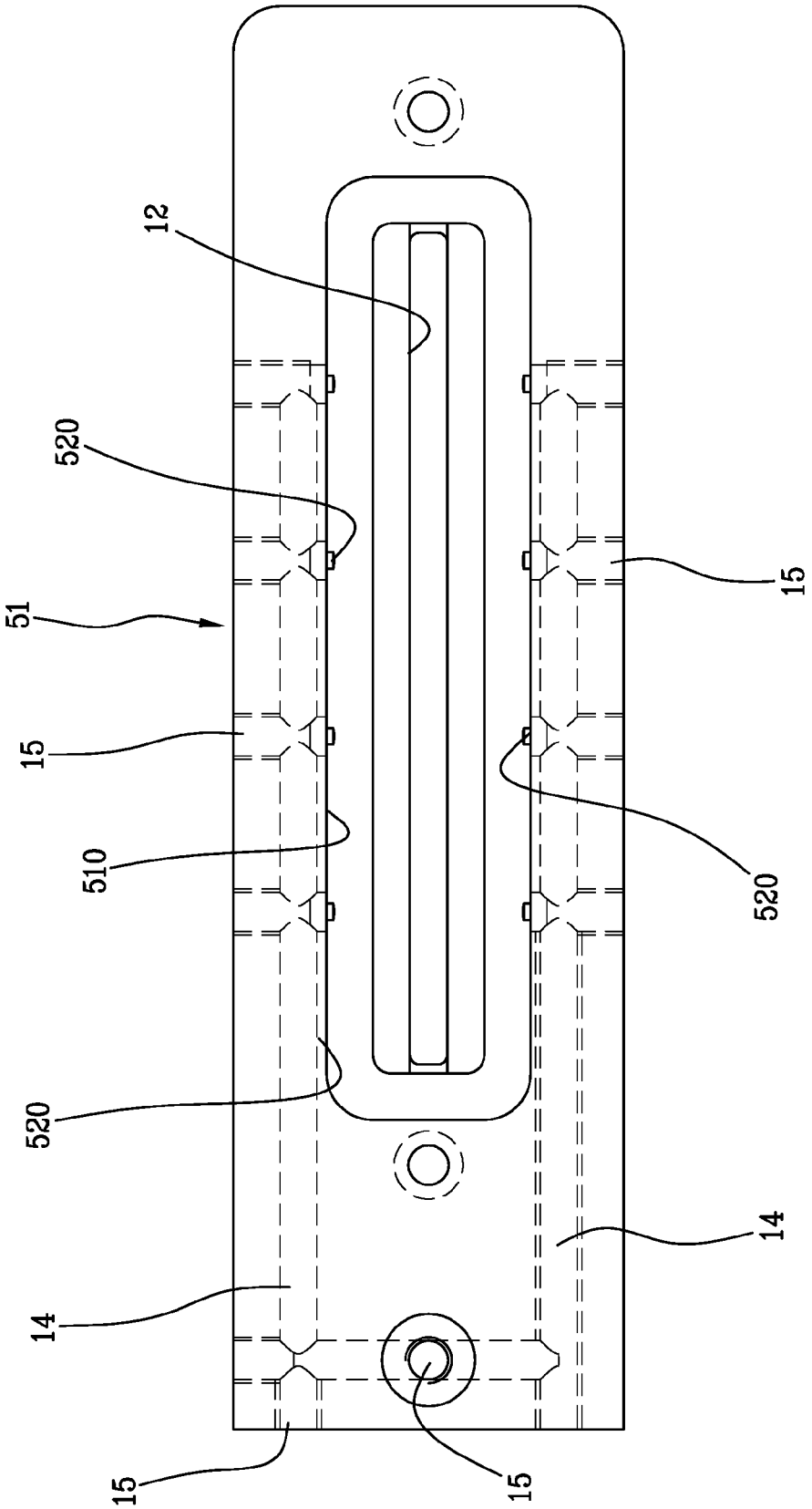


Fig.9

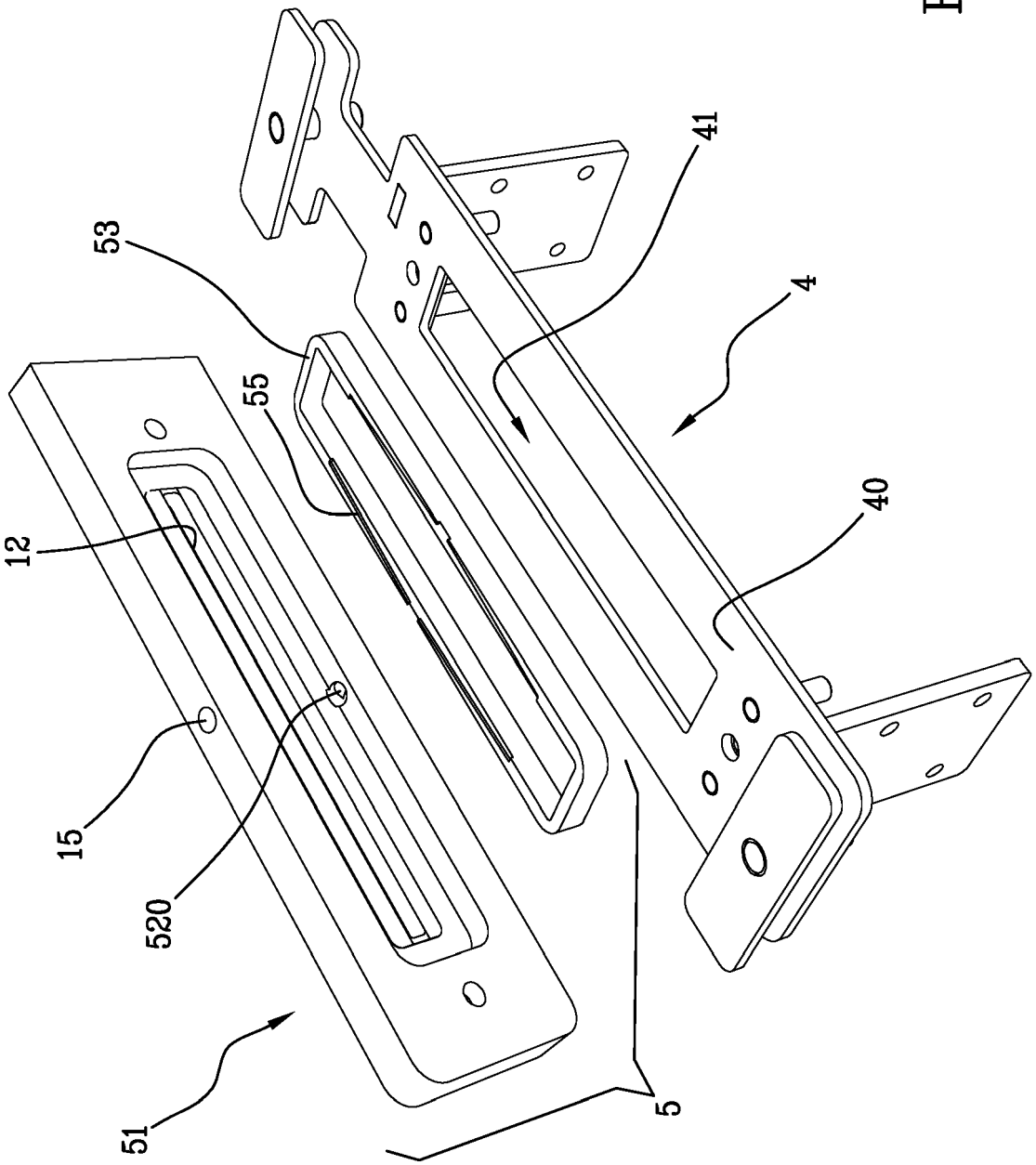


Fig.10

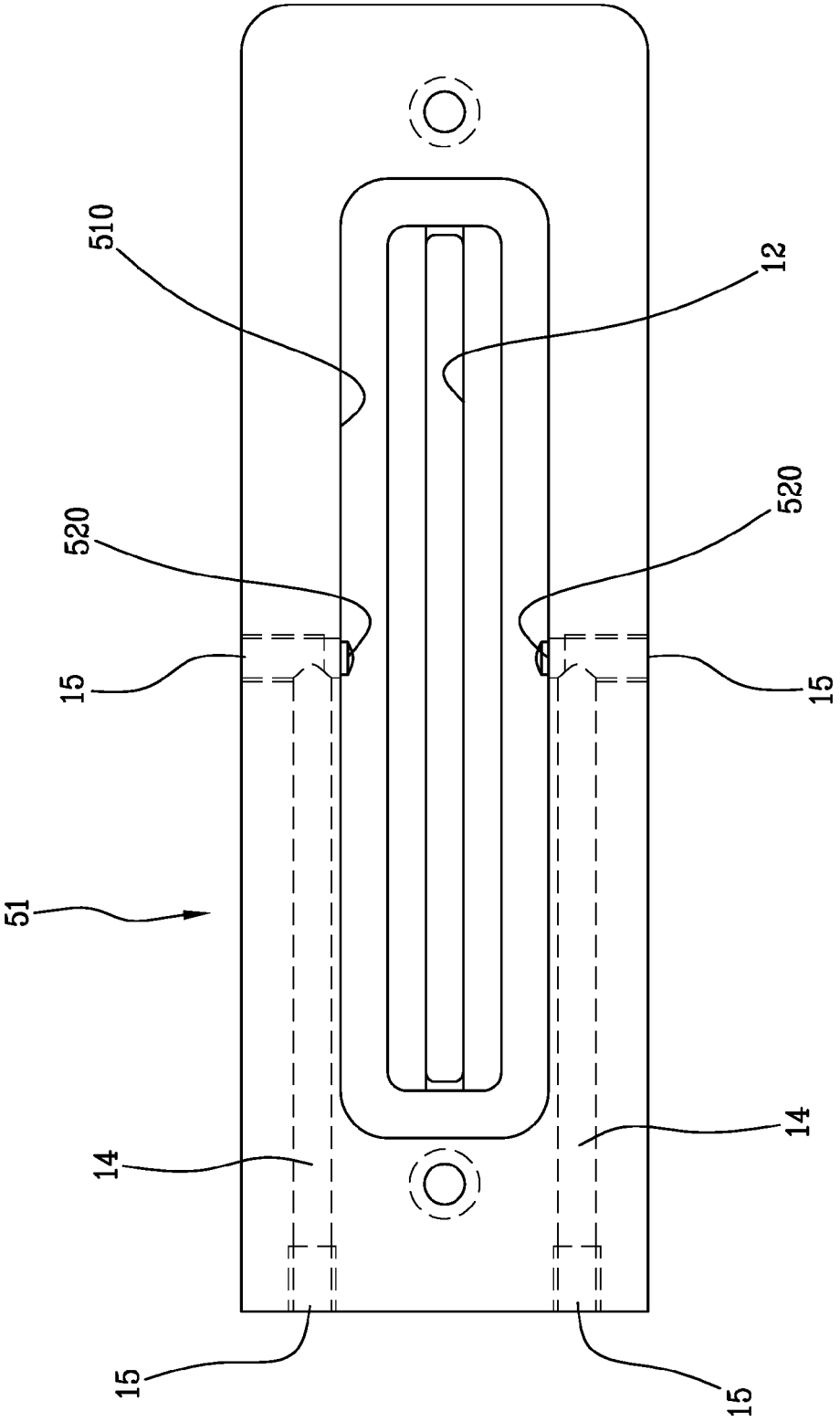


Fig.11

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 4092

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2010/101075 A1 (SII PRINTEK INC [JP]; SAKATA AKIFUMI [JP]; TOMINAGA KAZUYOSHI [JP]; WA) 10 September 2010 (2010-09-10) * abstract; figures 4,6-7,18 *	1-3,5-14	INV. B41J2/165
X	JP 2011 235495 A (IBIDEN CO LTD) 24 November 2011 (2011-11-24) * figures 1,2 *	1-7	
X	JP 2011 178040 A (SEIKO EPSON CORP) 15 September 2011 (2011-09-15) * figures 1-3 *	1-3,6,7	
			TECHNICAL FIELDS SEARCHED (IPC)
			B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 October 2015	João, César

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010101075 A1	10-09-2010	JP 2010208053 A	24-09-2010
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