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(54) A PRINT SUBSTRATE STACK HANDLING MODULE FOR STACKING AND/OR SEPARATING SUBSTRATES

(57) A compact and efficient method for handling substrates of different media types for different print jobs without operator interference is provided. The method comprises the steps of:
- inserting a drawer (40, 40', 40") comprising a releasable stack support (42) over a first stack (11) of substrates on a liftable stack support (13);
- releasing the releasable stack support (42) from the drawer (40, 40', 40"), such that the releasable stack support (42) is supported by the first stack (11) on the lift stack support (13);
- lifting the releasable stack support (42) within a working range of a single substrate engager (20) by lifting the liftable stack support (13);
- moving a substrate (46) between the releasable stack support (42) and a transport path (30) of a printer by means of the single substrate engager (20);
- withdrawing the releasable stack support (42); and
- lifting the liftable stack support (13), so that the first stack (11) is positioned within the working range of the single substrate engager (20).

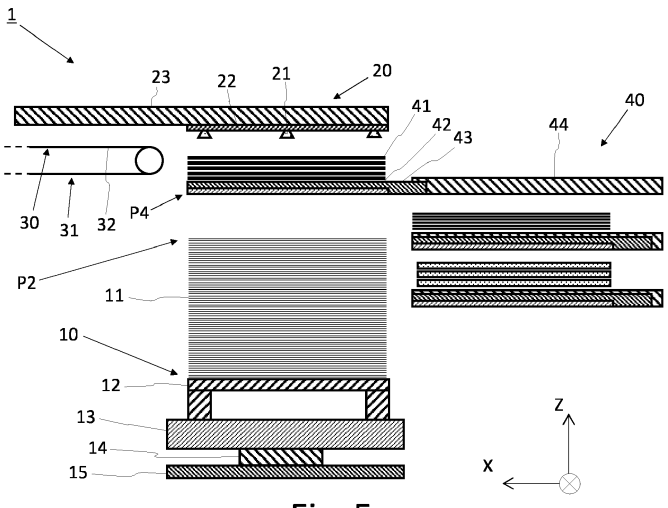

Fig. 5

EP 4 530 236 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The invention relates to a method of printing, a print substrate stack handling module, and a printer comprising such a module.

2. Description of Background Art

[0002] WO21021086 A1 discloses a print substrate stack handling module, wherein substrates from a printer are handled into a stack. For larger format media, such as cardboard, rigid substrates, or panels, the media may be supplied in stack form on a pallet. Preferably, the pallet with the stack is placed in the stack handling module. The stack handling module comprises a single substrate engager, which separates a single substrate from the stack and feeds it onto a transport path to a printing assembly for forming an image on the substrate. Similarly, such a stack handling module may be provided at the output side of the printer for stacking printed substrates on a pallet. During operation, the stack is positioned on a liftable stack support, which is raised or lowered to maintain the top of the stack in a working range of the single substrate engager. The liftable stack support move further be horizontally translatable between a (un)loading position and a working position below the single substrate engager.

SUMMARY OF THE INVENTION

[0003] It is an object of the invention to provide a versatile print substrate stack handling module, specifically one that allows for unattended printing of different print jobs.

[0004] In accordance with the present invention, a method of printing according to claim 1, a print substrate stack handling module according to claim 9, and a printer according to claim 15 are provided.

[0005] The method comprises the steps of:

- inserting a drawer comprising a releasable stack support over a first stack of substrates on a liftable stack support;
- releasing the releasable stack support from the drawer, such that the releasable stack support is supported by the first stack on the lift stack support;
- lifting the releasable stack support within a working range of a single substrate engager by lifting the liftable stack support;
- moving a substrate between the releasable stack support and a transport path of a printer by means of the single substrate engager;
- withdrawing the releasable stack support; and
- lifting the liftable stack support, so that the first stack is positioned within the working range of the single substrate engager.

At least one drawer is positioned on a side of the liftable stack support. The liftable stack support can move the top of the stack on it near the single substrate engager for adding substrates to or separating these from said stack. The drawer is then in the buffer position. Thus, substrates of a first media type that are on the liftable stack support can be handled by the single substrate engager. When it is determined that a print job requires a different media type (or that the liftable stack support has been depleted or reached its maximum capacity), the liftable stack support is positioned, so that the drawer can move over the liftable stack support and any stack on it. Thereby, the releasable stack support of the drawer is positioned facing the single substrate engager on one side of it and the liftable stack support on an opposite side. The liftable stack support is lifted, so that it contacts the releasable stack support of the drawer. The releasable stack support is released, so that it is free of the remainder of the drawer. The rest of the drawer is then withdrawn back to the buffer position, leaving the releasable stack support on the stack on the liftable stack support. The liftable stack support can then be moved, so that the top of the releasable stack support or a stack on it is moved into the working range of the single substrate engager. This movement is achieved by moving the first liftable stack support. The releasable stack support may hold a stack of substrates of a different media type than those originally on the liftable stack support, so that this different media type may be used for the next print job. The releasable stack support may also be empty to stack thereon substrates of a certain print job, so that this print job is not mixed with the one on the liftable stack support. Thus, different print jobs requiring different media types can be easily and productively handled. The method further allows for printing of such print jobs without direct operator interference, as multiple drawers may be pre-loaded at the same time in preparation of such print jobs. Thereby the object of the present invention has been achieved.

[0006] More specific optional features of the invention are indicated in the dependent claims.

[0007] In an embodiment, the liftable stack support is lifted with the releasable stack support on it. The releasable stack support is supported by the stack on the liftable stack support.

[0008] The releasable stack support is raised and lowered by a drive that moves the liftable stack support. No additional drive for lifting is required. In another embodiment, a controller determines a height of a stack on the liftable stack support and a height of a stack in the respective drawers. Said heights are applied to position the top substrate in the working range of the single substrate engager. Since the stack heights change during operation, the controller tracks each stack height, for example by counting a number of substrates handled and/or by sensors for detecting the stack height.

[0009] In an embodiment, the method further comprises the step of moving a substrate between the first stack on the liftable stack support and the transport path by means of the single substrate engager. The single substrate engager may be configured to perform as a substrate feeder, which separates individual substrates from the stack on the first liftable stack support and supplies these to a transport path of the printer. The single substrate engager may also be configured to perform as a stacker, which receives individual substrates from the transport path and forms these into a single stack on the first liftable stack support. Only a one single substrate engager is required to handle substrates from all the drawers and the liftable stack support, resulting in a compact, low-costs device.

[0010] In an embodiment, the method further comprises the steps of:

- a first print job prescribing a first media type and a second print job defining a second media type different from the first;
- the single substrate engager engaging substrates from the first stack on the liftable stack support while performing the first print job; and
- the single substrate engager engaging substrates from a drawer while performing the second print job.

The first print job requires substrates of a first media type, that is assigned to the liftable stack support. A stack of substrates of the first media type is present on the liftable stack support during operation, except when the stack has been depleted or emptied. The drawer holds a stack of substrates of a second media type that corresponds to the requirements of the second print job. Before starting the second print job, the drawer is inserted, so that the correct media type is accessible to the single substrate engager.

[0011] In an embodiment, when released, the releasable stack support is supported only by the first stack on the liftable stack support. The releasable stack support is supported entirely by the stack on the liftable stack support. This allows the releasable stack support and any stack on it to move unhindered with the liftable stack support. In another embodiment, the step of releasing comprises raising the liftable stack support, so that it is free of guide beams. The drawer comprises guide beams which support the releasable stack support in the buffer position as well as during insertion and retraction. The releasable stack support is raised above the guide beams, so that it is free of the guide beams, while being supported by the first stack on the liftable stack support. This provides a simple means to transfer the releasable stack support from the drawer to the liftable stack support. By lowering the releasable stack support onto the guide beams, it may be transferred back to the drawer. Preferably, the guide beams are to the sides of the first stacks in a width direction perpendicular to the insertion direction of the drawer.

[0012] In an embodiment, the method further comprises the step of selecting the drawer to be inserted from a plurality of drawers. Multiple drawers, preferably at least two or three, are provided to provide versatility and allow the operator to prepare for multiple print jobs in advance. Preferably, the plurality of drawers, when not inserted, overlap one another when viewed in a lifting direction of the liftable stack support. In the buffer position, the drawers preferably the same position, when viewed in the lifting direction, to ensure a small footprint of the module. A drawer is selected based upon the media type which it currently holds. The media type for a drawer is set by an operator in the memory of the controller. By comparing the medias type requirements of a print job to the stored media types for each drawer, the controller can determined whether a drawer can be applied to handle a certain print job.

[0013] In an embodiment, the drawer is inserted in an insertion direction perpendicular to a lifting direction of the liftable stack support, which insertion direction is preferably parallel to a transport direction of the transport path. The single substrate engager substantially moves substrates between the transport path and a position over the liftable stack support in the transport direction of said transport path. The single substrate engager may further move in a limited manner in the lifting direction for the substrate stacking or separation, though said movement range is smaller than its range in the transport direction. This allows the liftable stack support to be movable in the width direction perpendicular to the transport direction and the lifting direction for rapidly loading and unloading stacks from the liftable stack support. Two liftable stack supports may be provided together on a sliding frame, so that when one liftable stack support is moved below the single substrate engager, the other is to the side of it and accessible for loading or unloading a pallet.

[0014] In an embodiment, the method further comprises the steps of:

- positioning the liftable stack support, so that the drawer is free to move under the releasable stack support, after completing a print job on the releasable stack support, followed by
- lowering the liftable stack support, so that the releasable stack support is supported on the drawer; and
- withdrawing the drawer with the releasable stack support to the buffer position.

After release, the releasable stack support is free of the rest of drawer. For retraction, the releasable stack support is positioned slightly above its guide beams as these are inserted. The releasable stack support is then lowered onto the guide beams by lowering the liftable stack support. The liftable stack support is lowered even further, so that the first stack does not contact the bottom side of the releasable stack support. It will be appreciated that herein it is referred to the surfaces of the releasable

stack support and the guide beams, which make direction contact. Other portions of the guide beam and the releasable stack support may different relative positions. In another embodiment, the releasable stack support comprises a flat bottom surface. The bottom surface of the releasable stack support is preferably free from any protrusions which could result in indentations in the top substrate of the first stack. Preferably, the same applies to the top surface with regard to the bottom substrate in a stack on the releasable stack support.

[0015] The present invention further relates to a print substrate stack handling module comprising:

- a single substrate engager for moving a single substrate between a transport path of a printer and a stack of substrates on a liftable stack support;
- a plurality of drawers independently moveable between a buffer position on a side of the liftable stack support and an active position overlapping the liftable stack support, when viewed in a lifting direction of the liftable stack support, wherein each drawer comprises a releasable stack support, which releasable stack support is configured to be released from the drawer in the active position, so that the drawer can be withdrawn to the buffer position, leaving the releasable stack support over the liftable stack support, so that the releasable stack support can be raised by means of the liftable stack support towards the single substrate engager.

[0016] The different drawers can hold or receive stacks of substrates of a different media type from that of the first stack on the liftable stack support. In case a print job requires a different media type, the corresponding drawer is inserted over any stack present on the liftable stack support. The top substrate of the first stack on the liftable stack support can then be brought into contact with the releasable stack support, so that the releasable stack support is transferred from the respective drawer to the liftable stack support. The height position of the releasable stack support can then be controlled by moving the liftable stack support. The respective drawer is then preferably withdrawn to its buffer position besides the liftable stack support to allow the liftable stack support to move unhindered. The liftable stack support can then be moved to position the releasable stack support and any stack on it in the working range of the single substrate engager, so that substrates can be stacked onto or separated from the releasable stack support. Upon completion of the respective print job, the releasable stack support can be returned to the drawer, so that printing from the first stack on the liftable stack support may continue. Having a plurality of such drawers allows the stack handling module to handle different print jobs in absence of an operator.

[0017] In an embodiment, each drawer comprises guide rails, support beams, and an actuator, which support beams are configured to releasably support the releasable stack support and wherein the support beams are mounted movably onto the guide rails, such that the actuator can move the drawer between buffer position and the active position. The actuator is arranged to slide the support beams and the releasable stack support along the guide beams back and forth between the active position over the liftable stack support and the buffer position. The sliding direction is preferably perpendicular to the lifting direction. The releasable stack support is releasably supported on the guide beams. Preferably, the releasable stack support lies freely on the guide beams, so that it can be released by moving it vertically away from the guide beams during operation against the direction of gravity. The guide beams may comprise holders to restrict displacement of the releasable stack support in the horizontal directions. In another embodiment, the support beams are arranged to support only a bottom side of the releasable stack support at opposing edges of the releasable stack support extending in an insertion direction of the drawer. Lifting the liftable stack support then releases the releasable stack support from the guide beams in a simple and compact manner.

[0018] In an embodiment, after having been released, the releasable stack support is free of the remainder of the drawer, so that the liftable stack support is able to freely move the releasable stack support towards the single substrate engager. After release, the guide beams of the respective drawer are retracted to the buffer position out of the path of the liftable stack support.

[0019] In an embodiment, the drawers are arranged to move perpendicularly to the lifting direction of the liftable stack support, such that the releasable stack supports in their buffer positions do not overlap with the liftable stack support. The drawers in their buffer positions are to a side of the liftable stack support when viewed in the lifting direction. Preferably, the drawers in their buffer positions are on an opposite side of the liftable stack support with respect to the transport path of the printer.

[0020] In an embodiment, the drawers in their buffer positions overlap with one another when viewed in the lifting direction of the liftable stack support. Preferably, the drawers are configured the same or similarly having for example the same structure and/or dimensions.

[0021] The present invention further relates to a printer comprising the print substrate stack handling module as described above. The printer is preferably an inkjet printer capable of handling large substrates, such as B3 or B2 media in the form of cardboard, rigid sheets, panels, etc. The printer, specifically the print substrate stack handling module, is configured to load and/or unload stacks of such substrates on a pallet into and/or out of the print substrate stack handling module.

[0022] Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the present invention, are given by way of illustration only, since various

changes and modifications within the spirit and scope of the present invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Fig. 1	is a schematic side view of a print substrate stack handling module according to the present invention;
Figs. 2 t/m 14	are schematic side views of different steps of feeding substrates by means of the print substrate stack handling module in Fig. 1;
Figs. 15 and 16	are schematic front views of the different steps of feeding substrates by means of the print substrate stack handling module in Fig. 1 during different steps; and
Fig. 17	is a schematic top view of the print substrate stack handling module in Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The present invention will now be described with reference to the accompanying drawings, wherein the same reference numerals have been used to identify the same or similar elements throughout the several views.

[0025] Fig. 1 schematically illustrates a print substrate stack handling module 1 for supplying and/or receiving substrates to and/or from a printer (not shown) via a transport path 30. The transport path 30 is in Fig. 1 illustrated as a transport device 31 comprising an endless transport belt 32. The transport device 31 is configured to move a substrate in the transport direction X between the printer and the stack handling module 1. The substrate may move either towards the stack handling module 1 to be stacked or away from the stack handling module 1 to be printed on.

[0026] The stack handling module 1 comprises lifting device 10, which a liftable stack support 13. A drive 14 is provided to move the liftable stack support 13 in the liftable direction Z with respect to the frame 15 of the stack handling module 1. The drive 14 may e.g. comprise a motor connected to a cable, spindle, or rack and pinion system to raise and lower the liftable stack support 13 while it remains horizontal. The liftable stack support 13 is configured as a pallet support, which is dimensioned to hold at least one entire pallet 12. Preferably the liftable stack support has a pallet support surface of at least 1200x800 mm. During operation, the pallet 12 is supported on the liftable stack support 13 and holds a stack of substrates 11. It will be appreciated that during operation the liftable stack support 13 may be temporarily empty for example, at the start of a print job or during (un)loading operations.

[0027] The drive 14 is configured to move and maintain the top of the stack 11 in a working range of a single substrate engager 20. The single substrate engager 20 is configured to engage and hold a single substrate and transfer it between the transport path 30 and the liftable stack support 13. The single substrate engager 20 comprises a holding device 21 in the form of suction cups or other temporary holding means, such as clamps. The holding device 21 can hold a single substrate. The holding device 21 is provided on a support 22, which is movably mounted on the guide beam 23. The support 22 can move along the beam 23 in the transport direction X, so that the holding device 21 while holding a substrate can move between the transport path 30 and the liftable stack support 13. At either of the lateral location, the holding device 21 may release or pick up an individual substrate. The holding device 21 is preferably further movable in the lifting direction Z within a limited working range to separate an individual substate from a stack 11 or the belt 32. Alternatively, the drive 14 can be operated to temporarily lower the stack. In another embodiment, the single substrate engager comprises a blower for blowing an air flow against a side of the stack, thereby at least partially releasing the top substrate from the rest of the stack. Limiters, such as plates or stops, may be provided at edges of the stack to prevent the top substrate from becoming mispositioned, as it at least partially floats over the stack. Such a blower is known from e.g. US 2012/0086163 A1, which is incorporated herein by reference. In addition, one or more transport belts may be provided to move a substrate from the stack in the transport direction. A suction unit may further be provided to draw the top substrate against the one or more transport belts, for example as disclosed in US 2011/0272S77 A1, which is incorporated herein by reference. Similarly, the single substrate engager can be part of a stacker, for example one with parallel transport belts which transport the substrate over a stack. The multiple, parallel belts may temporarily deform the substrate , so that it comprises a profile to increase its rigidity, such as a wavey or sinusoidal profile. Additional stacking aids, such as a blower and/or a side edge jogger may be provided additionally.

[0028] Beside the lifting device 10 in the transport direction X, a plurality of drawers 40, 40', 40" are provided. Each drawer 40, 40', 40" is configured similarly. The drawers 40, 40', 40" in Fig. 1 are positioned in their buffer positions P0, wherein the drawers 40, 40', 40" have the same position in the horizontal X and Y directions, so that these overlap when viewed in the lifting direction Z. The lifting direction Z during operation is the vertical direction, while the X, Y directions are in the horizontal

plane. Each drawer 40, 40', 40" comprises a releasable stack support 42 configured to hold a stack of substrates 41. The releasable stack support 42 is supported on supports beams 43, which support beams 43 are slidably mounted on the guide rails 44, so that the releasable stack support 42 can translate in the transport direction X by sliding the support beams 43 over the guide rails 44.

[0029] Fig. 2 illustrates the stack handling module 1 in a step of supplying a substrate from the first stack 11 on the liftable stack support 13 of the lifting device 10. The drawers 40 are all in their buffer positions P0, so that the first stack 41 is accessible to the single substrate engager 20. The drive 14 is controlled to maintain the top of the first stack 41 at the first position P1 in the working range of the single substrate engager 20, so that the top substrate is near the holding device 21. The holding device 21 is then lowered to engage and hold the top substrate. Consequently the holding device 21 is raised while holding the top substrate, so that the top substrate is separated from the stack 41. As shown in Fig. 3, the holding device 21 with the substate 16 is then moved in the transport direction X towards the belt 32 forming the transport path 30 by sliding the support 22 along the guide beam 23. There, the holding device 21 releases the substrate 16, so that is positioned on the belt 32. The belt 32 then carries the substrate 16 towards a printing assembly (not shown) of the printer for printing an image on the substate 16. The holding device 21 is then returned to its position in Fig. 2 over the liftable stack support 13 for engaging another substrate from the fist stack 11. These steps may be repeated for performing one or more print jobs, which require substrates 16 of the media type provided on the liftable stack support 13. The first stack 11 depletes during operation. The drive 13 is controlled to compensate for this depletion to maintain the top of the stack 11 in the working range of the single substrate engager 20, since the holding device 21 may only be arranged to move in the lifting direction Z within a limited range. In the examples in Figs. 1 to 17, the stack handling module 1 is configured to operate as a supply device to separate individual substrates from a stack 11 into a printer, but it will be appreciated the stack handling module 1 may be configured as a stacker as well, wherein substrates are received from the printer and stacked on top of one another.

[0030] Fig. 4 illustrates the step of lowering the liftable stack support 13 to create an insertion space for a drawer 40. It has been determined that for an upcoming print job a different media type than the one currently loaded on the liftable stack support 13 is required. The required media type is available on the releasable stack support 42 as the stack 41. At the moment the controller of the printer determines that the different media type of the stack 41 is required, the liftable stack support 13 is moved, so that it and any stack 11 on it do not overlap with the respective drawer 40 when viewed in the transport direction X. The controller during operation constantly determines the height of the stack 11 on the liftable stack support 13, e.g. by sensors and/or counting the number of substrates added or removed. This allows the controller to ensure that the top of the stack 11 on the liftable stack support 13 can be positioned in a position P2 below the drawer 40 in its buffer position P0, as in Fig. 4 at any time.

[0031] With the top of the stack 11 on the liftable stack support 13 in the second position P2 below the drawer 40, the drawer 40 in Fig. 5 is actuated to move in the transport direction X. Therein a motor (not shown) pushes the guide beams 43 along the guide rails 44, so that the releasable stack support 42 is positioned over the liftable stack support 13. The releasable stack support 42 with the second stack 41 of the different media type thus slides above the liftable stack support 13 until it is positioned within the working range of the single substrate engager 20, at least in the transport direction X, so that the releasable stack support 42 is in its operative position P4. A stop element may be provided on the frame 15 to ensure that the releasable stack support 42 stops in the operative position P4.

[0032] In Fig. 6, the drive 14 is controlled to drive the liftable stack support 13, so that the top of the first stack 11 reaches the fifth position P5, wherein it contacts the bottom side of the releasable stack support 42 in the operative position P4. Thereby, the releasable stack support 42 can be raised some distance above the support beams 43, so that the releasable stack support 42 is released from the drawer 40. The motor of the drawer 40 is then controlled to withdraw the guide beams 43 back to the buffer position P0. Since the guide beams 43 no longer contact the releasable stack support 42, the guide beams 43 move in the transport direction X, while the releasable stack support 42 remains stationary on the first stack 11. The guide beams 43 are retracted to the buffer position P0, so that these do not obstruct the movement of the stack 11, 41 on the liftable stack support 13, resulting in the situation shown in Fig. 7.

[0033] In Fig. 8, the drive 14 is controlled to raise the top of the second stack 41, which is on the first stack 11, into the working range of the single substrate engager 20. The releasable stack support 42 is supported entirely on the first stack 11, so that by moving the liftable stack support 13 both stacks 11, 41 move together in the lifting direction Z. The drive 14 stops the liftable stack support 13 in the sixth position P6 when the top substrate of the second stack 41 is in reach of the holding device 21. Individual substrates 46 of the different media type can now be fed into the printer via the holding device 21, as shown in Fig. 9. Thus a print job requiring this different media type can be performed without changing the main stack 11 on the liftable stack support 13.

[0034] In Fig. 10, the print job requiring the different media type has been completed. The second stack 41 has been entirely depleted, so the liftable stack support 13 has reached its seventh position P7. The controller determines the completion of the latter print job and determines that a further print job requiring substrates

from the first stack 11 is scheduled next. Fig. 11, illustrates the optional step of lowering the liftable stack support to the fifth position P5, so that the releasable stack support 42 is slightly below the guide beams 43. In Fig. 12, the guide beams 43 are then again inserted from its buffer position P0 to its operative position P4. The insertion can be performed while the releasable stack support 42 is (slightly) above the guide beams 43, for example in the fifth position P5. The drive 14 may during the insertion already be actuated to lower the releasable stack support 42 while keeping it slightly above the guide beams 43. In Fig. 13, the drive 14 lowers the liftable stack support 13 to the eight position P8 until the releasable stack support 42 contacts and rests on the guide beams 43. Thereby, the releasable stack support 42 is released from the first stack 11. The eight position P8 is lower than the fifth position P5, as in the eight position P8 the releasable stack support 42 contacts the guide beams 43, while in the fifth position P5, the releasable stack support 42 is raised above the guide beams 43, so that these are free to be retracted or inserted below the releasable stack support 42. Since the guide beams 43 in the eight position P8 contact the releasable stack support 42, the releasable stack support 42 may be retracted to the buffer position P0 by sliding the guide beams 43 along the guide rails 44, as shown in Fig. 14. Preferably after reaching the eight position P8, the liftable stack support 13 is lowered further, so that there is no direct contact between the releasable stack support 42 and the first stack 11.

[0035] Feeding substrates from the first stack 11 may then continue by raising the liftable stack support 13 back to the first position P1. By having a plurality of drawers 40, 40', 40" an operator may handle different print jobs for different print media in an efficient manner. The drawers 40, 40', 40" may be loaded and unloaded, while the stack handling module 1 continues to handle substrates from or to the first stack on the liftable stack support 13. Additionally, the insertion of a drawer 40, 40', 40" may be performed without direct operator interference, allowing for the substantially unattended printing of such print jobs. The operator may also load and unload the different drawers 40, 40', 40" at the same time, allowing for a productive planning of print jobs. It will be appreciated that in addition to the above example, the stack handling module 1 may also be configured to stacks substrates from the transport path onto the stack supports 13, 42. Additionally, while utilizing a drawer 40, 40', 40", the operator may also load or unload substrates from the liftable stack support 13. A drawer 40, 40', 40" may even hold the same media type as the liftable stack support 13, so that it can be used as a temporary buffer when the operator re-supplies the liftable stack support 13. Thus, printing can be performed productively with a minimum interruption.

[0036] Fig. 15 illustrates the drawer in the eight position P8. Therein the releasable stack support 42 is supported on the support beams 43, which in turn are supported by the guide rails 44. In the width direction Y, the releasable stack support 42 has a width larger than the maximum substrate support area of the releasable stack support 42 and that of the liftable stack support 13. This allows the first stack 11 to be insert in between the guide beams 43, when raising the liftable stack support 13 to be fifth position P5 to lift the releasable stack support 42 from the guide beams 43, as illustrated in Fig. 16. It will be appreciated that the drawers 40 may hold substrates with dimensions larger than those fitting onto the liftable stack support 13. The distance between the support beams 43 in the width direction Y is wider than the width of the first stack 11. This allows the first stack 11 to be raised into contact with the releasable stack support 42 as shown in Fig. 16.

[0037] Fig. 17 illustrates a top view of a drawer 40. The releasable stack support 42 as well as the liftable stack support 13 may be provided with alignment elements 47 positioned and dimensioned to a variety of commonly used media sizes, for example A0-A5, B0-B5, letter, etc. The alignment elements 47 are formed as stops, such as protrusions in the lifting direction Z which limit movement of a substrate in the X, Y directions. Additionally and/or alternatively, the position of a substrate in X, Y directions may be correct by sensing its position and according moving the holding device 21 while holding the substrate in the X, Y directions.

[0038] Although specific embodiments of the invention are illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are examples only and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0039] It will also be appreciated that in this document the terms "comprise", "comprising", "include", "including", "contain", "containing", "have", "having", and any variations thereof, are intended to be understood in an inclusive (i.e. non-exclusive) sense, such that the process, method, device, apparatus or system described herein is not limited to those features or parts or elements or steps recited but may include other elements, features, parts or steps not expressly listed or inherent to such process, method, article, or apparatus. Furthermore, the terms "a" and "an" used herein are intended to be understood as meaning one or more unless explicitly stated otherwise. Moreover, the terms "first", "second", "third", etc. are used merely as labels, and are not intended to

impose numerical requirements on or to establish a certain ranking of importance of their objects.

[0040] The present invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. A method of printing comprising the steps of:

- inserting a drawer (40, 40', 40") comprising a releasable stack support (42) over a first stack (11) of substrates on a liftable stack support (13);
- releasing the releasable stack support (42) from the drawer (40, 40', 40"), such that the releasable stack support (42) is supported by the first stack (11) on the lift stack support (13);
- lifting the releasable stack support (42) within a working range of a single substrate engager (20) by lifting the liftable stack support (13);
- moving a substrate (46) between the releasable stack support (42) and a transport path (30) of a printer by means of the single substrate engager (20);
- withdrawing the releasable stack support (42); and
- lifting the liftable stack support (13), so that the first stack (11) is positioned within the working range of the single substrate engager (20).

2. The method according to claim 1, further comprising the step of moving a substrate (16) between the first stack (11) on the liftable stack support (13) and the transport path (30) by means of the single substrate engager (20).

3. The method according to any of the previous claims, further comprising the steps of:

- a first print job prescribing a first media type and a second print job defining a second media type different from the first;
- the single substrate engager (20) engaging substrates (16) from the first stack (11) on the liftable stack support (13) while performing the first print job; and
- the single substrate engager (20) engaging substrates (46) from a drawer (40, 40', 40") while performing the second print job.

4. The method according to any of the previous claims, wherein, when released, the releasable stack support (42) is supported only by the first stack (11) on the liftable stack support (13).

5. The method according to any of the previous claims, further comprising the step of selecting the drawer (40, 40', 40") to be inserted from a plurality of drawers (40, 40', 40").

6. The method according to claim 5, wherein the plurality of drawers (40, 40', 40"), when not inserted, overlap one another when viewed in a lifting direction (Z) of the liftable stack support (13).

7. The method according to any of the previous claims, wherein the drawer (40, 40', 40") is inserted in an insertion direction (X) perpendicular to a lifting direction (Z) of the liftable stack support (13), which insertion direction (X) is preferably parallel to a transport direction (X) of the transport path (30).

8. The method according to any of the previous claims, further comprising the steps of:

- positioning the liftable stack support (13), so that the drawer (40, 40', 40") is free to move under the releasable stack support (42), after completing a print job on the releasable stack support (42), followed by
- lowering the liftable stack support (42), so that the releasable stack support (42) is supported on the drawer (40, 40', 40"); and
- withdrawing the drawer (40, 40', 40") with the releasable stack support (42).

9. A print substrate stack handling module (1) comprising:

- a single substrate engager (20) for moving a single substrate (16, 46) between a transport path (30) of a printer and a stack (11, 41) of substrates (16, 46) on a liftable stack support (13);
- a plurality of drawers (40, 40', 40") independently moveable between a buffer position (P0) on a side of the liftable stack support (13) and an active position (P4) overlapping the liftable stack support (13), when viewed in a lifting direction (Z) of the liftable stack support (13), wherein each drawer (40, 40', 40") comprises a releasable stack support (42), which releasable stack support (42) is configured to be released from the respective drawer (40, 40', 40") in the active position (P4), so that the drawer (40, 40', 40") can be withdrawn to the buffer position (P0), leaving the releasable stack support (42) over the liftable stack support (13), so that the releasable stack support (42) can be raised by means of the liftable stack support (13) towards the single substrate engager (20).

10. The print substrate stack handling module (1) according to claim 9, wherein each drawer (40, 40', 40") comprises guide rails (44), support beams (43), and an actuator, which support beams (43) are configured to releasably support the releasable stack support (42) and wherein the support beams (42) are mounted movably onto the guide rails (44), such that the actuator can move the drawer (40, 40', 40") between the buffer position (P0) and the active position (P4).

11. The print substrate stack handling module (1) according to claim 10, wherein the support beams (43) are arranged to support only a bottom side of the releasable stack support (42) at opposing edges of the releasable stack support (42) extending in an insertion direction (X) of the drawer (40, 40', 40").

12. The print substrate stack handling module (1) according to claim 10 or 11, wherein after having been released, the releasable stack support (42) is free of the remainder of the drawer (40, 40', 40"), so that the liftable stack support (13) is able to freely move the releasable stack support (42) towards the single substrate engager (20).

13. The print substrate stack handling module (1) according to any of the claims 10 to 12, wherein the drawers (40, 40', 40") are arranged to move perpendicularly to the lifting direction (Z) of the liftable stack support (13), such that the releasable stack supports (42) in their buffer positions (P0) do not overlap with the liftable stack support (13).

14. The print substrate stack handling module (1) according to claim 13, wherein the drawers (40, 40', 40") in their buffer positions (P0) overlap with one another when viewed in the lifting direction (Z) of the liftable stack support (13).

15. A printer comprising the print substrate stack handling module (1) according to any of the claims 9 to 14.

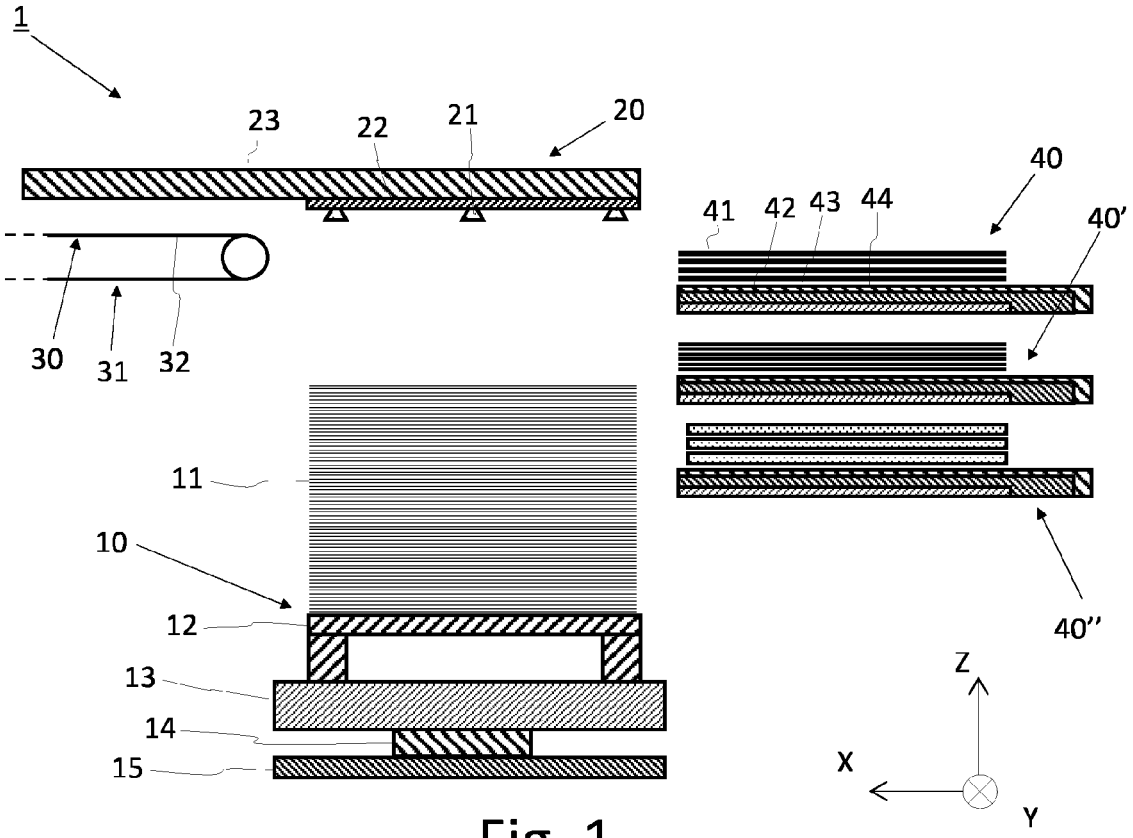
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Fig. 1

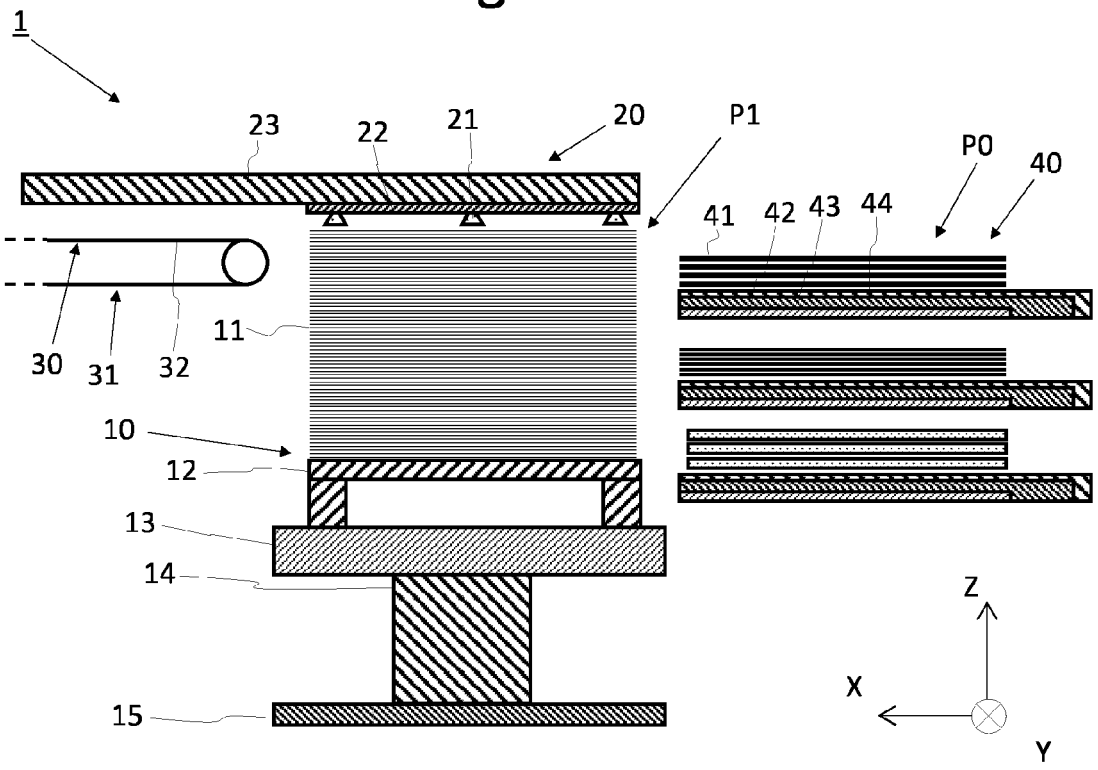
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Fig. 2

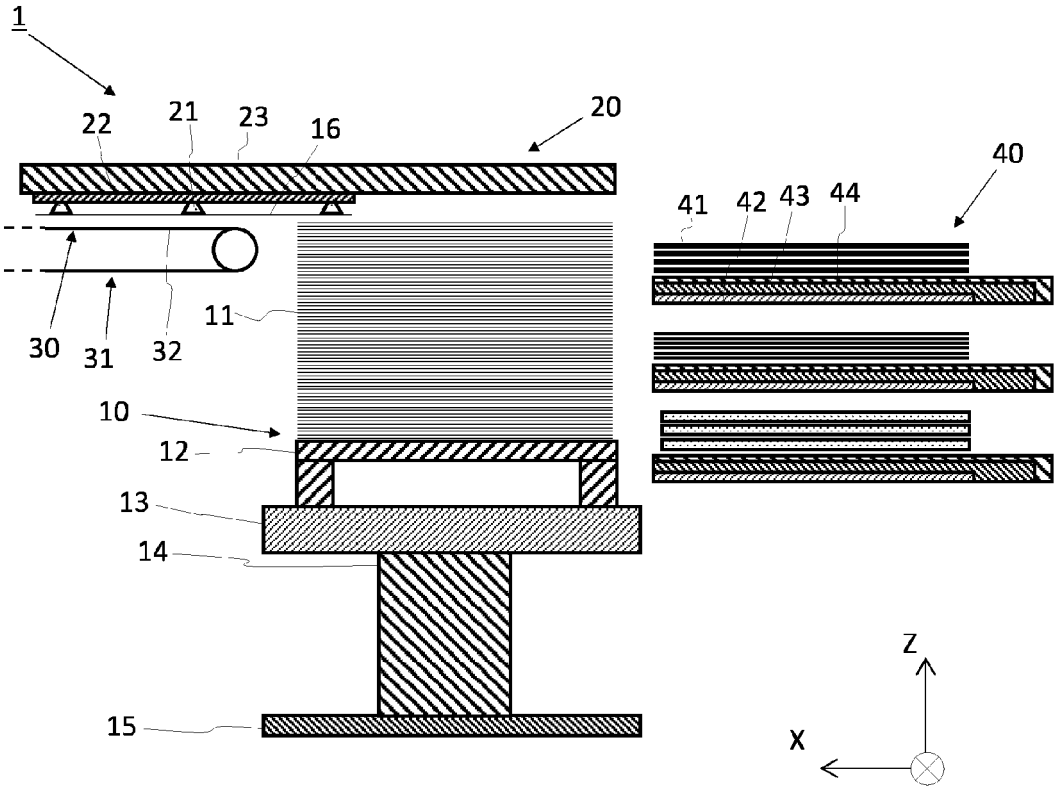
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Fig. 3

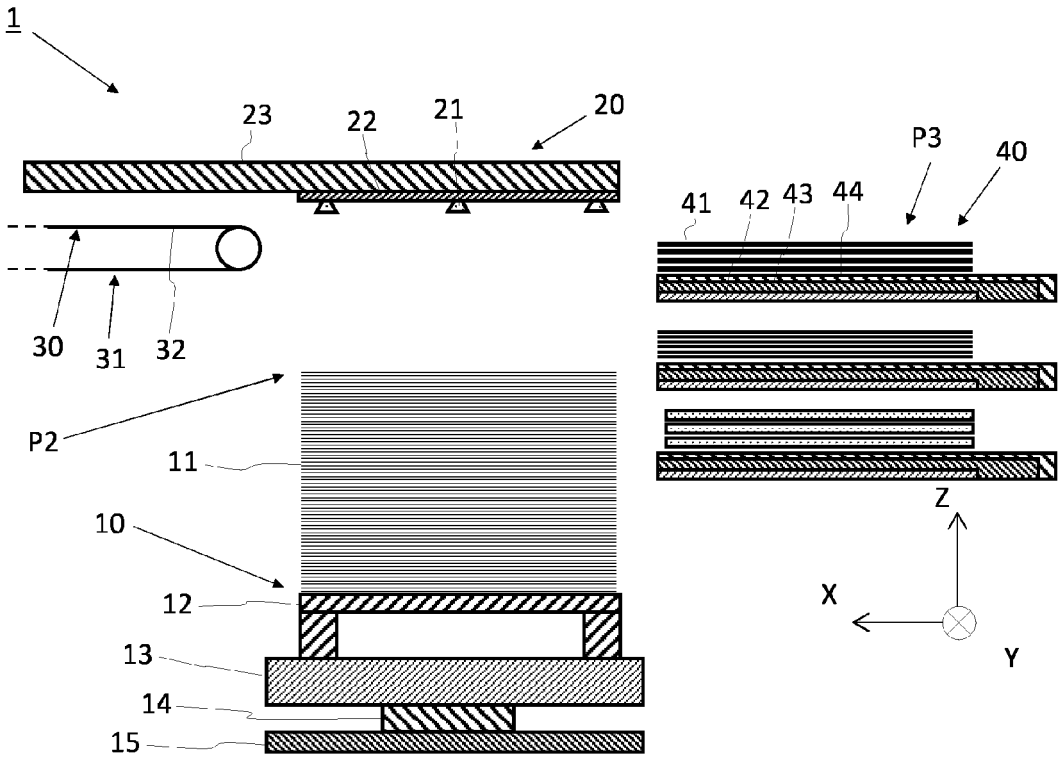
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Fig. 4

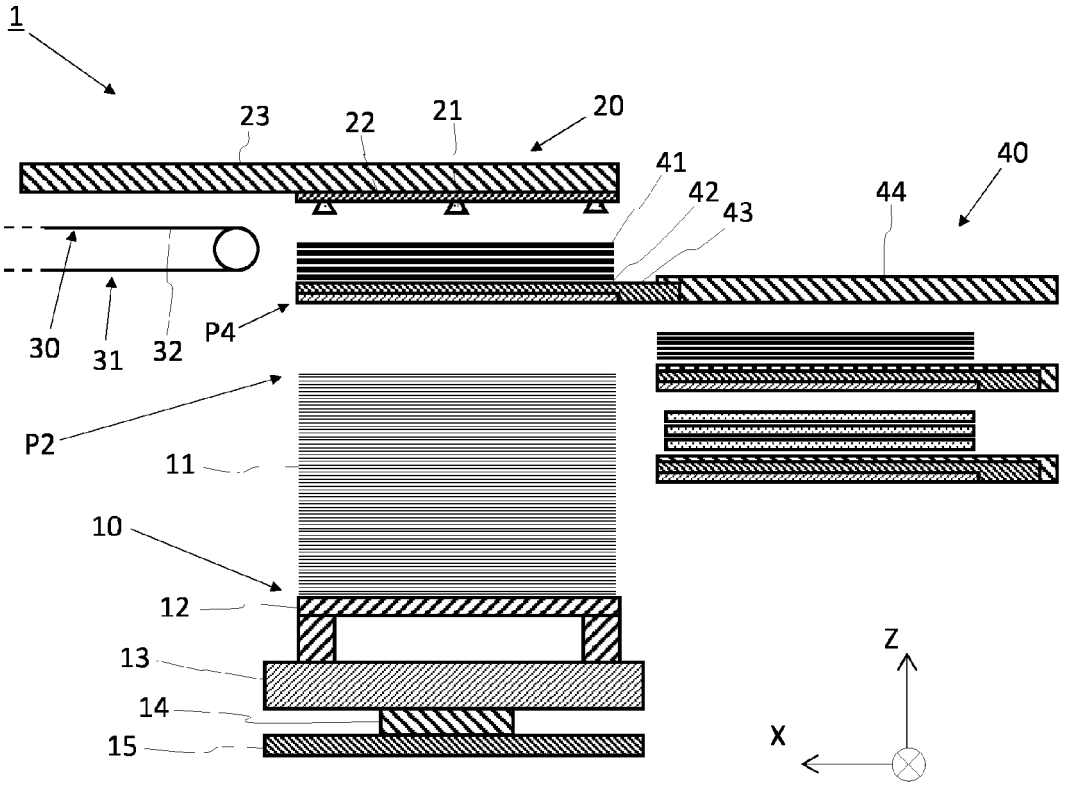
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Fig. 5

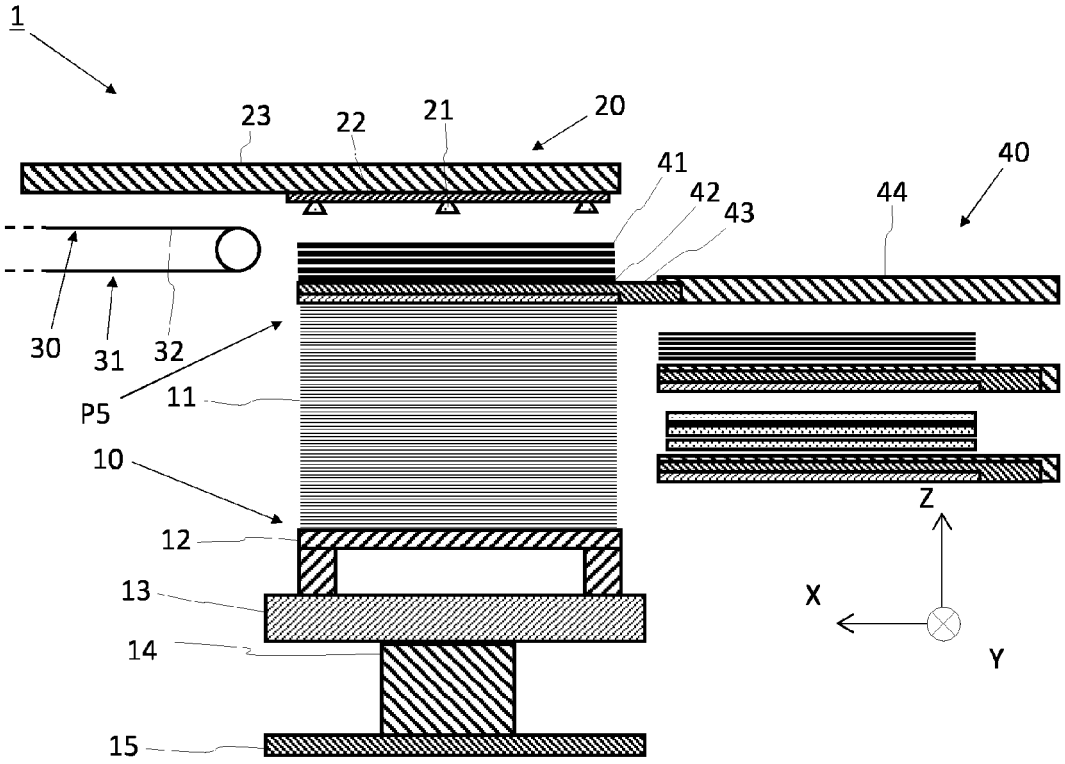
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Fig. 6

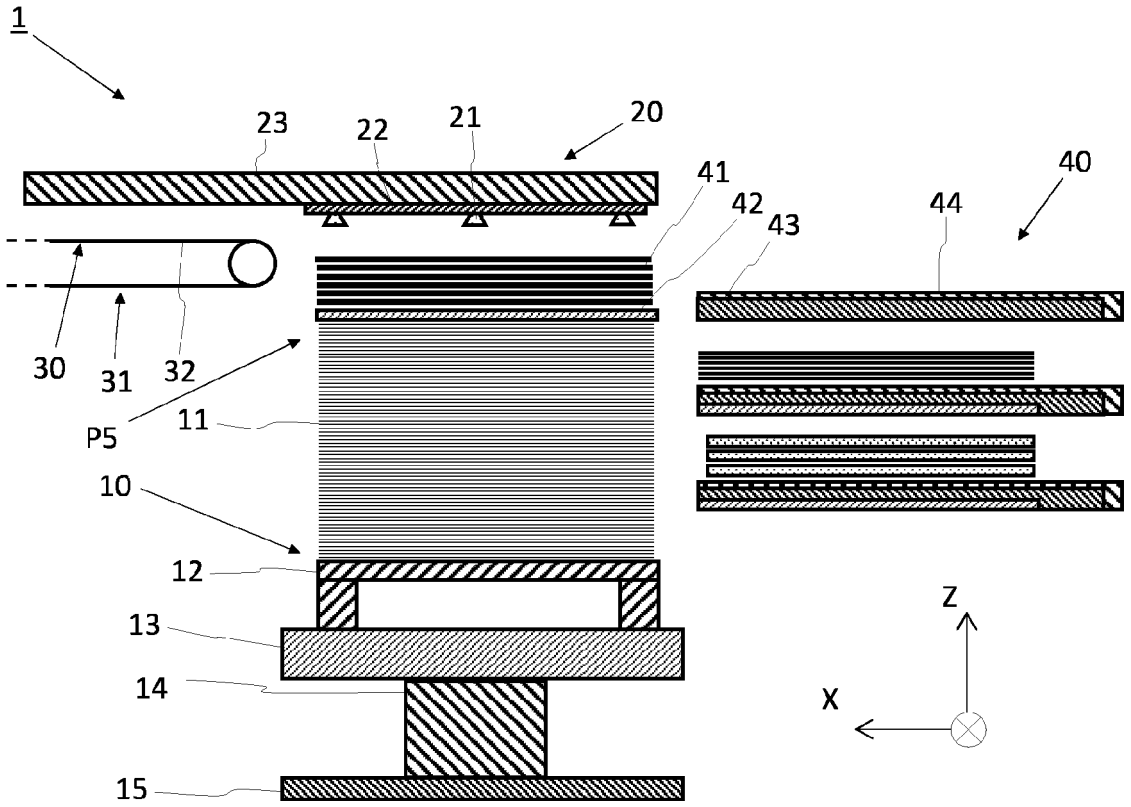
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Fig. 7

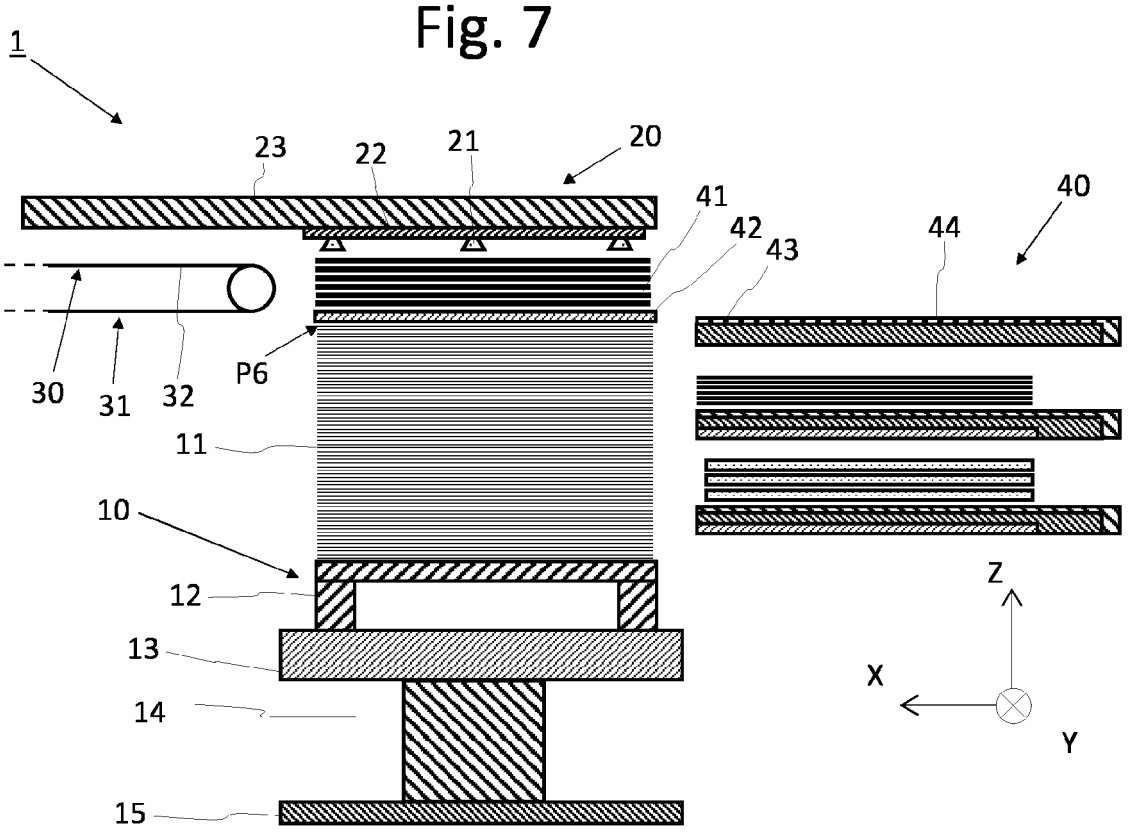
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Fig. 8

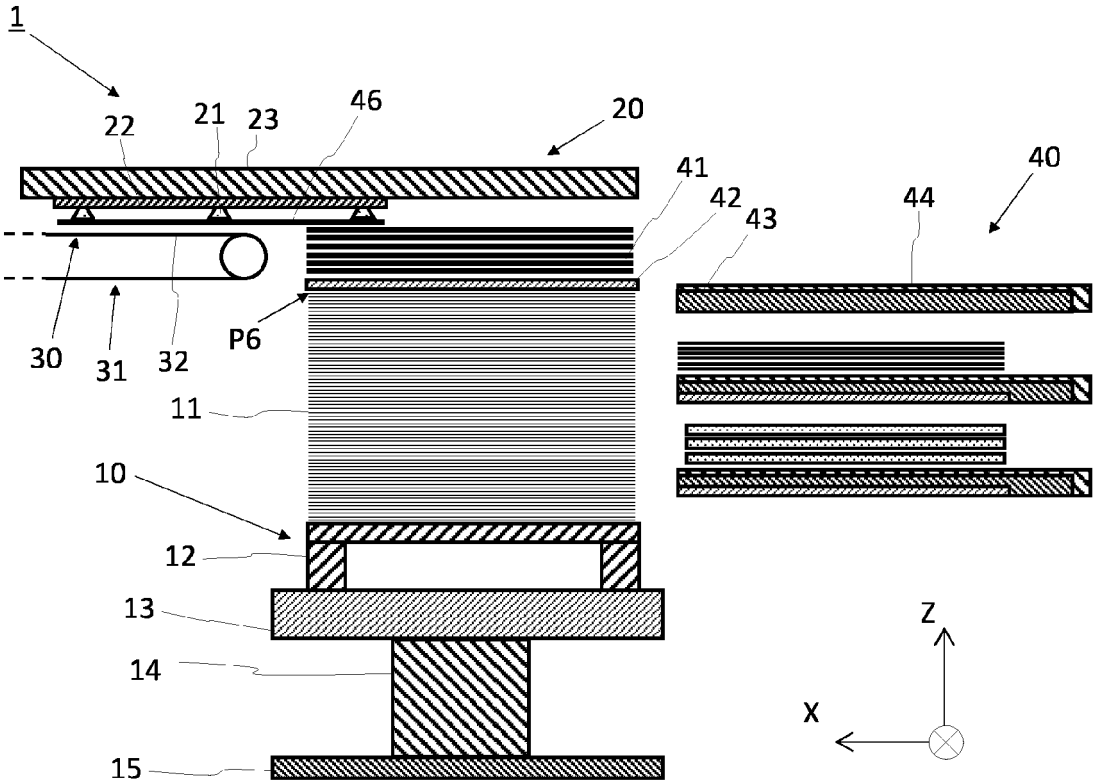
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Fig. 9

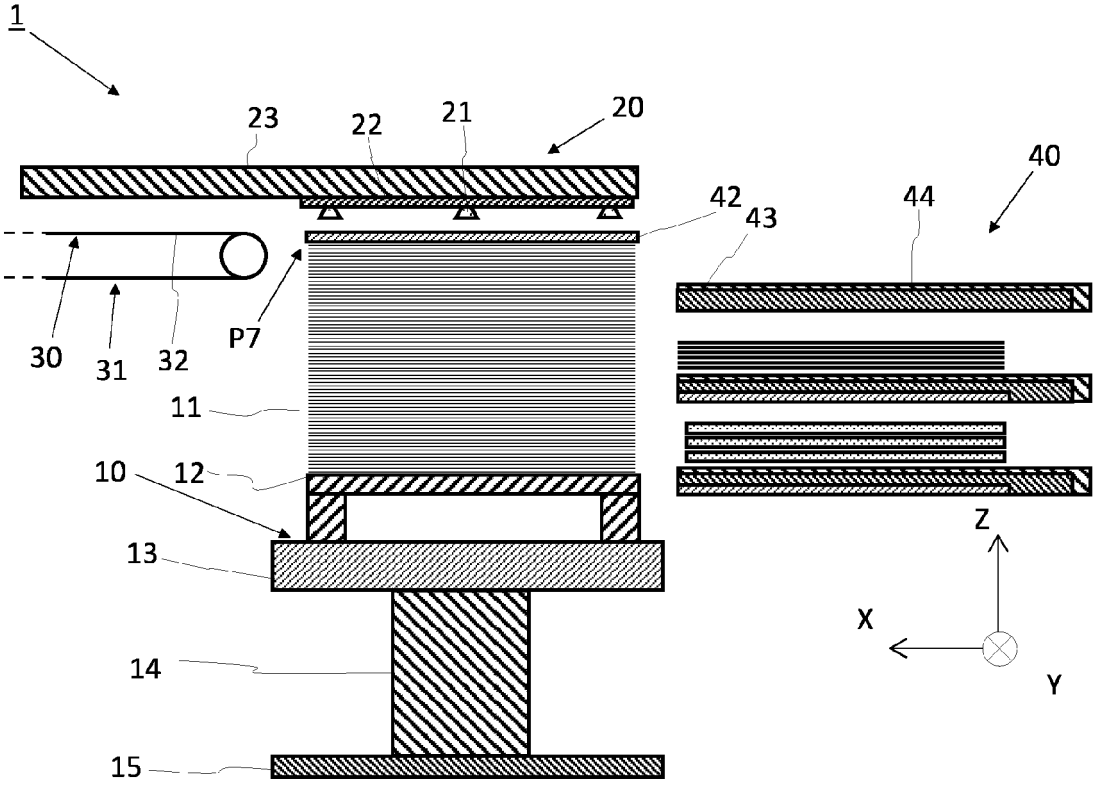
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Fig. 10

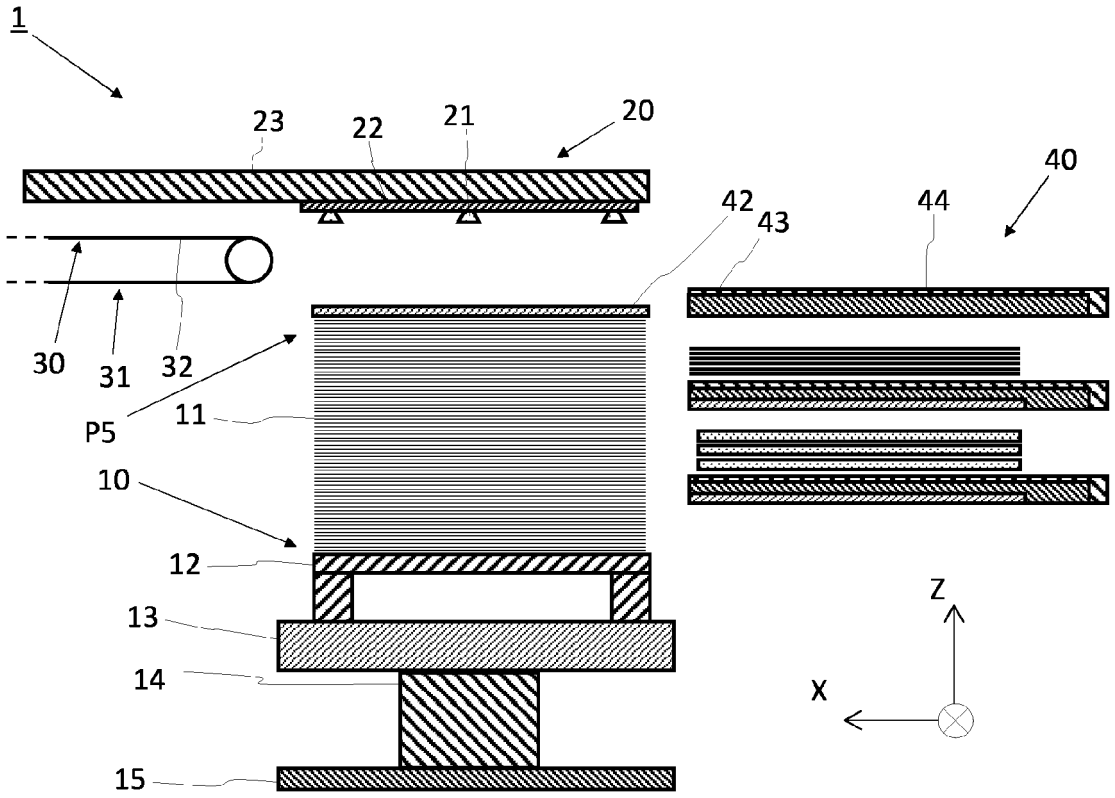
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Fig. 11

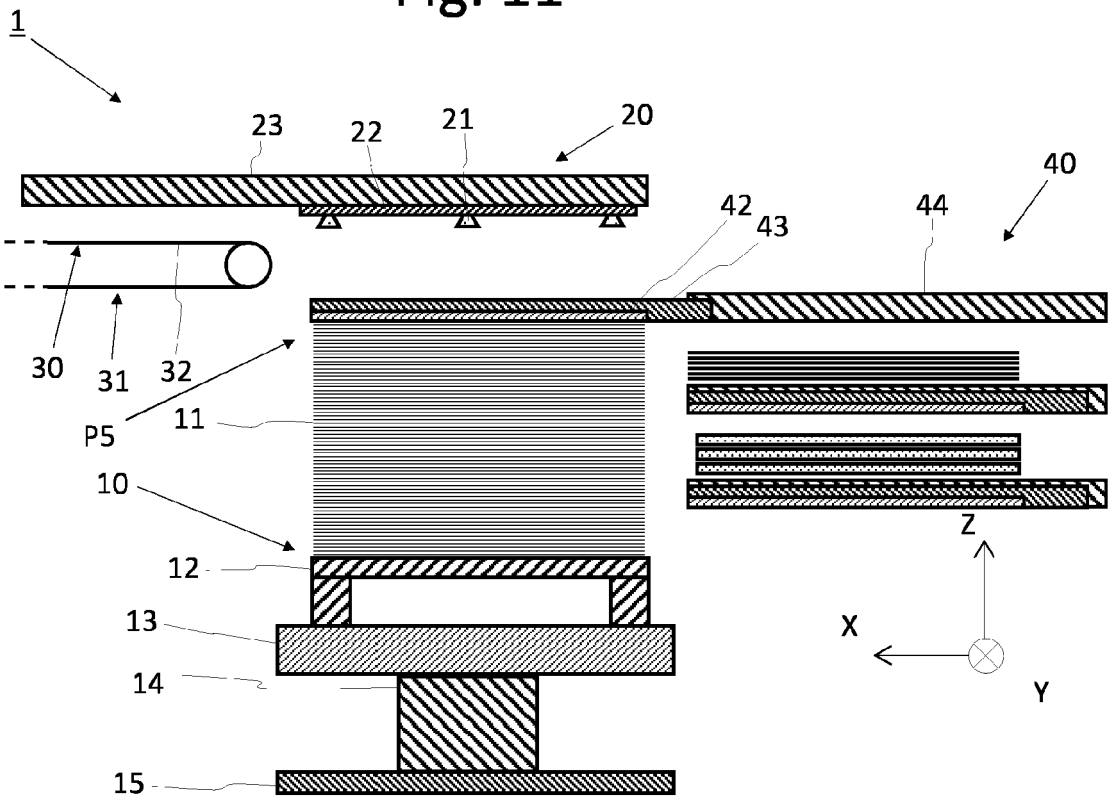
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Fig. 12

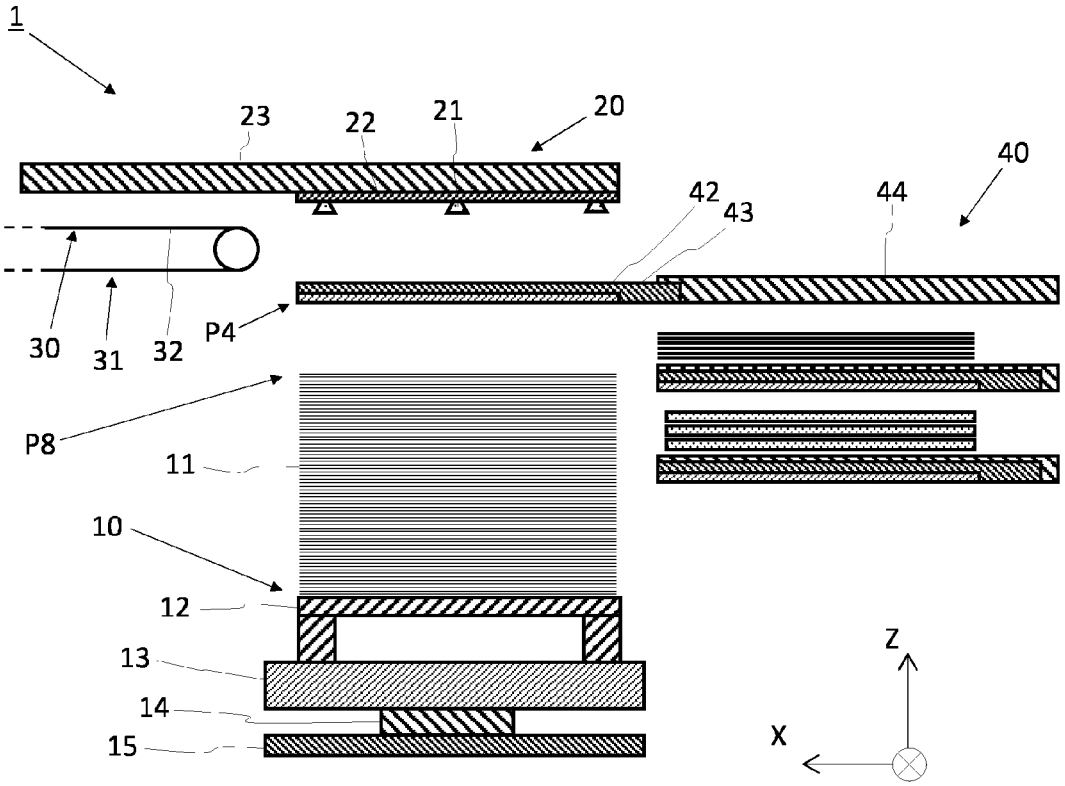
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Fig. 13

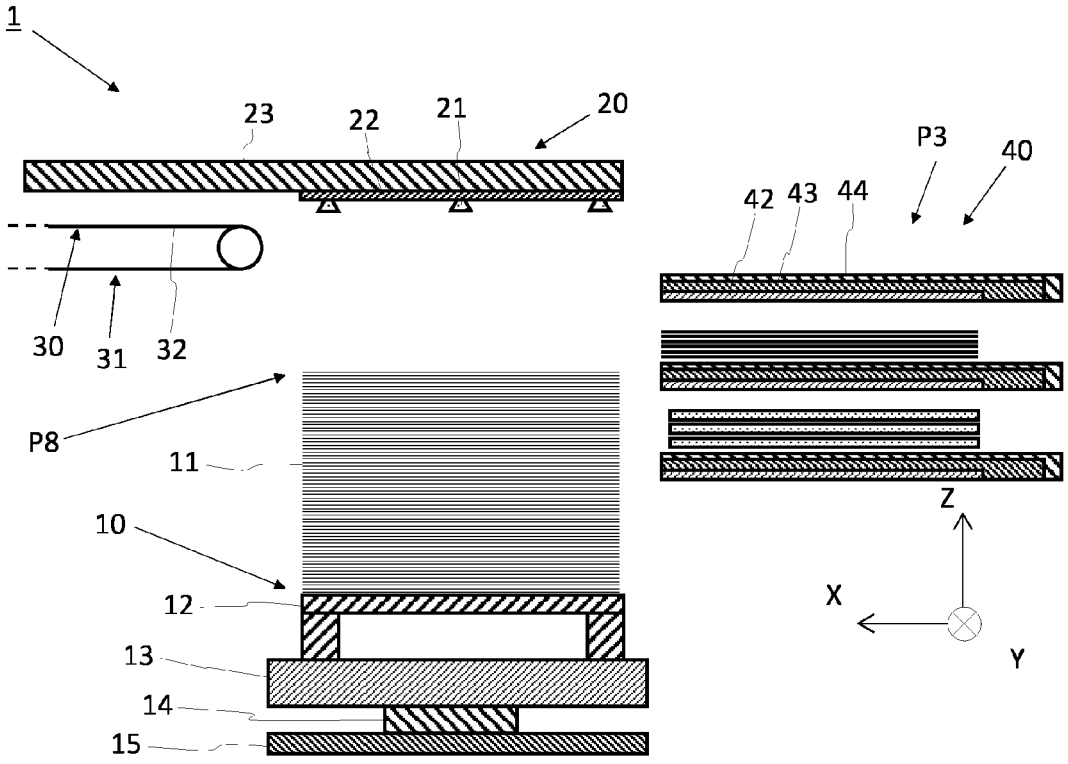
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Fig. 14

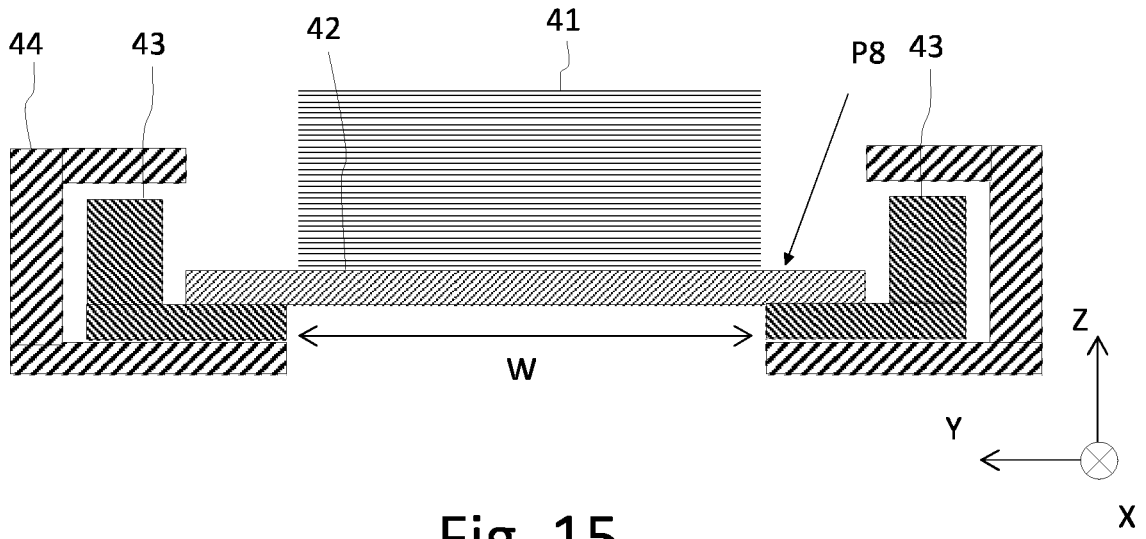

Fig. 15

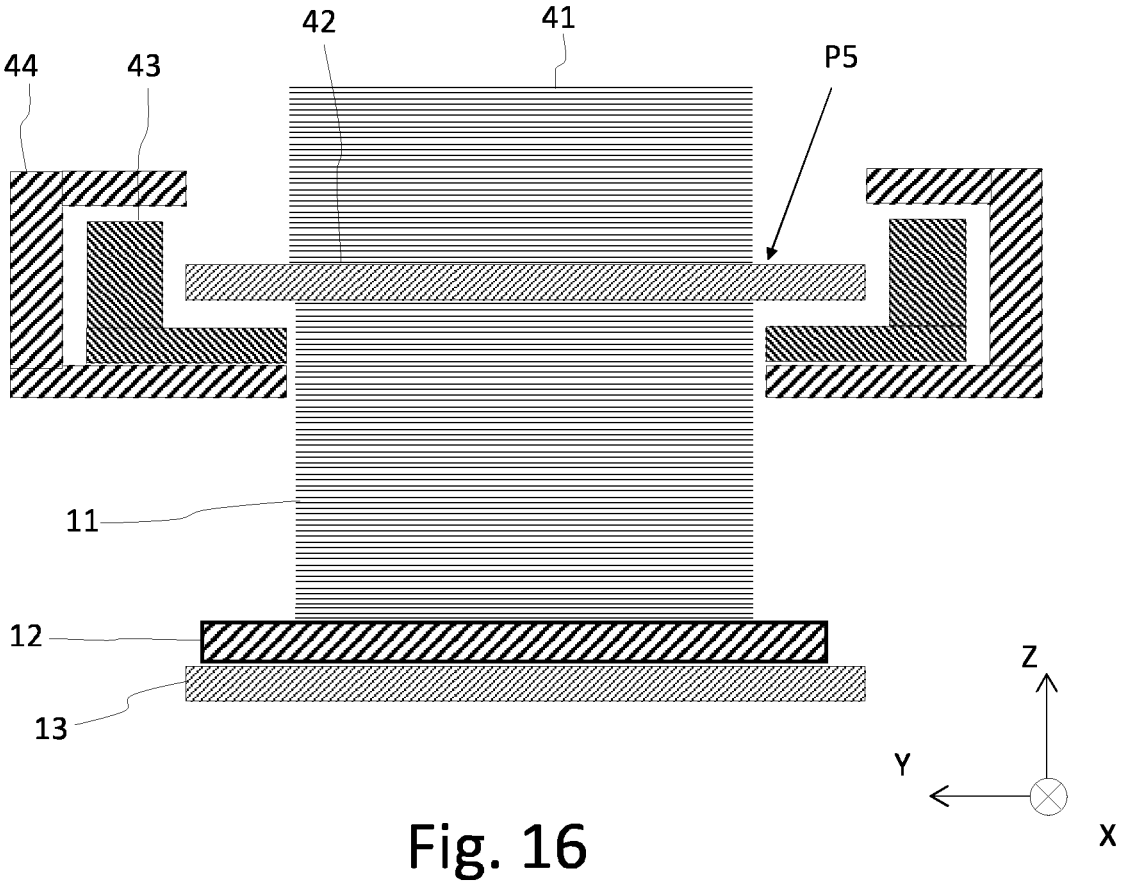

Fig. 16

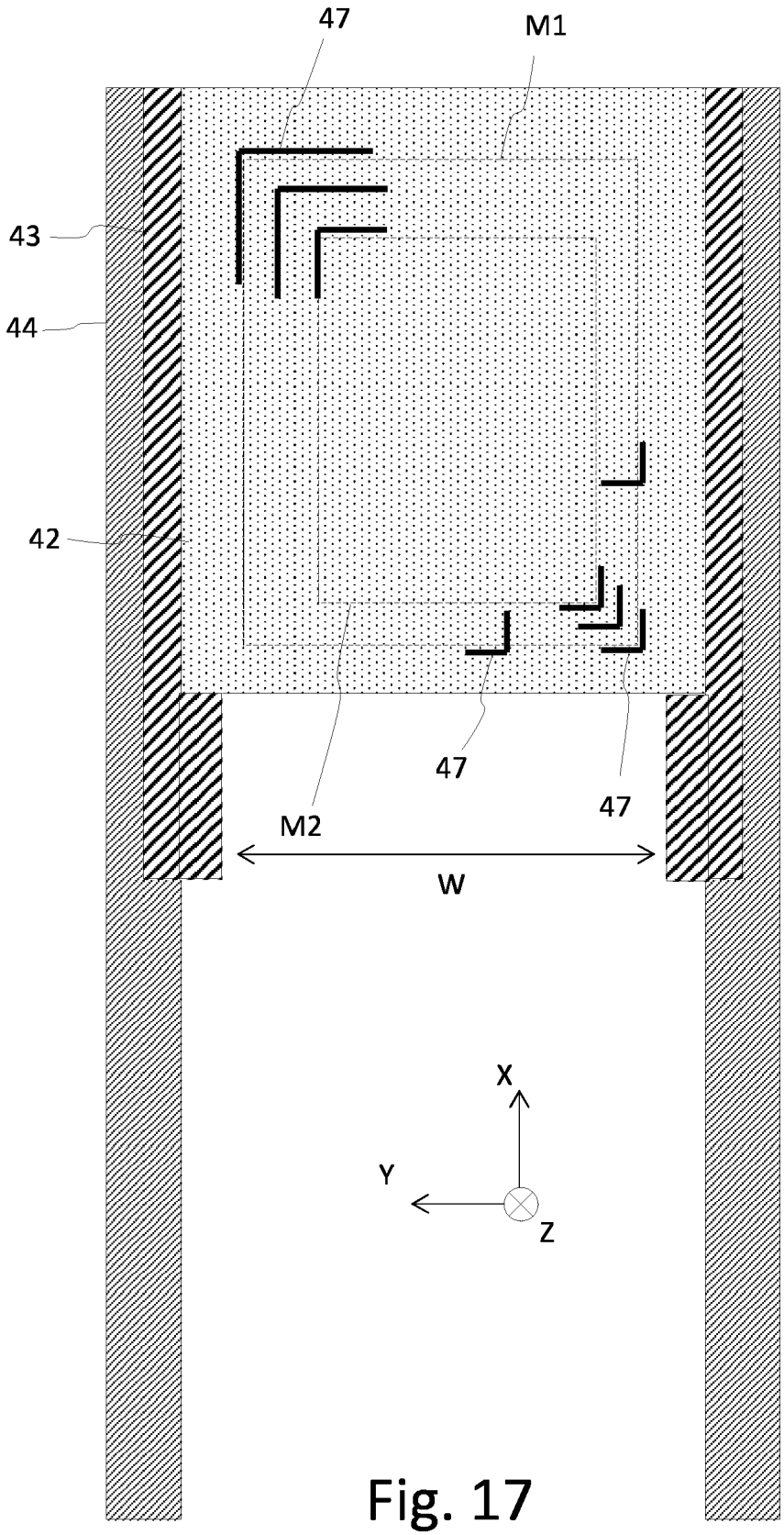

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 0536

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	US 2010/116162 A1 (KOROLIK PAVEL [IL] ET AL) 13 May 2010 (2010-05-13)	9-15	INV.
			B65H1/14
A	* the whole document *	1-8	B65H1/26
			B65H1/30
A	US 2007/169655 A1 (CUMMINGS CALVIN D [CA] ET AL) 26 July 2007 (2007-07-26) * the whole document *	1-15	B65H3/44
A,D	WO 2021/021086 A1 (HEWLETT PACKARD DEVELOPMENT CO [US]) 4 February 2021 (2021-02-04) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 March 2024	Athanasiadis, A

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15-03-2024

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		WO 2021021086 A1	04-02-2021

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- US 20120086163 A1 **[0027]**
- US 20110272S77 A1 **[0027]**