materials along different structures, even when printing on individual substrates, the exchange of a printing screen is necessary if it is not desired to provide a separate printing machine for each printing process. Therefore, screen magazines have already been developed in the past which are used for storing multiple printing screens and assigned to the doctor device for exchanging printing screens. Today, for example, changing devices are known which perform an exchange of a printing screen of the printing machine with a printing screen kept in a screen magazine in a fully automated manner. As such, known screen magazines are arranged independently next to the printing machine and are designed to hold a plurality of printing screens. Printing machines having such screen magazines require a lot of installation space which is rarely available, especially in production lines.

Summary

In an aspect, the present disclosure refers to a printing machine for printing on planar substrates, in particular circuit boards, comprising: a printing table which extends in a horizontal plane and on which at least one substrate to be printed on can be arranged; at least one printing device assigned to the printing table, which printing device has a screen holder for an interchangeable printing screen and a doctor device assigned to the screen holder, wherein, by means of the doctor device, a printing material can be applied onto the substrate to be printed on through the printing screen; and a screen magazine assigned to the doctor device for storing at least one printing screen for the doctor device, **characterized in that** the screen magazine has a housing with at least two drawers which are arranged in parallel to one another and are each designed to hold one printing screen, wherein the housing is pivotably arranged such that it can pivot between a first end position, in which the drawers are oriented parallel to the horizontal plane, and a second

end position, in which the drawers are oriented at an angle to the horizontal plane, in particular vertical thereto.

In another aspect, the present disclosure refers to a printing system for printing on planar surfaces, comprising: a printing machine according to the above aspect; and at least one printing screen designed to be held in one of the drawers of the screen magazine.

Therefore, an object of the ~~invention~~ disclosure is to provide an improved printing machine, requiring little installation space despite the presence of a screen magazine and enabling an advantageous exchange of printing screens.

The object of the ~~invention~~ disclosure is achieved by a printing machine having the features of ~~claim 1~~the above aspect. It has the advantage that the screen magazine only needs a lot of installation space when a screen exchange takes place and is otherwise arranged on the printing machine in a manner saving installation space. This makes it possible, for example, for the printing machine to be arranged in a production line such that the screen magazine is arranged in a path for people or operators leading past the printing machine for performing an exchange process and otherwise clears the path. This ensures an advantageous utilization of the available installation space, for example in a production hall or the like. According to the ~~invention~~disclosure, this is achieved by the screen magazine having a housing with at least two drawers which are arranged in parallel to one another and are each designed to hold one printing screen, wherein the housing is pivotably arranged relative to the doctor device such that it can pivot between a first position, in which the drawers are

oriented in parallel to the horizontal plane, and a second end position, in which the drawers are oriented at an angle, in particular at a right angle, to the horizontal plane. Thus, the screen magazine is pivotably mounted between a horizontal orientation and one inclined relative thereto. In the horizontal orientation, the housing or the screen magazine extends far into the space next to the printing machine, whereas it substantially rests against the printing machine in the vertical orientation, thus only requiring little installation space next to the printing machine. Thus, the pivotability of the screen magazine achieves only temporary use of installation space, which results in the printing machine being able to also be arranged in locations where a sufficiently wide passage must be present at the machine at least temporarily to allow personnel or vehicles driving autonomously, for example, to pass. In order to ensure that the installation space is cleared in an advantageous manner if an exchange of a screen does not take place, the housing preferably has a height which is significantly smaller than the length of the housing. As such, the length of the housing is understood to mean the (horizontal) longitudinal extension of the housing in the first end position, and accordingly, the height of the housing is understood to mean the (vertical) height of the housing in the first end position. Preferably, for this purpose, the screen magazine has a limited number of drawers, such as, for example, a maximum of four or less, preferably only two. In particular, the screen magazine is integrated or able to be integrated into the printing machine in a permanent/fixed or interchangeable/releasable manner.

According to a preferred ~~development~~ example~~of the invention~~, the housing is oriented at least substantially vertically to the drawers in the second end position. This results in a particularly low use of installation space at the moment where an exchange of a printing screen is not carried out or at the time when a printing process is performed by the printing machine by means of a printing screen. For this purpose, the housing is pivoted, in particular by 90°, from the horizontal into the vertical end position or the other way around.

According to a preferred exampledevelopment of the invention, the housing is mounted to be height-adjustable relative to the screen holder at least in the first end position. By adjusting the height of the housing it is achieved that the printing screens arranged in the housing and retained in the drawers are movable in height. In this way it is achieved, for example, that the printing screen to be used for a print is always arranged at the height of the screen holder thanks to a height adjustment of the housing. As a result, the respective screen can always be extended from the housing at the same height with respect to the screen holder, thereby requiring simple mechanics or kinematics for performing the actual exchange process. According to a further exampleembodiment of the invention, the housing is pivotable by up to 180°, so that it reaches the second end position in a stowed position underneath the printing table, thereby ensuring maximum installation space to be saved next to the printing machine. According to a further exampleembodiment of the invention, the drawers are additionally or alternatively height-adjustable in the housing, so that they can be displaced in height within the housing, without the printing screen to be inserted or pushed out always being at the desired height with respect to the doctor device or the screen holder.

Furthermore, it is preferably provided that the printing machine has a device designed to insert a printing screen into one of the drawers and pull it from one of the drawers and into the screen holder. Hence, the device is used to exchange printing screens. Thus, the exchange process is performed, in particular fully automatically, by the printing machine itself.

Particularly preferably, the device is designed as a magnetically operated gripping device. As such, the printing screens are preferably magnetizable or magnetized themselves to cooperate with the gripping device. Thanks to the magnetic design, a positive-fit connection of the device and the printing screen is not necessary, so that the printing screen itself is able to be implemented at low cost and saving installation space.

Particularly preferably, the device is designed separately from the doctor device. This means that the device has its own actuators for moving the respective printing screen from the screen magazine to the doctor device and back.

According to an alternative example~~embodiment of the invention~~, the device is formed by the doctor device itself. This means that the doctor device is also suitable for inserting one of the printing screens into the screen magazine and pulling another printing screen from the screen magazine and placing it in the screen holder, for example. Typically, the doctor device has a carrier or carriage which extends transversally across the printing table and which is guided on rails on the edges and is movable using a drive. This enables simple positioning of the doctor device or a doctor blade of the doctor device. Thus, it is provided, for example, that a doctor blade holder for holding a doctor blade is movable by the doctor device above the printing table and is used as a gripping device for displacing a printing screen. For this purpose, the doctor blade holder is designed to be magnetizable, for example, to displace one of the printing screens if needed. Particularly preferably, in this case, the doctor blade holder is also movable in height, in particular to grip or release a printing screen.

According to a further example~~embodiment of the invention~~, the device is preferably formed integrally with a camera device movable across the printing table. Known printing machines have a camera device which is used, for example, to check for the correct orientation and/or position of a substrate on the printing table or of a printing screen to be employed on the doctor device. For this purpose, a camera is traversed across the printing table, by means of which the substrate and/or the printing screen is/are captured visually. Then, image analysis is used to establish whether the printing screen and substrate are optimally oriented relative to one another. If deviations are detected, the printing screen or the substrate is displaced on the printing table, for example, until the desired positioning is achieved. As such camera devices comprise a camera movable in an X-Y plane, the

permanently. Rather, the releasable retaining device ensures positive-fit locking, for example a latch engagement, in particular on the frame.

Preferably, the housing is designed to hold differently sized printing screens. For this purpose, for example, the drawers are designed differently or designed such that differently sized printing screens can be placed in the drawers.

Particularly preferably, the respective drawer is designed to hold the respective printing screen and a doctor tool for the doctor device. Thus, it is achieved that a printing screen can be arranged together with the doctor tool, in particular the doctor blade, in the housing. Carrying the doctor blade along with the printing screen has the advantage that a simple conversion of the doctor device to different printing materials or types of printing materials is possible as the doctor blade stays together with the printing screen and is exchanged along with it. In this way, cleaning the doctor blade for performing a further printing process with a then different printing material can be omitted. This further reduces the conversion time of the printing machine. In particular, the respective printing screen has a holder for at least one doctor blade, so that the doctor blade is able to be carried along with the respective printing screen.

Particularly preferably, the screen magazine is releasably or interchangeably arranged on the frame or the doctor device. In this way, an exchange of the entire screen magazine or screen magazine is also easy to perform, for example. Thus, the screen magazine can be equipped and prepared away from the printing machine and then added to the printing machine, for example, locked on the frame and connected or coupled to the at least one actuator. Particularly preferably, the screen magazine is designed to be released or removed from the rest of the printing machine by a robot, in particular a material handling tool, and moved to a pick-and-place machine, for example for being mounted with printing screens or for exchange of the printing screens mounted in the screen magazine. According to an alternative example~~embodiment of the invention~~, the screen magazine is

preferably arranged on the frame or the doctor device in a permanent or fixed manner, so that a particularly robust connection to the frame or the doctor device can be implemented.

According to a preferred exampledevelopment of the invention, the screen magazine has a means for pushing out and/or retracting printing screens out of and/or into one of the drawers. As an example, the means is a pusher arranged on the end of the housing facing away from the doctor device to push at least part of a printing screen out of the housing as needed, so that it can be gripped by the device for displacing or for exchanging the printing screens more easily.

Furthermore, in an example, the invention disclosure relates to a printing system for printing on planar surfaces, having a printing machine designed as described above.

The printing system according to the inventionan example, having the features of claim 18the above aspect, is characterized by having at least one printing screen designed to be held in one of the drawers of the screen magazine. For this purpose, the printing screen has an outer contour, for example, corresponding to the dimensions of the respective drawer.

Particularly preferably, the printing screen is designed to hold at least one doctor tool, in particular a doctor blade, and the respective drawer of the screen magazine is designed to hold the printing screen together with the at least one doctor tool. This results in the advantages already mentioned above.

The invention will be explained in more detail below with reference to the drawings. Therein,

Figure 1 shows a perspective representation of an advantageous printing machine,

Figures 2A and 2B show the printing machine in different operating states, each in a side view, and

Figure 3 shows a detailed perspective view of the printing machine.

CLAIMS

1.A printing machine ~~(1)~~ for printing on planar substrates, in particular circuit boards, comprising: a printing table ~~(4)~~ which extends in a horizontal plane and on which at least one substrate to be printed on can be arranged; at least one printing device assigned to the printing table ~~(4)~~, which printing device has a screen holder ~~(12)~~ for an interchangeable printing screen ~~(22, 23)~~ and a doctor device ~~(7)~~ assigned to the screen holder ~~(12)~~, wherein, by means of the doctor device ~~(7)~~, a printing material can be applied onto the substrate to be printed on through the printing screen ~~(22, 23)~~; and a screen magazine ~~(18)~~ assigned to the doctor device ~~(7)~~ for storing at least one printing screen ~~(22, 23)~~ for the doctor device ~~(7)~~, **characterized in that** the screen magazine ~~(18)~~ has a housing ~~(19)~~ with at least two drawers ~~(20, 21)~~ which are arranged in parallel to one another and are each designed to hold one printing screen ~~(22, 23)~~, wherein the housing ~~(19)~~ is pivotably arranged such that it can pivot between a first end position, in which the drawers ~~(20, 21)~~ are oriented parallel to the horizontal plane, and a second end position, in which the drawers are oriented at an angle to the horizontal plane, in particular vertical thereto.

2.The printing machine according to claim 1, **characterized in that** the housing ~~(19)~~ is oriented at least substantially vertically to the drawers ~~(20, 21)~~ in the second end position.

3.The printing machine according to any of the preceding claims, **characterized in that** the housing ~~(19)~~ is mounted to be height-adjustable at least in the first end position.

4.The printing machine according to any of the preceding claims, **characterized by** a device ~~(30)~~ designed to insert a printing screen ~~(22, 23)~~ into one of the drawers ~~(20, 21)~~ and pull it out of the drawers ~~(20, 21)~~.

5.The printing machine according to any of the preceding claims, **characterized in that** the device ~~(30)~~ has a magnetically operated gripping device.

6.The printing machine according to any of the preceding claims, **characterized in that** the device ~~(30)~~ is designed separately from the doctor device ~~(7)~~.

7.The printing machine according to any of the preceding claims, **characterized in that** the device ~~(30)~~ is formed by the doctor device ~~(7)~~.

8.The printing machine according to any of the preceding claims, **characterized in that** the device ~~(30)~~ is formed by a camera device ~~(14)~~ movable across the printing table ~~(4)~~.

9.The printing machine according to any of the preceding claims, **characterized by** a frame ~~(2)~~ on which the printing table ~~(4)~~, the doctor device ~~(7)~~ and the screen magazine ~~(18)~~ are arranged.

10.The printing machine according to any of the preceding claims, **characterized in that** the housing ~~(19)~~ is mounted on the frame ~~(2)~~ such that it is displaceable in height.

11.The printing machine according to any of the preceding claims, **characterized in that** the housing ~~(19)~~ is mounted on the frame ~~(2)~~ by a linearly displaceable pivot joint ~~(26)~~.

12.The printing machine according to any of the preceding claims, **characterized in that** at least one controllable actuator ~~(31)~~ for shifting and/or pivoting the screen magazine ~~(18)~~ is assigned to the housing ~~(18)~~.

13.The printing machine according to any of the preceding claims, **characterized in that** the actuator ~~(31)~~ is designed as an electric, hydraulic, or pneumatic actuator.

14.The printing machine according to any of the preceding claims, **characterized in that** the screen magazine ~~(18)~~ is designed to hold differently sized printing screens ~~(22, 23)~~.

15.The printing device according to any of the preceding claims, **characterized in that** the respective drawer ~~(20, 21)~~ is designed to hold the respective printing screens ~~(22, 23)~~ and a doctor tool, in particular a doctor blade ~~(36)~~, assigned to the respective printing screen.

16.The printing machine according to any of the preceding claims, **characterized in that** the screen magazine ~~(18)~~ is retained interchangeably on the frame ~~(2)~~.

17. The printing machine according to any of the preceding claims, **characterized in that** the screen magazine ~~(18)~~ has a means for pushing out and retracting printing screens out of and/or into one of the drawers.

18. A printing system for printing on planar surfaces, comprising: a printing machine ~~(1)~~ according to any one of claims 1 to 17; and at least one printing screen ~~(22, 23)~~ designed to be held in one of the drawers ~~(20, 21)~~ of the screen magazine ~~(18)~~.

19. The printing system according to claim 18, **characterized in that** the printing screen ~~(22, 23)~~ is designed to hold a doctor tool, in particular a doctor blade ~~(36)~~, and in that the respective drawer ~~(20, 21)~~ is designed to hold the printing screen ~~(22, 23)~~ together with the doctor tool.