The doctor blades are particularly preferably arranged on the doctor frame in such a way and the gearing is formed in such a way that the doctor blades can be pivoted by means of the gearing into a V-shaped position, in which the doctor blades abut against one another on their free effective doctor edges. The effective doctor edges are thereby understood to be the longitudinal edges of the doctor blades, which are assigned to the printing screen or printing mask during operation and which press printing compound through the printing mask or the printing screen. By means of the pivoting into the V-shaped position, the doctor blades, together, enclose a V-shaped space, which is closed on its pointed end by the abutment of the effective doctor edges against one another. Printing compound located on the doctor blades can thus not escape from this space in the region of the effective doctor edges. A type of printing compound pocket is thus formed in the doctoring unit, with the help of which the printing compound can be held back securely, in order to perform, for example, a template or screen change or in order to exchange the doctoring unit as a whole.

According to a preferred embodiment of the invention, the gearing is formed as worm gearing. The self-locking of the gearing can be realized thereby securely and cost-efficiently in a simple and known manner. High setting forces can be transferred by means of the worm gearing and a high robustness against unintentional adjustment of the blade angles is ensured.

Each doctor blade is thereby preferably arranged on a respective rotatably mounted shaft for pivoting, whereby a worm wheel of the worm gearing, which engages with a worm shaft of the worm gearing that is connected or can be connected to the drive, is arranged in a rotationally fixed manner on each of the shafts. The doctor blades can thus be adjusted with the help of the gearing. An adjusting of the doctor blades, without the worm shaft being driven, however, is prevented by means of the self-locking. The shafts are preferably formed integrally in the respective doctor blade, so that the doctor blades also form the respective shaft itself, for example on their longitudinal side facing away from the effective edge of the doctor, for the purpose of which shaft stubs protrude, for example on the front sides of the respective doctor blade, which shaft stubs can be inserted into a bearing receptacle, for example of the bearing frame, for the pivotable mounting. It is thus also conceivable that the respective worm wheel is formed in one piece with the respective doctor blade and does not form a complete worm wheel in this respect, but a worm wheel, which extends over less than 360° in the circumference. According to an alternative embodiment of the invention, the respective doctor blade is pushed onto a continuous shaft and is either rotatably mounted on the shaft or the shaft is rotatably mounted in the bearing receptacle, for example of

the doctor frame. In this case, the worm wheel is then either connected in a rotationally fixed manner to the doctor blade and/or in a rotationally fixed manner to the shaft.

It is furthermore preferably provided that the gearing has a drive shaft, which, on the one hand, is coupled to the worm shaft and which, on the other hand, has a coupling end, which is formed for releasably coupling the drive shaft to the drive device. The drive shaft is in particular coupled in a rotationally fixed manner to the worm shaft, so that a drive force acting on the drive shaft, in particular a drive torque, is exerted directly on the worm shaft, in order to pivot the doctor blades. The drive shaft can be releasably connected to the drive device by means of the coupling end. The doctoring unit as a whole can thus be released from the drive device in an advantageous manner, whereby the self-locking of the gearing unfolds its effect by means of the releasing and prevents a further adjusting of the doctor blades on the doctor blades themselves. A simple joining or operative connecting of the doctoring unit to the drive device is furthermore ensured by means of the coupling end.

The coupling end is particularly preferably formed as part of a frictional or positive releasable coupling, in particular as part of a frictional coupling or claw coupling. A simple joining of the coupling end to the drive device, which then preferably likewise has a shaft comprising a part of the frictional coupling or claw coupling or of the frictional or positive coupling, respectively, is ensured by means of the frictional or claw coupling.

According to a preferred further development of the invention, the doctoring unit has a housing, in or on which the gearing, the doctor carrier, and the doctor blades are held, whereby the drive shaft is guided outwards through an opening of the housing. On the one hand, the parts of the doctor blade arranged in the housing, such as the gearing, the doctor carrier, and the doctor blades, are protected against external influences by means of the housing. Due to the fact that the drive shaft protrudes from the housing, a simple coupling to the drive device is ensured. On the other hand, the drive shaft protruding from the housing can furthermore also be manually actuated by a user, in order to change the position of the doctor blades, for example for cleaning purposes, when necessary. The doctoring unit can thus be actuated manually or in an automated manner by means of a cleaning machine, for example outside the printing apparatus, in order to open the receiving pocket formed by the doctor blades and to release the printing compound contained therein.

According to a preferred further development of the invention, the doctoring unit has means for releasably fastening the doctoring unit to the drive device. The doctoring unit can thus be

releasably fastened to the drive device by means of the means, whereby a simple exchange of the doctoring unit of a printing apparatus or on the drive device, respectively, is made possible. The entire doctoring unit can thus be easily released from the drive device and can be moved, for example, to another printing apparatus comprising a corresponding drive device, and can be connected to the drive device there, in order to perform a further printing process on the other printing apparatus. The doctoring unit can also be supplied to a cleaning device, released from the drive device and therefore from the printing apparatus. Means for releasably fastening are in particular understood to be means, which allow for an in particular tool-free release or fastening of the doctoring unit to the drive device in just a few steps. In this context, a screw connection, in the case of which the doctoring unit could be fastened to the drive device by means of a fastening screw, is not understood to be a means for releasably fastening, but as permanent fastening means.

The means is particularly preferably formed as locking means. The doctoring unit can thus be locked in a positive manner to the drive device through locking. The locking means preferably has one or several elastically displaceable locking elements, which can be brought into a position, which holds the doctoring unit in a positive manner on the drive device under elastic deformation. In addition, the means preferably have depressions or notches, for example formed in the housing or the drive device, in order to cooperate in a positive manner with a respective elastically displaceable locking element of the drive device or of the housing. The respective elastically displaceable or deformable locking element can thus be arranged on the doctoring unit itself or on the drive device. The depression or notch is then arranged or formed on the respective other device.

According to a preferred further development of the invention, the doctoring unit has a drive device, which has at least one drive machine, in particular electric machine, which can be coupled or is coupled to the gearing, in particular to the drive shaft of the gearing. The drive device is in particular the above-described drive device, to which the remaining doctoring unit can be releasably connected. The drive device is optionally integrated into the printing device, which in particular additionally has a printing table, on which the substrate to be printed can be arranged.

The drive machine preferably has an output shaft, which has an end that is coupled or can be coupled to the gearing. The end of the output shaft can thus be releasably connected to the coupling end of the drive shaft. Together, the coupling end and the end in particular form a coupling, which operates in a positive manner or which operates in a frictional manner, in particular a claw coupling or a frictional coupling.

the center axis. With the formation of the actuator as pneumatic actuator, the actuator obtains an elasticity by means of the compressible pneumatic medium. It is thus ensured that the doctoring unit can be pivoted or moved against the force of the actuator in the event that an excessive resistance occurs when moving the doctor blades, so that damage to the doctor blades is securely avoided. The pneumatic actuator thus acts on the doctor frame in the manner of a bias. The entire doctoring unit can hereby in particular be displaced in a pivotable manner against the biasing force of the actuator.

The printing apparatus according to the invention comprising the features of claim 19 is characterized by the formation of the doctoring apparatus according to the invention. The doctoring unit is in particular fastened or can be fastened in an exchangeable manner to the drive device, by means of the above-mentioned means. Together with the doctoring device, the doctoring unit in particular forms the print head of the printing apparatus. In addition, a printing system is preferably created, in the case of which several printing apparatuses are present, which each have a drive device, to which the doctoring unit according to the invention can be fastened.

Further advantages and preferred features and feature combinations follow in particular from what has been described above as well as from the claims. The invention will be described in more detail below on the basis of the drawings, in which

Figure 1	shows an advantageous doctoring apparatus for a printing apparatus in a simplified side view,
Figure 2	shows the doctoring device in a top view,
Figure 3	shows a detail view of the doctoring device,
Figures 4A to 4C	show a lifting apparatus of the doctoring device in different views.

Figure 1 shows an advantageous doctoring apparatus 1 for a printing apparatus 2, which is not illustrated in more detail here, for printing flat substrates, in particular circuit boards, wafers, or the like, in a simplified side view. The doctoring apparatus 1 is formed to press printing compound through openings or structures of a printing screen 3, which is only suggested in Figure 1, and to thus apply it to one or several substrates located below the printing screen 3.

For this purpose, the doctoring device 1 has a doctoring unit 4, which carries two doctor blades 5, 6. In Figure 1, the doctor blades 5, 6 extend perpendicular to the image plane, whereby the doctor blades 5, 6 are each held with a longitudinal edge on a doctor carrier 9 of the doctoring unit 4 and, on the longitudinal edge thereof, which faces away from this longitudinal edge, form an effective edge 7, 8 of the doctor, which serves the purpose of sweeping over the printing compound or the printing screen 3, respectively. The doctor blades 5, 6 can be made of metal or plastic and can be formed to be stiff or slightly elastically deformable.

Figure 2 shows the doctoring unit 4 in a simplified top view. The doctoring unit 4 has the doctor carrier 9, on which the doctor blades 5, 6 are pivotably mounted. For this purpose, the doctor blades 5, 6 are each connected to a rotatably mounted shaft 10, 11 or are fastened thereto in a rotationally fixed manner, respectively, in each case on their end facing away from the effective edge 7, 8 of the doctor, so that a rotation of the respective shaft 11, 10 leads to a corresponding adjustment of the doctor angle α_5 or α_6, respectively, of the respective doctor blade 5, 6, as shown in Figure 1. The shafts 10, 11 have radial slits, for example, in which the doctor blades 5, 6 are held so as to be inserted.

As shown in Figure 2, the shafts 10, 11 are advantageously rotatably mounted by means of several rolling body bearings 12, so that a rotation takes place with small friction losses. Paste limiters 13, which prevent that the applied printing paste escapes laterally past the doctor blades 5, 6 when sweeping over the printing screen 3, are optionally assigned to the doctor blades 5, 6 on the front side.

The shafts 10, 11 each carry a worm wheel 14, 15, which is connected in a rotationally fixed manner to the respective shaft 10, 11. The worm wheels 14, 15 are in particular arranged in the center on the shafts 10, 11, viewed in the longitudinal extension of the shafts 10, 11, as shown in Figure 2. The worm wheels 14, 15 thus lie parallel to one another. A worm shaft 16, which meshes or engages with the two worm wheels 14, 15, respectively, is arranged between the worm wheels 14, 15. The worm shaft 16 is rotatably mounted on the doctor carrier 9 by means of a further roller body bearing 12. For this purpose, the worm shaft 16 merges into a drive shaft 17, is thus formed in one piece with the latter, which passes through a housing 18, which is arranged on the doctor carrier 9, in the region of the roller body bearing and protrudes outwards from the housing 18. The doctor carrier 9 optionally forms the housing 18. The housing 18 is formed in a trough-shaped manner, as shown in an exemplary manner in Figure 1, whereby the drive shaft 17 passes through the bottom of the trough shape, and surrounds at least the shafts 10, 11 as well as

CLAIMS

1. A doctoring unit (4) for a printing apparatus (2) for printing flat substrates, in particular circuit boards, wafers, or solar cells, comprising two doctor blades (5,6), which extend parallel to one another and are pivotably mounted, **characterized in** that the doctor blades (5,6) are operatively connected to a gearing (35) and by means of the gearing (35), which is formed in a self-locking manner as worm gearing and can be coupled or is coupled to a drive device (22).

2. The doctoring unit according to claim 1, **characterized in** that the doctor blades (5,6) can be pivoted by means of the gearing (35) into a V-shaped transport position, in which the doctor blades (5,6) abut against one another on their free effective doctor edges (7,8).

3. The doctoring unit according to any one of the preceding claims, **characterized in** that each doctor blade (5,6) is arranged on a respective rotatably mounted shaft (10,11) for pivoting, whereby a worm wheel (14,15), which engages with a worm shaft (16) that is connected or can be connected to the drive device (22), is arranged in a rotationally fixed manner on each of the shafts (10,11).

4. The doctoring unit according to any one of the preceding claims, **characterized in** that the gearing (35) has a drive shaft (37), which, on the one hand, is coupled to the worm shaft (16) and which, on the other hand, has a coupling end (19), which is formed for releasably coupling the drive shaft (17) to the drive device (22).

5. The doctoring unit according to any one of the preceding claims, **characterized in** that the coupling end (19) is formed as part of a positive or frictional coupling (26).

6. The doctoring unit according to any one of the preceding claims, **characterized in** that it has a housing (18), in or on which the gearing (35), the doctor carrier (9), and the doctor blades (5,6) are held, whereby the drive shaft (17) is guided outwards through an opening of the housing (18).

7. The doctoring unit according to any one of the preceding claims, **characterized in** that the doctoring unit (4) has means (27) for releasably fastening to the drive device (22).

8. The doctoring unit according to any one of the preceding claims, **characterized in** that the means (27) is formed as locking means.

9. A doctoring apparatus (1) for a printing apparatus (2) for printing flat substrates, in particular circuit boards, wafers, or solar cells, comprising a doctoring unit (4) and a drive device (22) for the doctoring unit (4), **characterized by** the formation of the doctoring unit (4) according to any one of claims 1 to 8.

10. The doctoring apparatus according to claim 9, **characterized in** that the drive device (22) has an electric machine (23), which can be coupled to the gearing (35).

11. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the drive device (22) has an output shaft (24), which has an end (25) that is coupled or can be coupled to the gearing (35).

12. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the end (25) of the output shaft (24) is formed for releasably coupling to the drive shaft (17) of the gearing (35).

13. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the drive device (22) has a doctoring unit holder (30), which can be releasably connected to the doctoring unit (4).

14. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the means (27) have at least one elastically deformable or displaceable locking element (28).

15. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the doctoring unit holder (30) is pivotably mounted about a center axis (48), which extends parallel to the shafts (10,11).

16. The doctoring apparatus according to any one of the preceding claims, **characterized in** that a controllable actuator (49) for pivoting the doctoring unit holder (30) is assigned to

the doctoring unit holder (30) on at least one protrusion (50), which is spaced apart from the center axis (48).

17. The doctoring apparatus according to any one of the preceding claims, **characterized in** that the actuator (49) is formed as pneumatic actuator (49) comprising a lifting piston (51), which is assigned to the protrusion (50) and which can in particular be displaced tangentially to the center axis (48).

18. A printing apparatus for printing flat substrates, in particular circuit boards, wafers, or solar cells, comprising a doctoring apparatus (1), comprising a printing screen holder, on which a printing screen or a printing stencil or mask can be arranged or is arranged, and comprising a printing table, on which the substrate can be arranged on the side of the printing screen holder facing away from the doctoring apparatus, characterized by the formation of the doctoring apparatus (1) according to any one of claims 9 to 17.