The invention relates to an apparatus for producing a printing form. It is an object of the invention to develop an apparatus for producing a printing form which, with little expenditure, permits reliable protection of optical imaging elements. In an apparatus for producing a printing form, comprising a radiation source emitting at least one imaging beam which is aimed at a material on which an image is to be set, further comprising a positioning device for the radiation source relative and parallel to the surface of the material, and comprising a shutter which, when the imaging is not being carried out, can be positioned in a shielding manner between the radiation source and the material, the invention consists in that the the shutter (19, 26, 36) can be positioned by the action of an element (11, 24, 34) that comes into action during imaging.
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Abstract

The invention relates to an apparatus for producing a printing form. It is an object of the invention to develop an apparatus for producing a printing form which, with little expenditure, permits reliable protection of optical imaging elements. In an apparatus for producing a printing form, comprising a radiation source emitting at least one imaging beam which is aimed at a material on which an image is to be set, further comprising a positioning device for the radiation source relative and parallel to the surface of the material, and comprising a shutter which, when the imaging is not being carried out, can be positioned in a shielding manner between the radiation source and the material, the invention consists in that the the shutter (19, 26, 36) can be positioned by the action of an element (11, 24, 34) that comes into action during imaging.

Fig. 1
Apparatus for producing a printing form

The invention relates to apparatus for producing a printing form according to the preamble of claim 1.

5 In order to protect imaging optics against contamination, in particular in material-removing imaging methods, DE 100 13 454 A1 describes an apparatus for producing a printing form in which a slide that can be positioned parallel to the surface of a printing form blank is provided which, when imaging is not being carried out, is moved in a shielding manner in front of a radiation source. The slide, provided with light passage openings, is positioned by a cam which acts on a driver element.

In a device according to US 5,936,652, in order to protect a lens, use is made of a flat shutter which can be positioned by a separate actuator transversely with respect to light sources arranged in the longitudinal direction.

In an imaging device disclosed in JP 60-44194 (A), a row of light passage openings is assigned individual flat aperture elements, which are each coupled to a horizontally acting actuator. The actuators can be driven independently of one another, so that individual light passage openings can be closed as desired.

30 The known apparatuses have closure elements which have a high outlay on design, use a great deal of material and are costly.

Also known are imaging apparatuses in which gas flows are used to protect optical elements.

DE 298 16 107 U1 shows a variant in which a small quantity of a protective gas flows continuously through
gas flow is produced which prevents an objective lens being contaminated by dirt particles which are liberated during a machining operation with a laser radiation source.

In a laser imaging system according to JP 2001-56569 (A), a shield matched to the beam path is used in order to protect a condenser lens against removed particles. In this case, the interior of the shield can be placed under pressure, so that the particles do not reach the surface of the condenser lens.

It is an object of the invention to develop an apparatus for producing a printing form which, with little expenditure, permits reliable protection of optical imaging elements.

The object is achieved by an apparatus which has the features as claimed in claim 1. Advantageous refinements emerge from the subclaims.

The core of the invention is that the positioning of one or more shutters is performed using drive energy which originates from elements which are already supplied with energy in order to carry out the imaging process. This means that no additional energy has to be provided to position a shutter.

In an advantageous variant, use is made, for positioning a shutter, of the same compressed air which is also used to blow on the surface of a material on which an image is to be set, in order to keep an imaging area free of contamination. For this purpose, a pneumatic cylinder that is coupled to the shutter can also be actuated. The shutter exposes the imaging beam path each time when the compressed air is provided. At all other times, the imaging beam path remains closed, so that the imaging beams cannot emerge freely.
In a further variant, a housing for guiding a protective gas stream is designed as a shutter at the same time. For this purpose, the housing or mechanical elements connected to the housing are accommodated in guides such that they can be displaced or pivoted. When the protective gas stream is switched on during imaging, then the housing or the aforesaid elements are brought into a position which permits the free passage of imaging beams. As in the case of the first variant, the drive of the housing can be carried out pneumatically with the protective gas under pressure. However, it is also possible to position the housing in an imaging position and in a rest position with a separate actuator, such as a pneumatic operating cylinder or an electromagnetic actuator.

In a further variant, the force of a spring and an actuator for positioning a radiation source are used to position a shutter.

The invention is to be explained in more detail by using drawings, in which:
figures 1 and 2 show a schematic drive of an imaging apparatus with a pneumatically positionable shutter when imaging is not being carried out and during imaging,
figures 3 and 4 show a schematic drawing of an imaging apparatus with a positionable extraction housing as shutter,
figures 5.1 to 5.4 show a schematic drawing of an imaging apparatus with a shutter acting counter to a spring.

Figures 1 and 2 show an imaging apparatus having an imaging head 1 which contains a plurality of laser diode arrays 2 having optical projecting elements 3. The laser diode arrays 2 are built up in the form of rows and aligned along a line which lies parallel to the axis of rotation of a printing form cylinder 4, on
which there is a printing form blank 5. The laser diode arrays 2 radiate in the direction of the axis of rotation of the printing form cylinder 4. The beams 6 from a laser diode are focused by means of the optical imaging element 3 onto the surface of the printing form blank 5, in order to produce an image point there which accepts printing ink. In order to be able to cover the entire surface of the printing form blank 5, the imaging head 1 can be positioned in the direction of the axis of rotation on a slide 7, while the printing form cylinder 4 rotates. The slide 7 is held in a linear guide and coupled to a stepping motor drive. The printing form cylinder 4 is coupled to an individual drive, its rotational position being registered by a rotary encoder.

When, as shown in figure 2, a beam 6 strikes the printing form blank 5, the topmost layer of the printing form blank 5 is removed in accordance with an image. In order that no removed particles get onto the optical elements 3, a blowing and suction apparatus 9 is provided opposite a line with the focal points 8 on the printing form blank 5. The blowing and suction apparatus 9 comprises a housing 10 having a blown air chamber 11, a suction air chamber 12 and light passage slots 13 which lie between them and extend over the entire width of the printing form cylinder 4. Close to the light passage slots 13 there are an air outlet slot 14 and an air inlet slot 15 into the blown air chamber 11 and the suction air chamber 12. In the direction perpendicular to the optical axis 16, a plurality of operating cylinders 17 are arranged on the blown air chamber 11. The operating cylinders 17 project into the blown air chamber 11 and form a vertical longitudinal guide for operating pistons 18. A strip-like slide 19 is coupled to the operating pistons 18.

In figure 1, the position of the slide 19 is illustrated in a lower position. The blown air chamber
11 is not under pressure, so that the operating piston 18 with the slide 19 is moved downward by the action of the force of gravity or the action of a spring, so that the light passage slot 13 is covered by the slide 19 and no laser beams 6 can get onto the surface of the printing form blank 5. Because in this position of the slide 19 no imaging takes place, no protective air curtain is required either between the air outlet slot 14 and the air inlet slot 15 in front of the light passage slot 13.

In figure 2, the position of the slide 19 during the imaging operation is illustrated. The blown air chamber 11 is put under pressure, so that the operating pistons 18 are forced upward, until they rest with the stops 20 on the lower collar of the operating cylinders 17. The slide 19 is in its upper position and opens the passage of the beams 6 through the light passage slots 13 onto the surface of the printing form blank 5. When a laser diode belonging to the laser diode array 2 is activated, material is removed from the surface of printing form blank 5, so that an image point is produced at the focal point 8. Air emerges through the air outlet slot 14 through the blown air chamber 11 which is put under pressure, at the same time air being sucked out of the suction air chamber 12. The air flow between the air outlet slot 14 and the air inlet slot 15 prevents removed particles being able to reach the optical element 3.

The system comprising housing 10 and slide 19 can be provided repeatedly over the width of the printing form cylinder 4. The slides 19 can additionally be seated in lateral guides.

Elements with the equivalent function already described in relation to figures 1 and 2 will be cited with the same designations in the following text.
A variant with a displaceable housing 21 for forming an air curtain protecting optical components 3 is shown in figures 3 and 4. As distinct from the variant according to figures 1 and 2, the housing 21 fulfills a dual function.

As figure 3 illustrates, the housing 21 acts as a shutter for laser beams 6. The housing 21 is connected to an adjusting apparatus, comprising an operating cylinder 22, operating pistons 23 and a compressed air source 24. The housing 21 is mounted in vertical longitudinal guides 25. In the housing 21 there is a light passage slot 13 which is asymmetric with respect to the optical axis 16. The wall 26 of the blown air chamber 11 which faces the light passage slot 13 is provided in angled-over form. Figures 3 illustrates the lower position of the housing 21, which is achieved by positioning the operating piston 23 in the operating cylinder 22 by means of the compressed air source 24.

In this position of the housing 21, the beams 6 strike the angled-over part of the wall 26. The inclination of the angled-over part of the wall 26 with respect to the optical axis 16 is such that no direct or reflected beams 6 pass through the light passage slot 13 onto the surface of the printing form blank 5. In order to suppress the reflections, the parts of the housing 21 which face the optical axis 16 are designed to be poorly reflective.

Figure 4 shows the housing 21 in the imaging position. Using the operating cylinder 22 and the operating piston 23, the housing 21 has been moved upward in the longitudinal guides 25, so that the beams 6 can pass unimpeded through the light passage slot 13 and strike the surface of the printing form blank 5. The blown air chamber 11 is acted on with compressed air, while a vacuum is produced in the suction air chamber. As a result, an air curtain is formed in front of the light
passage slot 13, and prevents the deposition of removed particles on the optical elements 3.

According to figures 3 and 4, the housing is displaced in the vertical direction in the longitudinal guide 25. Of course, displacements and rotations in other directions and about different axes are also possible, as long as the housing 21 exposes the beam path when it reaches the imaging position and blocks the beams 6 when it reaches the closure position.

Figures 5.1 - 5.4 show an apparatus for producing a printing form, in which an imaging head 27 can be positioned in a linear guide 28 by a screw drive 29 between two side walls 30, 31. The screw drive 29 is accommodated in bearings 32, 33 in the side walls 30, 31 and coupled to a stepping motor 34. The nut (not illustrated) of the screw drive 29 is coupled to the imaging head 27, that is to say when the screw drive 29 is rotated by the motor 34, the imaging head 27 is moved in the lateral direction 35. The imaging head 27 contains a laser diode array 2 and optical imaging element 3 for focusing the beams 6 from a laser diode onto the surface of a printing form blank 5, which is clamped on a printing form cylinder 4. The special feature of this variant is that a shutter part 36 is arranged such that it can be displaced on the imaging head 27. In order to guide the shutter part 36 on the imaging head 27 in the direction 35, guide elements 37, 38 are formed on the imaging head 27. The shutter part 36 has a recess 39, in which a spring 40 is seated. The spring 40 is supported on a holder 41 of the imaging head 27 and exerts the action of a force in the direction 35 on the shutter part 36. In the vicinity of the side wall 30 there is a fixed stop 42 for a stop screw 43, which is seated adjustably on the shutter part 36. The shutter part 36 has a beam passage opening 44, whose axis of symmetry 45 lies parallel to
the optical axis 16 of the beams 6 originating from the laser diode array 2.

In figure 5.1, the imaging head 27 has been moved by the stepping motor 34 into a stop position. In this position, the stop screw 43 has run onto the stop 42. The shutter part 36 is forced in the direction of the holder 41 counter to the force of the spring 40. The axis of symmetry 45 and the optical axis 16 are at a distance which is greater than the opening width of the beam passage opening 44, so that the beams 6 are prevented from striking the surface of the printing form blank 5.

As figure 5.2 illustrates, the stop screw 43 remains on the stop 42, as a result of the action of the spring 40, when the imaging head 27 is moved out of the stop position.

As figure 5.3 illustrates, the imaging head 27 has been moved in the direction 35 from the stop position to such an extent that the stop screw 43 is just still resting on the stop 42 as a result of the action of the spring 40, and the axis of symmetry 45 of the beam passage opening 44 is aligned with the optical axis 16.

As figure 5.4 illustrates, the shutter part 36 remains in the position relative to the imaging head 27 when the imaging head 27 is moved still further away from the stop 42, and therefore the stop screw 43 lifts off the stop 42. The spring 40 presses the shutter part 36 with an extension 46 against the guide element 38, which acts as a stop or as a driver in the direction 35.

A shutter arrangement of the type shown in figures 5.1 - 5.4 can be provided twice or repeatedly over the width of a printing form cylinder 4 as required. In any case, the beam paths from the laser diode arrays 2 are
exposed only when the imaging head or heads is or are moved out of the protective stop position.
List of designations

1. imaging head
2. laser diode array
3. optical element
4. printing form cylinder
5. printing form blank
6. beam
7. slide
8. focal point
9. blowing and suction apparatus
10. housing
11. blown air chamber
12. suction air chamber
13. light passage slot
14. air outlet slot
15. air inlet slot
16. optical axis
17. operating cylinder
18. operating piston
19. slide
20. stop
21. housing
22. operating cylinder
23. operating piston
24. compressed air
25. longitudinal guide
26. wall
27. imaging head
28. linear guide
29. screw drive
30. 31. side wall
32. 33. bearings
34. stepping motor
35. direction
36. shutter part
37. 38. guide element
39. recess
40. spring
41 holder
42 stop
43 stop screw
44 beam passage opening
45 axis of symmetry
46 extension
Patent claims

1. An apparatus for producing a printing form, comprising a radiation source 13 emitting at least one imaging beam which is aimed at a material on which an image is to be set, further comprising a positioning device for the radiation source relative and parallel to the surface of the material, and comprising a shutter which, when the imaging is not being carried out, can be positioned in a shielding manner between the radiation source and the material, characterized in that the shutter (19, 26, 36) can be positioned by the action of an element (11, 24, 34) that comes into action during imaging.

2. The apparatus for producing a printing form as claimed in claim 1, characterized in that a device (9) for producing a shielding gas flow between the radiation source (1) and the material (5) is provided, and in that the shutter (19) can be positioned by the action of a compressed gas source (11) that produces the gas flow.

3. The apparatus as claimed in claim 2, characterized in that the shutter is designed as a strip-like slide (19).

4. The apparatus as claimed in claim 2, characterized in that the shutter (19) is coupled to at least one pneumatic operating cylinder (17, 18).

5. The apparatus as claimed in claim 2, characterized in that, when the material (5) is arranged on the surface of a rotating cylinder (4), the shutter (19) can be positioned at right angles to the axis of rotation of the cylinder (4).

6. The apparatus as claimed in claim 5, characterized in that, if the axis of rotation is aligned
horizontally, the shutter (19) can be positioned vertically.

7. The apparatus for producing a printing form as claimed in claim 1, characterized in that a device (21) for producing a shielding gas flow between the radiation source (1) and the material (5) is provided, and in that the device (21) for producing the gas flow comprises at least one mechanical element (26) which is designed as a shutter and, when imaging is not being carried out, can be positioned in a shielding manner between the radiation source (1) and the material (5).

8. The apparatus as claimed in claim 7, characterized in that, when the material (5) is arranged on the surface of a rotating cylinder (4), the element (26) can be positioned at right angles to the axis of rotation of the cylinder (4).

9. The apparatus as claimed in claim 8, characterized in that, when the axis of rotation is aligned horizontally, the element (26) can be positioned vertically.

10. The apparatus for producing a printing form as claimed in claim 1, characterized in that a shutter (36) provided with at least one beam passage opening is provided which, when imaging is not being carried out, can be positioned in a shielding manner between the radiation source (27) and the material (5) by the action of the positioning device (34, 28, 29), and which is guided parallel to the positioning direction (35) of the positioning device (34, 28, 29), in that, in a stop position of the radiation source (27), the shutter (36) rests on a stop (42) fixed to the frame, counter to the action of a spring (40), the passage of beams (6) onto the material (5) being prevented, and in that, in the operating position of the radiation source (27), the shutter (36) rests against a stop (38),
formed on the radiation source (27), as a result of the force of the spring (40). The passage of beams (6) onto the material (5) being made possible.