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(54) Benævnelse: **DISPENSERANORDNING MED EN DISPENSER TIL LEVERING AF EN VÆSKE, DER INDEHOLDER I DET MINDSTE EN CELLE OG/ELLER I DET MINDSTE EN PARTIKEL**

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RIBA J ET AL: "Label-free isolation and deposition of single bacterial cells from heterogeneous samples for clonal culturing", SCIENTIFIC REPORTS, Bd. 6, Nr. 1, 6. September 2016 (2016-09-06), Seiten 1-9, XP055526118, DOI: 10.1038/srep32837
SHIN D-Y ET AL: "Rapid jetting status inspection and accurate droplet volume measurement for a piezo drop-on-demand inkjet print head using a scanning mirror for display applications", REVIEW OF SCIENTIFIC INSTRUMENTS, AIP, MELVILLE, NY, US, Bd. 88, Nr. 2, 13. Februar 2017 (2017-02-13), Seiten 025109-1-02510913, XP012216056, ISSN: 0034-6748, DOI: 10.1063/1.4975094 [gefunden am 2017-02-13]
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Gross A ET AL: "Single-Cell Printer: Automated, On Demand, and Label Free", Journal of Laboratory Automation Society for Laboratory Automation and Screening, Bd. 18 1. Dezember 2013 (2013-12-01), Seiten 504-518, XP055276802, Gefunden im Internet: URL:http://jla.sagepub.com/content/18/6/50 4.full.pdf [gefunden am 2016-05-31]

DISPENSING MACHINE WITH DISPENSER FOR DISPENSING AT LEAST ONE CELL AND/OR AT LEAST ONE FLUID CONTAINING PARTICLES

The invention relates to a dispensing apparatus having a dispenser for dispensing a liquid containing at least one cell and/or at least one particle and an optical detection device for optically detecting at least one partial region of the dispenser, which has a light source for emitting an illumination light for illuminating the partial region and a deflection device for deflecting a detection light emanating from the partial region.

It is known from the prior art that active substances, such as monoclonal antibodies and other proteins, are produced with the aid of so-called monoclonal cell lines. These are populations of cells that are all descended from a single parent cell. The production of monoclonal cell lines is necessary because this is the only way to ensure that all cells of the population have approximately the same genome in order to produce active ingredients of a constant and reproducible quality.

In order to produce a monoclonal cell line, cells are transferred individually into the containers of a microtitre plate. The cells to be transferred are produced by genetically modifying a host cell line and isolating these modified cells. Individual cells are deposited in the microtitre plates by a dispensing apparatus. After the cells have been deposited in the respective containers of the microtitre plate, the cells can grow and may then be transferred to a bioreactor.

The user of the dispensing apparatus wants to know whether each liquid deposited in the container of the microtitre plate contains a cell and/or a particle. The dispensing apparatus therefore usually has an optical detection device which is used to determine whether the dispensed liquid contains a cell and/or a particle.

In order to obtain images with a high resolution, it is recommended that the optical detection device be placed as close as possible to a dispenser of the dispensing apparatus. However, this is not possible due to the structural conditions. The distance between the dispenser and the container for receiving the dispensed liquid should be as small as possible so that it is ensured that the dispensed liquid actually ends up in the container. However, this means that the optical detection apparatus cannot be arranged close to the dispenser and thus complex optical detection apparatus have to be used.

RIBA J ET AL: "Label-free isolation and deposition of single bacterial cells from heterogeneous samples for clonal culturing", SCIENTIFIC REPORTS, vol. 6, No. 1, September 6, 2016, discloses a device for dispensing a liquid which may contain bacterial cells. The device has an optical detection device having an object lens and a deflection

mirror.

SHIN D-Y ET AL: "Rapid jetting status inspection and accurate droplet volume measurement for a piezo drop-on-demand inkjet print head using a scanning mirror for display applications", REVIEW OF SCIENTIFIC INSTRUMENTS, AIP, MELVILLE, NY, US, Vol. 88, No. 2, February 13, 2017, discloses an ink jet printhead having a rotatable mirror.

ORTEGA ARROYO J ET AL: "Label-Free, A11-Optical Detection, Imaging, and Tracking of a Single Protein", NANO LETTERS, Vol. 14, No. 4, April 9, 2014 discloses a device for detecting, receiving and tracking a single protein. The device has a polarising beam splitter which deflects detection light to a CMOS camera.

DRECHSLER A ET AL: "Confocal microscopy with a high numerical aperture parabolic mirror", OPTICS EXPRESS, Vol. 9, No. 12, December 3, 2001 discloses a confocal microscope having a parabolic mirror.

Gross A ET AL: "Single-Cell Printer: Automated, On Demand, and Label Free", Journal of Laboratory Automation Society for Laboratory Automation and Screening, Vol. 18, December 1, 2013 discloses a device for dispensing a liquid. The device has a receiving device for receiving the dispensed liquid.

WO 2017/ 220 509 A1 discloses a device for detecting cells or particles in a fluid container. The device comprises a dispenser which is used to dispense at least one cell or at least one particle. In addition, the device has a detection apparatus for detecting the cell or the particle.

An object of the invention is therefore to provide an improved dispensing apparatus.

The object is achieved by a dispensing apparatus of the type mentioned at the beginning, which is characterised in that the deflection device deflects the detection light at least twice, in particular exactly twice, wherein the deflection device has at least one prism for deflecting the detection light and/or the illumination light.

The device according to the invention has the advantage that a high resolution and/or a high magnification of the partial region under consideration can be achieved even when using a standard object lens. This is possible because a higher numerical aperture can be used due to the deflection device. In particular, it is not necessary to use expensive object lenses in the device according to the invention, but a more cost-effective standard object lens can be used. The provision of the deflection device also offers the advantage that the components of the optical detection device, described in more detail below, do not have to be moved for optically detecting the partial region of the dispenser, in particular do not have to be moved relative to the dispenser.

Another advantage of the invention is that a partial region of the dispenser is illuminated with the illumination light. Thus, by looking at the partial region of the dispenser, it can be determined whether the liquid to be dispensed contains a cell or a particle. The partial region of the dispenser preferably corresponds to an output area of the dispenser, in particular an output area of the dispenser having a nozzle. It is therefore not necessary to look at the liquid that is actually dispensed from the dispenser. Viewing the partial region of the dispenser offers the advantage that no optical elements have to be arranged between the dispenser and a microtitre plate. Therefore, the distance between the dispenser and the microtitre plate can be small.

The liquid, in particular a drop of liquid, is dispensed by means of the dispenser. The dispensed liquid might contain no cells and/or particles. Alternatively, the dispensed liquid might contain exactly one single cell or a plurality of cells and/or one single particle or a plurality of particles.

The dispenser can be fluidically connected to a liquid reservoir of the dispensing apparatus. The drop of liquid can thereby have at least one cell and/or at least one particle. The dispensed liquid has a volume in a range between 10 pl (picolitres) to 50 nl (nanolitres). The fluid can be a cell suspension that promotes cell growth. The particle can be a glass or polymer bead and have substantially the same volume as the cell. The light source can be an LED lamp.

The detection light emanating from the partial region as a result of the illumination of the partial region with the illumination light can be detected. The detected detection light can be read out by means of a readout device described in more detail below and then evaluated.

In a particular embodiment, the deflection device can deflect the illumination light at least twice, in particular exactly twice. This means that the deflection device is designed and arranged in such a way that it deflects both the detection light and the illumination light. As a result, a compact optical detection device can be realised. In this case, the detection light can be deflected substantially by 90°, in particular precisely by 90°, during each deflection process. Similarly, the illumination light can be deflected substantially by 90°, in particular precisely by 90° in each case, during each deflection process.

In addition, the deflection device can be designed in such a way that the illumination light emerging through a first side of the deflection device is deflected at least twice to the illumination light entering through a second side. The deflection device can be designed in such a way that the illumination light emerging from the deflection device runs offset from the illumination light entering the deflection device. In particular, the deflection

device can displace the illumination light emerging from the deflection device substantially parallel, in particular parallel, to the illumination light entering the deflection device. The deflection of the illumination light can take place analogously to the detection light in each deflection process substantially by 90°, in particular precisely by 90°.

The detection light emerging from the deflection device can run offset to the detection light entering the deflection device. It is particularly advantageous if the detection light emerging from the deflection device is displaced substantially parallel, in particular parallel, to the detection light entering the deflection device. In addition, the deflection device can be designed in such a way that the detection light emerging through the second side of the deflection device is deflected at least twice to the detection light entering through the first side.

The prism offers the advantage that the illumination light emerging from the prism can be offset in a simple manner, in particular displaced parallel, to the illumination light entering the prism. Equally, the detection light emerging from the prism can easily be offset, in particular displaced parallel, with respect to the detection light entering the prism. The displacement takes place particularly easily if the prism has a base area with at least four, in particular exactly four, corners. The prism can be an oblique prism, in particular a parallelepiped. The prism can preferably be a rhombohedron. The use of a prism has the advantage that an exact parallel displacement of the illumination light and/or the detection light can be realised.

When using the prism, the first side corresponds to a lateral surface of the prism and the second side corresponds to another lateral surface of the prism. The first side, in particular the lateral surface, and the second side, in particular the other lateral surface, can run parallel to one another.

Alternatively or additionally, the deflection device can have at least two mirrors for deflecting the illumination light and/or the detection light. Regardless of whether the deflection device has the prism or the mirror, the deflection device is designed in both cases in such a way that it deflects the illumination light in the direction of the partial region of the dispenser so that the partial region of the dispenser is illuminated by the illumination light.

The optical detection device can have an object lens. The object lens is a collecting optical system that creates a real optical image of the object. The deflection device can be arranged in the beam path of the illumination light and/or detection light between the object lens and the dispenser. This enables the deflection device to be mechanically connected to the dispenser, whereby a compact device can be realised. In particular, the

deflection device can be attached to the dispenser, in particular directly. This enables the distance between the object lens and the dispenser to be small, which in turn is advantageous for the resolution and the magnification.

The deflection device can deflect the illumination light directly into the partial region of the dispenser. This means that no further optical elements are arranged between the dispenser and the deflection device in the beam path of the illumination light. In addition, the deflection device can deflect the detection light directly into the object lens. This means that no further optical elements are arranged between the object lens and the deflection device in the beam path of the detection light.

At least one lens can be attached or arranged on the side of the deflection device facing the dispenser, in particular the prism. The lens can have a flat side which is attached to the side of the deflection device facing the dispenser, in particular the light exit side. The flat side of the lens can be attached, preferably directly, to a lateral surface of the prism. By using the lens, imaging errors that result in particular from a spherical aberration can be at least partially eliminated in a simple manner.

The object lens can be arranged in such a way that an optical axis of the object lens runs transversely, in particular perpendicular, to a dispensing direction of the liquid from the dispenser. Such an arrangement of the object lens offers the advantage that the object lens can be arranged closer to the dispenser than with the known dispensing apparatus, in which the object lens is arranged above the dispenser. As a result, the above-described arrangement of the object lens increases the resolution and/or the magnification.

The dispensing apparatus can have an actuator for actuating the dispenser. The actuator can be a piezo actuator. The object lens and the actuator can face each other with respect to the dispenser. In particular, the actuator and the object lens can face each other with respect to a plane which runs in the same direction as a direction of discharge of the liquid from the dispenser.

In a particular embodiment, the optical detection device can have a readout device for reading out the detected detection light emanating from the partial region of the dispenser. The readout device is used for reading out the information contained in the detected detection light. The detection light results from illuminating the partial region with the illumination light and/or has, for example, illumination light reflected on the cells and/or particles.

The detection light and the illumination light can at least partially have a common beam path. The common beam path can have at least the object lens and the deflection device.

In addition, the optical detection device can have an imaging apparatus. Based on the detected detection light, the imaging apparatus can generate an image. In particular, an image of the partial region of the dispenser can be generated by means of the imaging apparatus. The partial region of the dispenser can have the output area of the dispenser, in particular the nozzle of the dispenser. The readout device can be integrated in the imaging apparatus. The imaging apparatus can be a camera.

The optical detection device can also have an evaluation device for evaluating the detected detection light. The evaluation device can evaluate the detected detection light in order to determine an optical property of the partial region. In particular, the evaluation device can evaluate the information read out by means of the readout device. For example, a transparency and/or a contrast and/or degree of reflection of the partial region can be determined as an optical property. Alternatively or additionally, further optical properties of the partial region can also be determined.

Based on the detected detection light, in particular based on the certain optical property of the partial region, the evaluation device can determine whether no cell and/or no particle is arranged in the partial region of the dispenser or whether a single cell and/or a single particle is arranged in the partial region of the dispenser is arranged or a plurality of cells and/or a plurality of particles are arranged. As a result, the number of cells and/or particles arranged in the partial region can be determined in a simple manner by the evaluation device. The evaluation device can be integrated in the imaging apparatus.

An algorithm for at least partial elimination of an imaging error that results, for example, from the spherical aberration, can be stored in the evaluation device. As a result, images with a better quality can be generated by the imaging apparatus.

In a particular embodiment, the optical detection device can have a further light source for dispensing an excitation light for illuminating the at least one partial region of the dispenser and/or at least one other partial region of the dispenser. The further light source can be a laser. A very particular embodiment is obtained when the excitation light and the illumination light at least partially have a common beam path. In this embodiment, a simple and compact optical detection system is obtained. The common beam path can have at least the object lens and the deflection device.

The readout device can be arranged and designed in such a way that it reads out a detected further detection light emanating from the partial region of the dispenser. The further detection light results from the illumination of the partial region and/or the other partial region of the dispenser. The further detection light can be deflected twice by the deflection device, analogously to the detection light. In particular, the further detection

light emerging from the deflection device can be displaced substantially parallel, in particular parallel, to the further detection light entering the deflection device.

Based on the detected further detection light, the imaging apparatus can generate a further image of the partial region and/or the other partial region. In addition, the evaluation device can evaluate the further detection light to determine a further optical property of the partial region and/or the other partial region. The further optical property can be fluorescence of the cell arranged in the partial region and/or of the particle arranged in the partial region. In this case, the excitation light is used for exciting the cell and/or the particle. The excitation light is absorbed by a fluorescent substance of the cell and/or a fluorescent substance of the particle. The further detection light emitted by the cell and/or the particle corresponds to a fluorescent light. Based on the further detection light, the evaluation device can determine whether no fluorescent cell and/or no fluorescent particle is arranged in the partial region and/or other partial region or whether exactly one single fluorescent cell and/or exactly one single fluorescent particle is arranged in the partial region and/or other partial region and/or whether a plurality of cells and/or a plurality of particles are arranged in the partial region.

The further detection light and the excitation light can at least partially have a common beam path. The common beam path can have at least the object lens and the deflection device.

The use of the readout device for reading out the detected detection light and the detected further detection light and the imaging apparatus for generating the image and the further image and the evaluation device for determining the further optical property offers the advantage that an optical detection system is implemented with few elements. The provision of the deflection device is particularly advantageous in the embodiment in which it is determined whether a fluorescent cell and/or a fluorescent particle is arranged in the partial region. As already described above, the provision of the deflection device offers the advantage of a higher numerical aperture. This means that, due to the resulting larger emission angle, a larger area is covered in which the photons emanating from the cell and/or the particle can reach the object lens. In this respect, a better image of the partial region can also be obtained due to the deflection device. In addition, due to the larger radiation angle, the cell and/or the particle can be excited for a shorter period of time, which enables the liquid to be dispensed from the dispenser more quickly.

In an alternative embodiment, the optical detection device can have a further readout device for reading out a detected further detection light. In addition, the optical detection device can have a further imaging apparatus for generating a further image of the partial

region and/or the other partial region based on the detected further detection light and/or a further evaluation device. The further evaluation device can evaluate the further detection light to determine the further optical property of the partial region. Based on the further detection light, the further evaluation device can determine whether no fluorescent cell and/or no fluorescent particle is arranged in the partial region and/or other partial region or whether exactly one single fluorescent cell and/or exactly one single fluorescent cell is arranged in the partial region and/or other partial region fluorescent particle is arranged and/or whether a plurality of cells and/or a plurality of particles are arranged in the partial region. The further imaging apparatus can be a camera and/or the further evaluation device and/or the further readout device can be integrated in the imaging apparatus.

The dispensing apparatus can have a deflection and/or suction device. The diversion device is used for diverting the dispensed liquid, in particular the dispensed liquid drop. The suction device is used for siphoning off the dispensed liquid. The dispensed liquid can be diverted and/or siphoned off into a reject container. The deflection and/or suction can take place before the dispensed liquid enters the container, in particular the container of a microtitre plate. The dispensed liquid can be deflected and/or siphoned off if the liquid contains no cells and/or no particles. Alternatively, the dispensed liquid can be deflected and/or siphoned off if the number of cells and/or particles contained in the liquid is greater than a predefined value, in particular greater than 1.

The subject of the invention is shown schematically in the figures, wherein elements that are the same or have the same effect are mostly provided with the same reference symbols. In the figures:

Figure 1 shows a schematic representation of a dispensing apparatus according to the invention according to a first embodiment.

Figure 2 shows a schematic representation of a dispensing apparatus according to the invention according to a second embodiment.

Figure 1 shows a dispensing apparatus 1 which has a dispenser 2 for dispensing a liquid 4 containing at least one cell 3 and/or at least one particle and an optical detection device 5 for optically detecting at least one partial region 6 of the dispenser 2. The optical detection device 5 has a light source 7, such as an LED lamp, for emitting an illumination light 8 and a deflection device 9 having a prism 24. The illumination light 8 is used for illuminating the partial region 6 and is deflected twice by the deflection device 9. A detection light 15 then emanating from the partial region 6 is also deflected twice by the deflection device 9.

The deflection device 9 is designed in such a way that the illumination light 8 emerging through the first side 10 of the prism is displaced parallel to the illumination light 8 entering through the second side 11 of the prism. Likewise, the detection light 15 emerging through the second side 11 of the prism is displaced parallel to the detection light 15 entering through the first side 10 of the prism. Figure 1 shows a state in which the light source 7 emits the illumination light 8.

The deflection device 9 is arranged in such a way that it deflects the illumination light 8 to the partial region 6 of the dispenser 2. The partial region 6 of the dispenser 2 corresponds to an output area of the dispenser 2. Figure 1 shows a state in which the dispenser 2 has dispensed a liquid 4, in particular a drop of liquid, which contains a cell 3. The liquid 4 is fed into a container 29. The dispenser 2 is actuated by an actuator, not shown, in particular a piezo actuator.

The optical detection device 5 also has an object lens 12.

The object lens 12 is arranged in such a way that an optical axis 13 of the object lens 12 runs perpendicular to a dispensing direction R of the liquid 4 from the dispenser 2. The deflection device 9 is arranged in the beam path of the illumination light 8 and/or of the detection light 15 between the dispenser 2 and the object lens 12.

In addition, the optical detection device 5 has a filter 25 which is arranged in the beam path of the illumination light 8 between the object lens 12 and the light source 7. The filter 25 is designed in such a way that it deflects the illumination light 8 in the direction of the object lens 12. In addition, the filter 25 is designed in such a way that it lets through the detection light 15 emanating from the partial region 6, which is shown in dashed lines in Figure 1. The detection light 15 let through by the filter 25 is deflected by a beam deflector 26 in the direction of an imaging apparatus 16. The detection light 15 and the illumination light 8 partially have a common beam path.

A readout device 14 arranged in the imaging apparatus 16 reads out the detection light 15 detected by a detector of the imaging apparatus 16. Based on the detected detection light 15, in particular on the information read out by the readout device 14, the imaging apparatus 16 can generate an image of the partial region 6.

The imaging apparatus 16 is electrically connected to an evaluation device 17, which is for example a computer, of the optical detection device 5. The evaluation device 17 can evaluate the recorded detection light 15. In particular, the evaluation device 17 can evaluate the information read out by means of the readout device 14. Based on the detection light 15, the evaluation device 17 can determine an optical property of the partial region 6.

By determining the optical property of partial region 6, it is possible to determine whether no cell 3 and/or no particle is arranged in the illuminated partial region or at least one cell 3 and/or at least one particle is arranged

The evaluation device 17 is electrically connected to a control device 28. Based on the evaluation result of the evaluation device 17, the control device 30 controls the dispensing process of the dispenser 2. The control device 30 is electrically connected to a moving device 29. The moving device 29 can move the dispenser 2 and/or the container 29 in such a way that the liquid 4 can be dispensed into the desired storage location.

In addition, the control device 30 can control a deflection and/or suction device 32 of the dispensing apparatus 1. The control device 30 can control the deflection and/or suction device 32 in such a way that the dispensed liquid 4 is deflected and/or siphoned off if no cell 3 and/or no particle is arranged in the liquid 4 or if a plurality of cells 3 and/or a plurality of particles are arranged in the liquid 4.

Figure 2 shows a schematic representation of a dispensing apparatus according to the invention according to a second embodiment. The second embodiment differs from the first embodiment shown in Figure 1 in that the optical detection device 5 additionally has a further light source 18, a further imaging apparatus 22 and a further readout device 21. The further light source 18 can be a laser and the further imaging apparatus 22 can be a camera. Figure 2 shows a state in which the further light source 18 emits an excitation light 19. In contrast, the light source 7 does not emit any illumination light 8.

Another difference is that the second embodiment has a further filter 28 instead of the beam deflector 26. The further filter 28 is designed in such a way that it deflects the detection light 15, not shown, to the imaging apparatus 16. In addition, the further filter 28 is designed in such a way that it lets through a further detection light 20. The optical detection device 5 also has a further beam deflector 27 which deflects the further detection light 20 in the direction of the further imaging apparatus 22, wherein the further detection light 20 is detected by a detector of the further imaging apparatus 22. The further detection light 20 is deflected twice by the deflection device 9, analogously to the detection light 15.

The further light source 18 emits the excitation light 19 for illuminating the partial region 6 of the dispenser 2, which is passed through the further beam deflector 27, the further filter 28, the filter 25 to the object lens 12. The excitation light 19 and the illumination light 8 have a common beam path. In particular, both the illumination light 8 and the excitation light 19 are passed through the object lens 12 and the deflection device 9.

The detected further detection light 20 emanating from the partial region 6 as a result of the excitation light 19 is read out by the further readout device 21. The further detection light 20 can be fluorescent light emitted by the cell 3 and/or by the particle, provided that a cell 3 and/or a particle with fluorescent properties is arranged in the partial region 6 of the dispenser 2. Based on the further detection light 20, the further imaging apparatus 22 can generate a further image of the partial region 6 of the dispenser 2. The further evaluation device 23 evaluates the further detection light 20 and determines whether no fluorescent cell 3 and/or no fluorescent particle is arranged in partial region 6 or whether at least one cell 3 and/or at least one particle is arranged in the partial region 6.

The excitation light 19 and the further detection light 20 partially have a common beam path.

List of reference numbers:

1	Dispensing apparatus
2	Dispenser
3	Cell
4	Liquid
5	Optical detection device
6	Partial region
7	Light source
8	Illumination light
9	Deflection device
10	First side
11	Second side
12	Object lens
13	Optical axis
14	Readout device
15	Detection light
16	Imaging apparatus
17	Evaluation device
18	Further light source
19	Excitation light
20	Further detection light
21	Further readout device
22	Further imaging apparatus
23	Further evaluation device
24	Prism
25	Filter
26	Beam deflector
27	Further beam deflector
28	Further filter
29	Container
30	Control device
31	Displacement device
32	Deflection and/or suction device
R	Dispensing direction

DISPENSERANORDNING MED EN DISPENSER TIL LEVERING AF EN VÆSKE, DER INDEHOLDER I DET MINDSTE EN CELLE OG/ELLER I DET MINDSTE EN PARTIKEL

PATENTKRAV

1. Dispenseranordning (1) med en dispenser (2) til levering af en væske (4), der indeholder i det mindste en celle (3) og/eller i det mindste en partikel, og en optisk registreringsanordning (5) til optisk registrering af et delområde (6) af dispenseren (2), der indbefatter en lyskilde (7) til udsendelse af et belysningslys (8) til belysning af delområdet (6) og en omdirigeringsanordning (9) til omdirigering af et detektionslys (15), der udgår fra delområdet (6), kendetegnet ved, at omdirigeringsanordningen (9) omdirigerer detektionslyset (15) mindst to gange, særligt nøjagtigt to gange, hvor omdirigeringsanordningen (9) i det mindste indbefatter et prisme (24) til omdirigering af detektionslyset (15) og/eller af belysningslyset (8).

2. Dispenseranordning (1) ifølge krav 1, kendetegnet ved, at
   a. omdirigeringsanordningen (9) omdirigerer belysningslyset (8) mindst to gange, særligt nøjagtigt to gange, og/eller at
   b. omdirigeringsanordningen (9) er udformet på en sådan måde, at belysningslyset (8), der kommer ud gennem en første side (10) af omdirigeringsanordningen, er omdirigeret mindst gange til belysningslyset (8), der kommer ind gennem en anden side (11), og/eller at
   c. belysningslyset (8), der kommer ud af omdirigeringsanordningen (9), bevæger sig forskudt i forhold til belysningslyset (8), der kommer ind i omdirigeringsanordningen (9), og/eller at
   d. belysningslyset (8), der kommer ud af omdirigeringsanordningen (9), er forskudt i det væsentlige parallelt, særligt parallelt, i forhold til belysningslyset (8), der kommer ind i omdirigeringsanordningen.

3. Dispenseranordning ifølge krav 1 eller 2, kendetegnet ved, at
   a. detektionslyset (15), der kommer ud af omdirigeringsanordningen (9), bevæger sig forskudt i forhold til detektionslyset (15), der kommer ind i omdirigeringsanordningen (9), og/eller at
   b. detektionslyset (15), der kommer ud af omdirigeringsanordningen (9), er

forskudt i det væsentlige parallelt, særligt parallelt, i forhold til detektionslyset (15), der kommer ind i omdirigeringsanordningen (9), og/eller at

c. omdirigeringsanordningen (9) er udformet på en sådan måde, at detektionslyset (15), der kommer ud gennem den anden side (11) af omdirigeringsanordningen (9), er omdirigeret mindst to gange til detektionslyset (15), der kommer ind gennem den første side (10).

4. Dispenseranordning (1) ifølge et af kravene 1 til 3, kendetegnet ved, at
   a. prismet (24) har en grundflade, der mindst har fire hjørner, og/eller at
   b. prismet (24) er et skævt prisme, særligt et parallelepipedum, fortrinsvis et romboeder, og/eller at
   c. en første side (10) af prismet (24), gennem hvilken belysningslyset (8) kommer ud af prismet (24), forløber parallelt med en anden side (11), gennem hvilken belysningslyset (8) kommer ind i prismet (24).

5. Dispenseranordning (1) ifølge et af kravene 1 til 4, kendetegnet ved, at
   a. den optiske registreringsanordning (5) har et objektiv (12), og/eller at
   b. omdirigeringsanordningen (9) er placeret i detektionslysets (15) og/eller belysningslysets (8) strålegang mellem objektivet (12) og dispenseren (2), og/eller at
   c. omdirigeringsanordningen (9) er udformet på en sådan måde, at detektionslyset (15), særligt direkte, omdirigeres til objektivet (12).

6. Dispenseranordning (1) ifølge et af kravene 1 til 5, kendetegnet ved, at
   a. omdirigeringsanordningen (9) er forbundet mekanisk med dispenseren (2), og/eller at
   b. omdirigeringsanordningen (9) er anbragt på dispenseren (2), og/eller at
   c. omdirigeringsanordningen (9) er udformet på en sådan måde, at den omdirigerer belysningslyset (8) direkte ind i delområdet (6), og/eller at
   d. der er anbragt en linse på den side af omdirigeringsanordningen (9), der vender mod dispenseren (2), eller at en linse, der har en plan side, er anbragt på den side af omdirigeringsanordningen (9), der vender mod dispenseren (2).

7. Dispenseranordning (1) ifølge krav 5 eller 6, kendetegnet ved, at objektivet (12) er placeret på en sådan måde, at en optisk akse (13) af objektivet (12) forløber på tværs af, særligt vinkelret på, en leveringsretning (R) for væsken fra dispenseren (2).

8. Dispenseranordning (1) ifølge et af kravene 1 til 7, kendetegnet ved en aktuator til betjening af dispenseren (2), hvor

a. aktuatoren er en piezoaktuator, og/eller at

b. aktuatoren og objektivet (12) ligger over for hinanden i forhold til dispenseren (2).

9. Dispenseranordning (1) ifølge et af kravene 1 til 8, kendetegnet ved, at den optiske registreringsanordning (5) har en udlæsningsanordning (14) til udlæsning af det detekterede detektionslys (15), der udgår fra dispenserens (2) delområde (6).

10. Dispenseranordning (1) ifølge krav 9, kendetegnet ved, at

a. den optiske registreringsanordning (5) har en billeddannende anordning (16), hvilken billeddannende anordning (16) på basis af det detekterede detektionslys (15) fremstiller en afbildning, og/eller hvilken billeddannende anordning (16) fremstiller en afbildning af dispenserens (2) delområde (6), og/eller at

b. den optiske registreringsanordning (5) har en analyseanordning (17) til analyse af det detekterede detektionslys (15), eller at den optiske registreringsanordning (5) har en analyseanordning (17) til analyse af det detekterede detektionslys (15), hvor der i analyseanordningen (17) er installeret en algoritme til en i det mindste delvis eliminering af afbildningsfejl.

11. Dispenseranordning (1) ifølge krav 10, kendetegnet ved, at

a. analyseanordningen (17) analyserer det detekterede detektionslys (15) til bestemmelse af en optisk egenskab ved delområdet (6) af dispenseren (2), eller at

b. analyseanordningen (17) baseret på det detekterede detektionslys, særligt baseret på den optiske egenskab ved delområdet (6) af dispenseren (2), bestemmer, om der i delområdet (6) af dispenseren (2) ikke er placeret nogen celle (1) og/eller partikel, eller om der i delområdet (6) af dispenseren

(2) er placeret nøjagtigt en eneste celle (3) og/eller en eneste partikel, eller om der i delområdet (6) af dispenseren (2) er placeret flere celler og/eller flere partikler.

12. Dispenseranordning (1) ifølge et af kravene 1 til 11, kendetegnet ved, at
    a. den optiske registreringsanordning (5) har en yderligere lyskilde (18) til udsendelse af et excitationslys (19) til belysning af det i det mindste ene delområde (6) af dispenseren (2) og/eller i det mindste et andet delområde af dispenseren (2), eller at
    b. den optiske registreringsanordning (5) har en yderligere lyskilde (18) til udsendelse af et excitationslys (19) til belysning af det i det mindste ene delområde (6) af dispenseren (2) og/eller i det mindste et andet delområde af dispenseren (2), og excitationslyset (19) og belysningslyset (8) i det mindste delvist har en fælles strålegang.

13. Dispenseranordning (1) ifølge krav 12, kendetegnet ved, at
    a. udlæsningsanordningen (14) er udformet til udlæsning af et detekteret yderligere detektionslys (20), og/eller at
    b. den billeddannende anordning (16) baseret på et yderligere detektionslys (20) fremstiller en yderligere afbildning af delområdet (6) og/eller af det andet delområde, og/eller at
    c. analyseanordningen (17) analyserer det detekterede yderligere detektionslys (20) til bestemmelse af en yderligere optisk egenskab ved delområdet (6) og/eller det andet delområde, og/eller at
    d. analyseanordningen (17) baseret på det detekterede yderligere detektionslys (20) bestemmer, om der i delområdet (6) og/eller det andet delområde ikke er placeret nogen fluorescerende celle (3) og/eller nogen fluorescerende partikel, eller om der i delområdet (6) og/eller i det andet delområde er placeret nøjagtigt en eneste fluorescerende celle (3) og/eller nøjagtigt en eneste fluorescerende partikel, og/eller om der i delområdet er placeret flere celler (3) og/eller flere partikler.

14. Dispenseranordning (1) ifølge krav 12, kendetegnet ved, at
    a. den optiske registreringsanordning (5) har en yderligere udlæsningsanordning (21) til udlæsning af et detekteret yderligere

detektionslys (20), og/eller at

b. den optiske registreringsanordning (5) har en yderligere billeddannende anordning (22) til fremstilling af en yderligere afbildning af delområdet (6) og/eller af det andet delområde baseret på det detekterede yderligere detektionslys (20).

15. Dispenseranordning (1) ifølge krav 12 eller 14, kendetegnet ved, at den optiske registreringsanordning (5) indbefatter en yderligere analyseanordning (23), hvor

a. den yderligere analyseanordning (23) analyserer det detekterede yderligere detektionslys (20) til bestemmelse af en yderligere optisk egenskab ved delområdet (6) og/eller af det andet delområde, og/eller hvor

b. den yderligere analyseanordning (23) baseret på det yderligere detektionslys (20) bestemmer, om der i delområdet (6) og/eller i det andet delområde ikke er placeret nogen fluorescerende celle (3) og/eller nogen fluorescerende partikel, eller om der i delområdet (6) og/eller i det andet delområde er placeret nøjagtigt en eneste fluorescerende celle (3) og/eller nøjagtigt en eneste fluorescerende partikel, og/eller om der i delområdet er placeret flere celler (3) og/eller flere partikler.

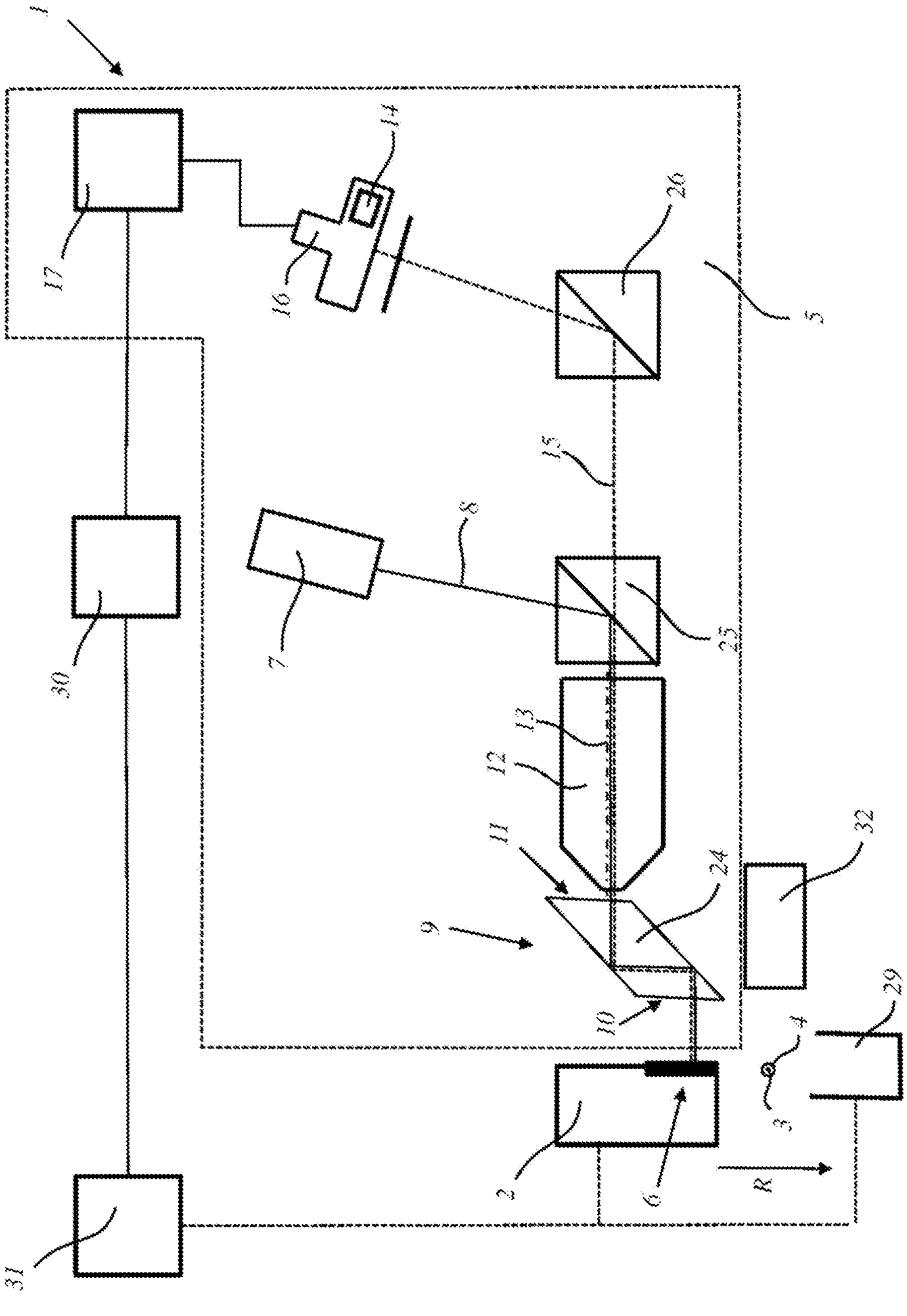


Fig. 1

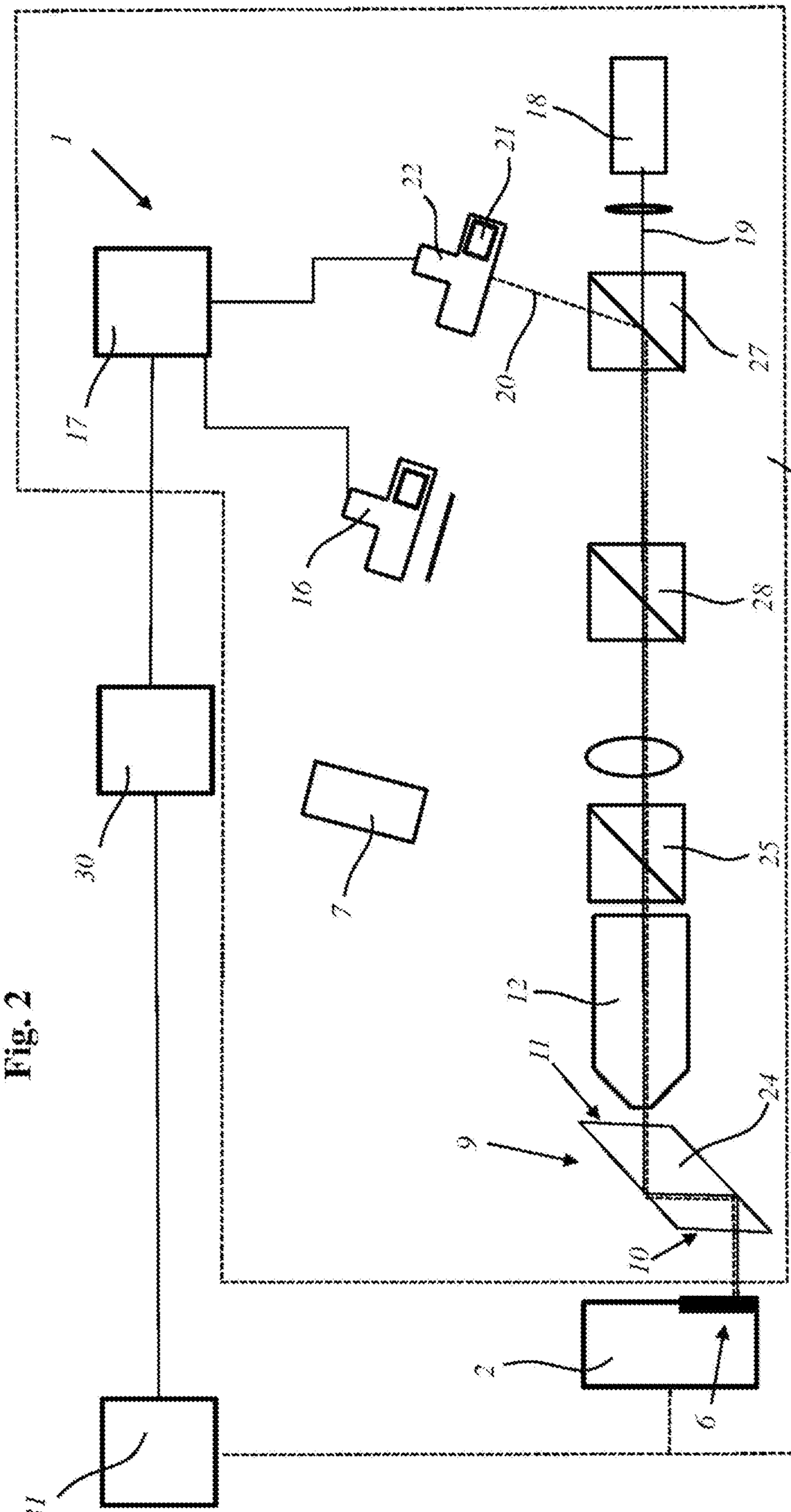


Fig. 2