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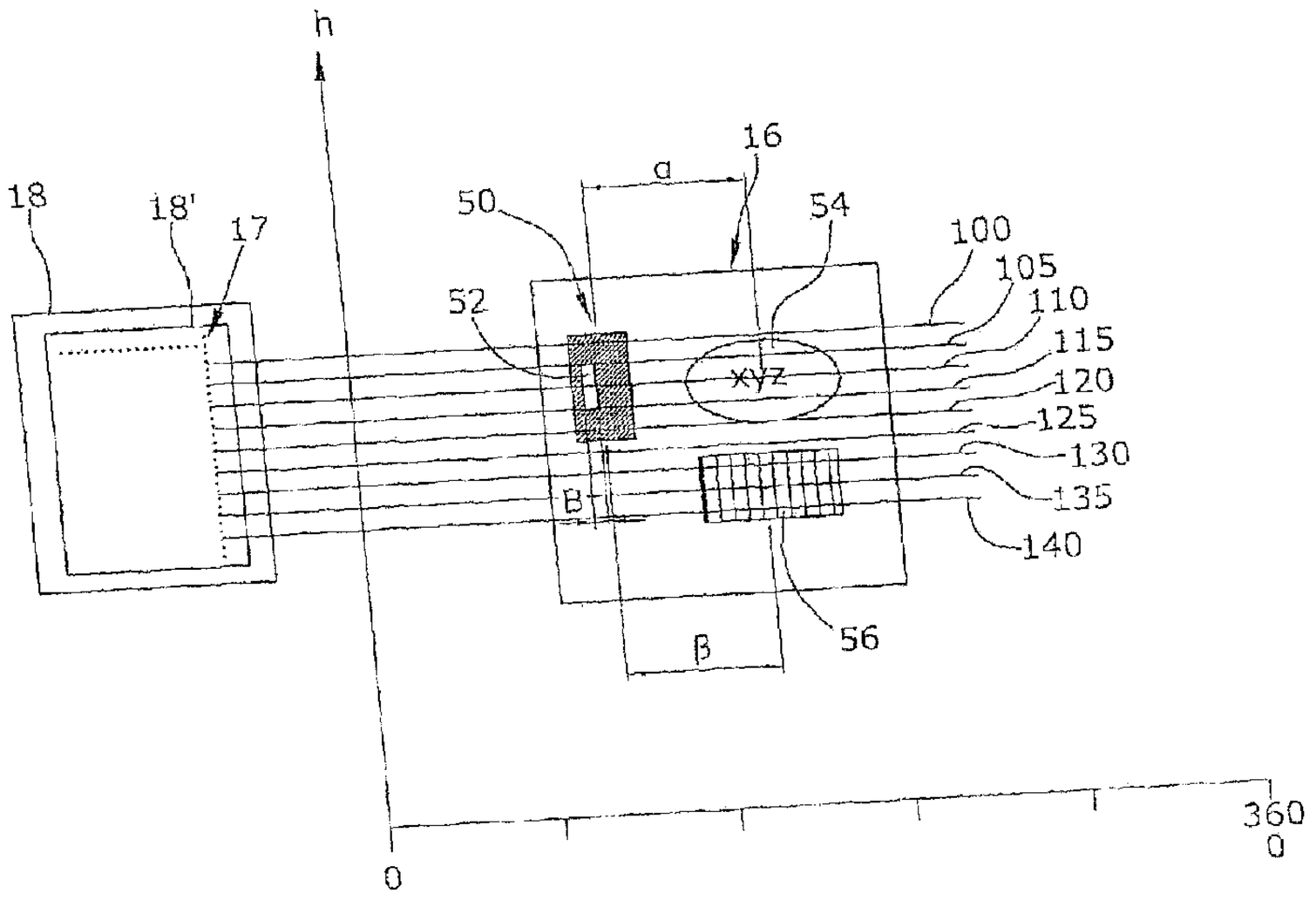
(54) Titre : PROCEDE DE LOCALISATION D'UN MARQUAGE OPTIQUE SUR UNE CUVETTE D'ANALYSE DE LABORATOIRE

(54) Title: METHOD FOR LOCATING AN OPTICAL IDENTIFICATION ON A LABORATORY ANALYSIS CUVETTE



(57) Abrégé/Abstract:
The invention refers to a method for locating an optical identification (54, 56) on a cylindrical laboratory analysis cuvette (12) containing a reagent (34), said cuvette being placed in a vertical cuvette chamber of a laboratory analyzer having a cuvette rotating device, wherein a digital camera with an axial resolution of more than 10 lines is associated with the cuvette chamber, and wherein, in fixed geometric relationship with the identification (54, 56), the cuvette (12) comprises an axial locating bar (50) with a fixed bar width. The method comprises the following steps: reading in at least four respectively non-adjacent lines of the digital camera, searching for the identification: if at least three mutually successive read-in lines comprise approximately axially in-line reflection signals with the bar width (B), reflected by the locating bar (50): rotating the cuvette (12) by an angle a, corresponding to the geometric relationship, such that the identification (54, 56) is aligned with the digital camera, and reading in the identification (54, 56) by reading out a plurality of adjacent lines of the line scan camera.

Abstract

The invention refers to a method for locating an optical identification (54, 56) on a cylindrical laboratory analysis cuvette (12) containing a reagent (34), said cuvette being placed in a vertical cuvette chamber of a laboratory analyzer having a cuvette rotating device, wherein a digital camera with an axial resolution of more than 10 lines is associated with the cuvette chamber, and wherein, in fixed geometric relationship with the identification (54, 56), the cuvette (12) comprises an axial locating bar (50) with a fixed bar width. The method comprises the following steps:

reading in at least four respectively non-adjacent lines of the digital camera,

searching for the identification: if at least three mutually successive read-in lines comprise approximately axially in-line reflection signals with the bar width (B), reflected by the locating bar (50):

rotating the cuvette (12) by an angle α, β corresponding to the geometric relationship, such that the identification (54, 56) is aligned with the digital camera, and

reading in the identification (54, 56) by reading out a plurality of adjacent lines of the line scan camera.

Figure 2

DESCRIPTION

METHOD FOR LOCATING AN OPTICAL IDENTIFICATION ON A LABORATORY ANALYSIS CUVETTE

The invention refers to a method for locating an optical identification on a laboratory analysis cuvette in a laboratory analyzer and to a laboratory analysis measuring device for performing this method.

From DE 41 09 118 C2, a method for an automatic evaluation of a substance contained in a water sample is known, wherein a laboratory analysis cuvette comprises an optical identification in the form of a barcode. The associated laboratory analyzer comprises a cuvette chamber with a cuvette rotating device. Further, a reading device is provided in the cuvette chamber, by means of which the cuvette barcode can be read out, while the cuvette is rotated in the cuvette chamber by the cuvette rotating device. The reading device scans in a punctiform manner. In adverse conditions, locating the barcode takes relatively long, since the start of the barcode has to be found at first.

Against this background, it is an object of the present invention to provide a method for a faster locating of an optical identification on a laboratory analysis cuvette in laboratory analyzer, and to provide a laboratory analysis measuring arrangement for performing this method.

According to one aspect of the present invention, there is provided a method for locating an optical identification on a cylindrical laboratory analysis cuvette containing a reagent, said cuvette being placed in a vertical cuvette chamber of a laboratory analyzer having a cuvette rotating device, wherein a digital camera with an axial resolution of more than 10 lines is associated with the cuvette chamber, and wherein, in fixed geometric relationship with the identification, the cuvette comprises an axial locating bar with a fixed bar width, the method comprising the following steps: reading in at least four respectively non-adjacent lines of the digital camera, searching for the identification: if at least three mutually successive read-in lines comprise approximately axially in-line reflection signals with the bar width, reflected by the locating bar: rotating the cuvette by an angle; corresponding to the geometric relationship, such that the identification is aligned with the digital camera, and reading in the identification by reading out a plurality of adjacent lines of the line scan camera.

According to another aspect of the present invention, there is provided a laboratory analysis measuring arrangement comprising a laboratory analyzer and a laboratory analysis cuvette, wherein the cuvette is cylindrical, includes a reagent serving for a quantitative determination of an analyte in water, and comprises a label having an identification and, in a fixed geometrical relationship therewith, a vertical locating bar, wherein the laboratory analyzer comprises: a cuvette chamber for receiving the cuvette, a cuvette rotating device in the cuvette chamber, a digital camera associated to the cuvette chamber with an axial resolution of more than 10 lines, and a control comprising an identification search module which, by means of the cuvette rotating device, rotates the cuvette about an angle corresponding to the geometric relationship, such that the identification is aligned with the digital camera, if at least three mutually successive read-in lines record approximately axially in-line reflection signals with the bar width, reflected by the locating bar.

The method of the present invention and the device of the present invention are directed, respectively, to the locating of an optical identification on a cylindrical laboratory analyzer cuvette containing a reagent and to a loboratory analysis

measuring device formed by a laboratory analyzer and a laboratory analyzer cuvette for performing the above-mentioned method.

The laboratory analyzer comprises a vertical cuvette chamber into which the cuvette is inserted for performing a quantitative determination of an analyte in a water sample.

The cuvette comprises at least one optical identification, e.g. a graphical identification of origin or a one- or two-dimensional barcode. The identification contains information about the type and/or the origin of the cuvette. The identification is suited for reading by a digital camera. For this purpose, the identification should be represented with contrasts as rich as possible. Further, the cuvette has an axial locating bar with a constant bar width. The locating bar may be a white strip on a black background. The term "axial", as used herein, always means vertical, since the cuvette can be placed into the correspondingly vertically oriented cuvette chamber exclusively in vertical orientation.

The laboratory analyzer comprises a digital camera at the cuvette chamber, which has an axial, i.e. vertical, resolution of more than 10 lines. The digital camera can be an axially, i.e. vertically oriented line scan camera, but it may also be an area scan camera capable to take a two-dimensional image. If the digital camera is designed as a line scan camera, a resolution of more than 10 lines means the number of pixels arranged one above the other in the vertical direction, which can record a corresponding number of lines as the cuvette is rotated by the cuvette rotating device.

If the digital camera is designed as an area scan camera, a circular section of the cuvette can basically be read in also when the cuvette is standing still, with a plurality of circular sections of the cuvette being scanned one after the other intermittently, in order to thereby scan the entire circumference of the cuvette. This procedure is advantageous in particular when reading in the optical identification.

According to the method, first, at least four lines of the digital camera that are not adjacent to each other are read in. If the digital camera is designed as a (vertical) line scan camera, the cuvette is rotated at a constant rotation speed by the cuvette rotation device during the reading operation. If the digital camera is designed as an area scan camera, a single vertical column of the digital camera can be activated in these method steps, while all other columns are inactive, so that the area scan camera is used only as a vertical line camera. As an alternative, provided the camera is an area scan camera, it is also possible in this method step to take a plurality of pictures of the cuvette in an intermittent manner, so that the entire circumference of the cuvette is thus scanned.

When reading in, at most every second line of the digital camera is read in, preferably at most every fourth line, and particularly preferred at most every eighth line. In this manner, the data volume to be evaluated is drastically reduced and the locating bar can be found quickly.

Only when at least three, particularly preferred at least four mutually successive read-in lines determine approximately in-line reflection signals with the correct bar width, reflected by the locating bar, it is assumed that the locating bar has been found. As long as less than three, particularly preferred less than four mutually successive read-in lines determine approximately in-line reflection signals with the correct bar width, reflected by the locating bar, the cuvette is rotated on and the search for the locating bar is continued. In this method step, successive read-in lines are the successive active lines, i.e. only those lines that are active in this method step. Thus, one or a plurality of non-active lines can exist between two successive active lines.

The locating bar is in a fixed geometric relationship with the identification or the identifications on the cuvette. The geometric relationship can be expressed, for example, by a rotation angle α, β and, as the case may be, by a vertical vector.

After the locating bar has been found, the cuvette is rotated by the rotation angle α, β corresponding to the geometric relationship, such that the identification

or one of the identifications is aligned with the digital camera such that the identification can be detected quickly by the digital camera in this position.

For the purpose of controlling the method, the laboratory analyzer is provided with a control including an identification search module.

The above described method and the above described device significantly accelerate the search for the optical identification, since the data volume to be evaluated in this process is reduced greatly, in particular in the case of a digital camera designed as an area scan camera.

The following is a detailed description of an embodiment of the invention with reference to the drawing.

In the Figures:

Figure 1 is a schematic illustration of a laboratory analyzer measuring arrangement with a laboratory analyzer and a laboratory analyzer cuvette,

Figure 2 is an upscale illustration of the laboratory analyzer cuvette of Figure 1 including a label with two identifications and a locating bar, and

Figure 3 illustrates a flat projection of the label in Figure 2.

Figure 1 schematically illustrates a laboratory analysis measuring arrangement 10 formed by a laboratory analyzer 14 and a laboratory analyzer cuvette 12. The measuring arrangement 10 serves to determine a certain analyte in a water sample. For this purpose, the cuvette 12 contains a dried solid reagent 34 which reacts in a color-modifying manner with the relevant analyte in the water sample pipetted into the cuvette 12. In the laboratory analyzer 14, the concentration of the analyte in the water sample is determined in a transmissive manner by

means of a photometer 19, 20 which is formed essentially by a transmitter 19 and a receiver 20.

The laboratory analyzer 14 has a digital camera 18, designed as an area scan camera, which is arranged on the cylindrical side wall of a vertical cuvette chamber 15. The digital camera may alternatively be operated in an area scan mode or a column scan mode, as will be explained below.

The cuvette chamber 15 is associated with a cuvette rotation device 21 formed by a rotary plate 22 in the region of the cuvette chamber 15 and by an electric drive motor 24 rotating the rotary plate 22, if needed.

The laboratory analyzer 14 further comprises a digital apparatus control 26 with an identification search module 28 and a central unit 30. The identification search module 28 controls the quick locating and reading of an identification 54, 56 on a label 16 of the cuvette 12.

The cuvette 12, illustrated in detail in Figure 2, is essentially formed by a transparent cylindrical cuvette body 32 of glass, whose bottom is closed. In the bottom portion of the cuvette body 32, the reagent 34 is stored in solid, dried form.

A water-resistant paper or plastics label is stuck on the cuvette body 32, which label is printed in black and white with an axial locating bar 50, a first identification 54 and a second identification 56. The locating bar 50 is designed as a white vertical strip 52 of constant horizontal width B on a black background. The first identification 54 is arranged on the label at the same height as the locating bar 50, and can be formed, for instance, by the company name or the so-called logo of the manufacturer of the cuvette 12 or of the laboratory analyzer 14. The second identification 56 can be a one-dimensional or a two-dimensional barcode which, in encoded form, includes information about the manufacturer, the batch, the shelf-life, the reagent or the analyte to be analyzed.

Both identifications 54, 56 are in a fixed and always constant geometric relationship with the locating bar 50: the first identification 54 is at approximately the same vertical height as the locating bar 50 and its central axis of symmetry is offset from the locating bar 50 by a rotation angle α. The second identification 56 is arranged offset both axially and, with respect to its axis of symmetry, rotationally from the locating bar 50 by an angle β. The geometric relationship is always the same for all cuvettes 12, irrespective of the type of reagent 32 they contain or of the analyte they are provided for.

Figure 3 schematically shows a flat projection of the label 16 of a cuvette 12 placed in the cuvette chamber 15 and the digital camera 18. The digital camera 18, designed as an area scan camera, has a CCD chip 18' having a resolution of, for example, 320 x 320 pixels, i.e. 320 lines and 320 columns.

For searching the locating bar 50, only a single column 17 of the CCD chip 18' is activated. In this column 17, only nine non-adjacent lines 100, 105, 110, 115, 120, 125, 130, 135, 140 are activated or read out by the identification search module 28, these lines being separated respectively by thirty-eight non-active lines.

For searching the locating bar 50, the cuvette rotating device 21 controlled by the central unit 30 rotates the cuvette 12, filled with a water sample and placed in the cuvette chamber 15, at a constant rotation speed in the cuvette chamber 15, while, at the same time, the nine lines 100, 105, 110, 115, 120, 125, 130, 135, 140 of the digital camera 18 are read and evaluated by the identification search module 28. As soon as approximately axially in-line reflection signals with the bar width B, reflected from the locating bar 50, are detected for four mutually successive active read-in lines 105, 110, 115, 120, it is assumed that the locating bar 50 or the locating bar strip 52 has been found. This is reported to the central unit 30 by the identification search module 28.

Then, the cuvette 12 is rotated by the cuvette rotating device 21 about the associated angle α of the first identification 54 to be read in thereafter, so as to align

the first identification 54 with the digital camera 18 for the first identification 54 to be read. In the example illustrated in Figure 3, the associated angle α indicates the rotational distance to the central symmetry axis of the identification 54. As an alternative, the associated angle may also indicate the rotational distance to the left or the right end of the respective identification, especially if the digital camera is a line scan camera.

After, in the present embodiment, the central symmetry axis of the identification 54 is aligned centrally with the digital camera 18, the digital camera reads in a two-dimensional full-surface picture of the identification 54 and is checked for authenticity by the identification search module 28 or the central unit 30. Thereafter or simultaneously, the second identification 56 in the form of a two-dimensional barcode can be read in and be decoded correspondingly.

Finally, based on the information acquired from the second identification 56, the water sample in the cuvette 12 is analyzed by photometry using the photometer 19, 20.

CLAIMS:

1. A method for locating an optical identification on a cylindrical laboratory analysis cuvette containing a reagent, said cuvette being placed in a vertical cuvette chamber of a laboratory analyzer having a cuvette rotating device, wherein a digital camera with an axial resolution of more than 10 lines is associated with the cuvette chamber, and wherein, in fixed geometric relationship with the identification, the cuvette comprises an axial locating bar with a fixed bar width, the method comprising the following steps:

- reading in at least four respectively non-adjacent lines of the digital camera,
- searching for the identification:
    - if at least three mutually successive read-in lines comprise approximately axially in-line reflection signals with the bar width, reflected by the locating bar:
        - rotating the cuvette by an angle corresponding to the geometric relationship, such that the identification is aligned with the digital camera, and
        - reading in the identification by reading out a plurality of adjacent lines of the line scan camera.

2. The method of claim 1, wherein, upon reading in, at least six non-adjacent lines are read in, and, upon determination of the rotational position of the locating bar, at least four mutually successive read-in lines include approximately axially in-line reflection signals with the bar width, reflected by the locating bar.

3. The method of claim 1, wherein the digital camera is an area scan camera, the reading being performed while the cuvette rotating device is at standstill.

4. The method of claim 1, wherein the locating bar is designed as a white vertical strip on a black background.

5. The method of claim 1, wherein the identification is a barcode.

6. The method of claim 1, wherein the identification is a graphical identification of origin.

7. A laboratory analysis measuring arrangement comprising a laboratory analyzer and a laboratory analysis cuvette,

wherein the cuvette is cylindrical, includes a reagent serving for a quantitative determination of an analyte in water, and comprises a label having an identification and, in a fixed geometrical relationship therewith, a vertical locating bar,

wherein the laboratory analyzer comprises:

a cuvette chamber for receiving the cuvette,

a cuvette rotating device in the cuvette chamber,

a digital camera associated to the cuvette chamber with an axial resolution of more than 10 lines, and

a control comprising an identification search module which, by means of the cuvette rotating device, rotates the cuvette about an angle corresponding to the geometric relationship, such that the identification is aligned with the digital camera, if at least three mutually successive read-in lines record approximately axially in-line reflection signals with the bar width, reflected by the locating bar.

8. The laboratory analysis measuring arrangement of claim 7, wherein the digital camera is an area scan camera, the reading being performed while the cuvette rotating device is at standstill.

9. The laboratory analysis measuring arrangement of claim 7 or 8, wherein the locating bar is designed as a white vertical strip on a black background.

10. The laboratory analysis measuring arrangement of any one of claims 7 - 9, wherein the identification is a barcode.

11. The laboratory analysis measuring arrangement of any one of claims 7 - 10, wherein the identification is a graphical identification of origin.

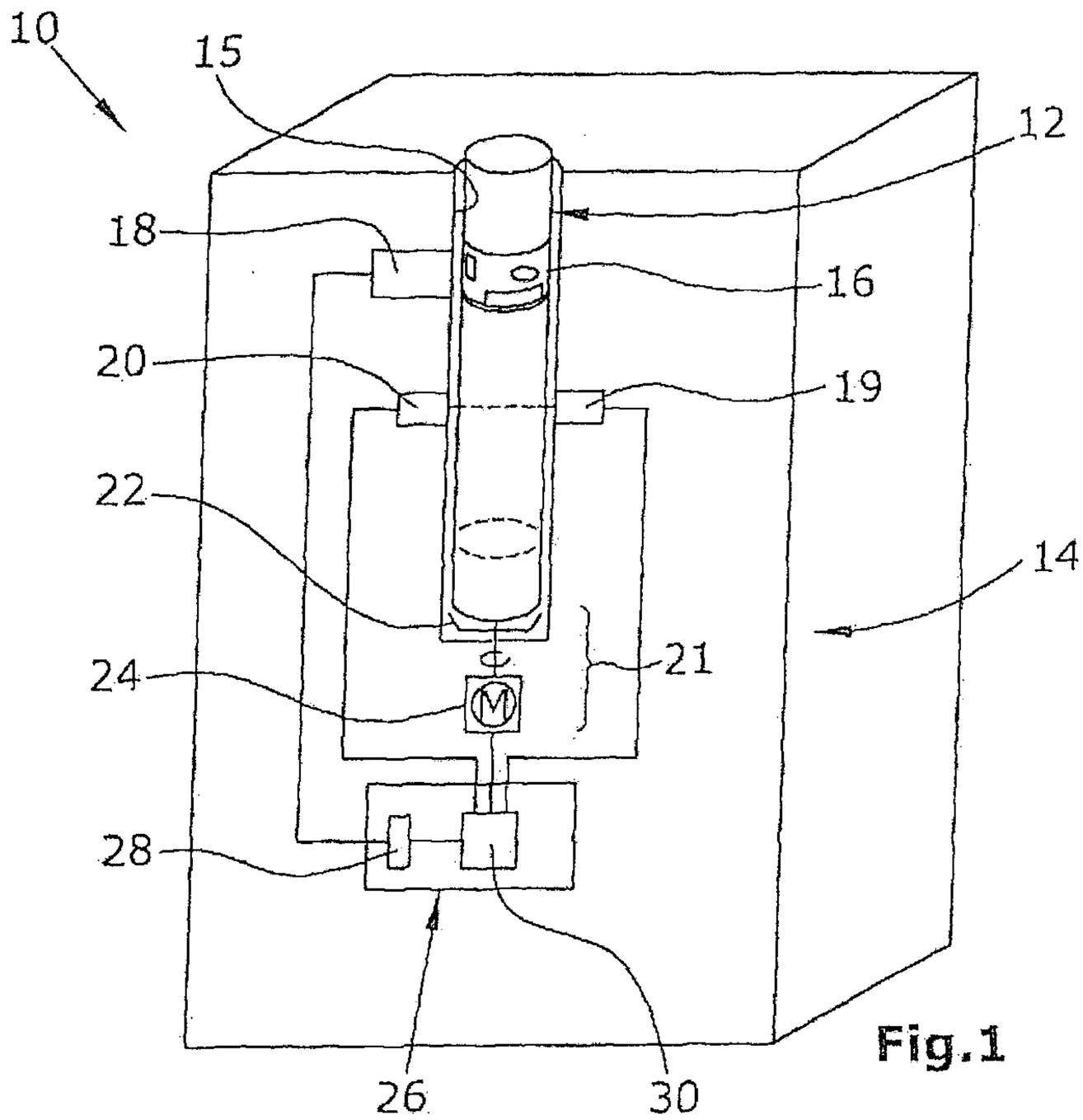

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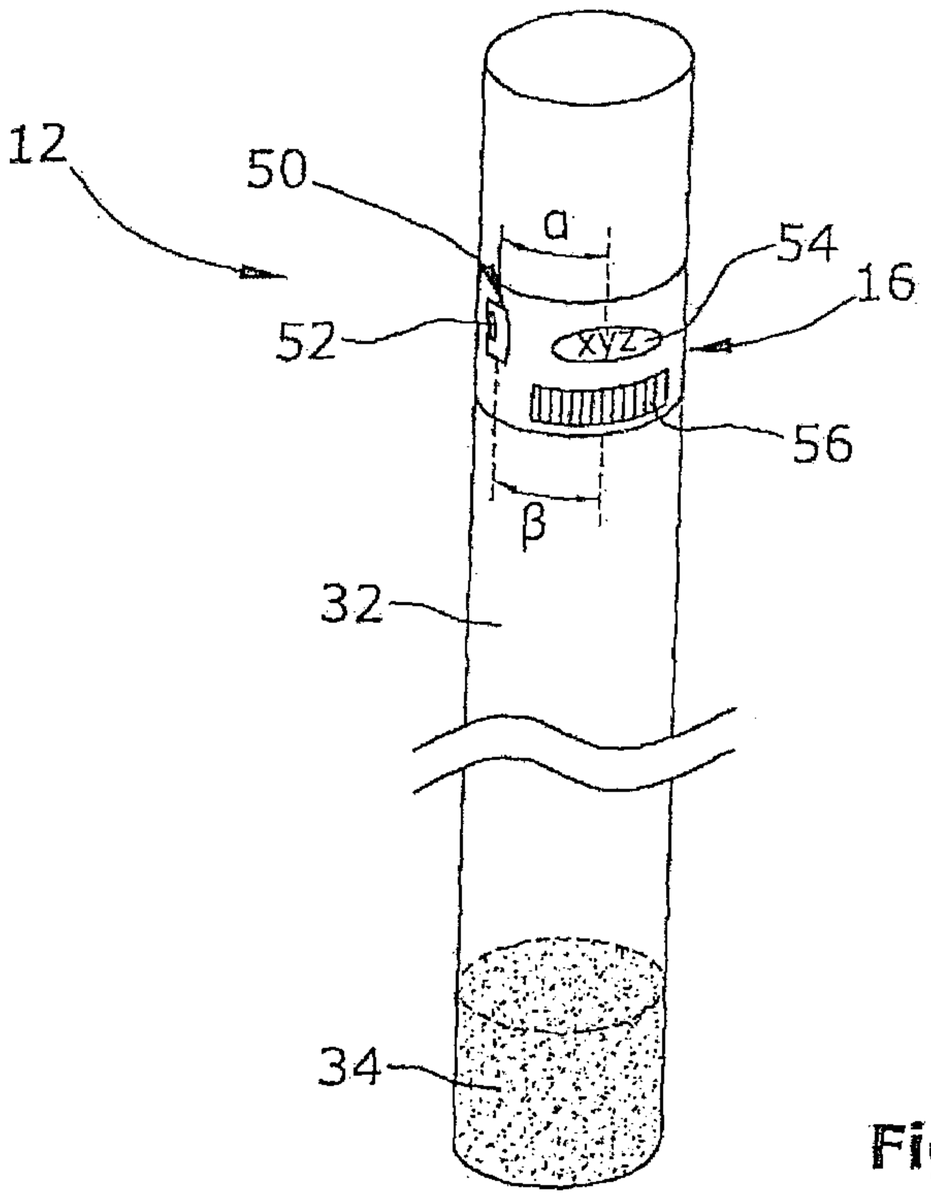
Fig.1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54
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52
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32
34

Fig.2

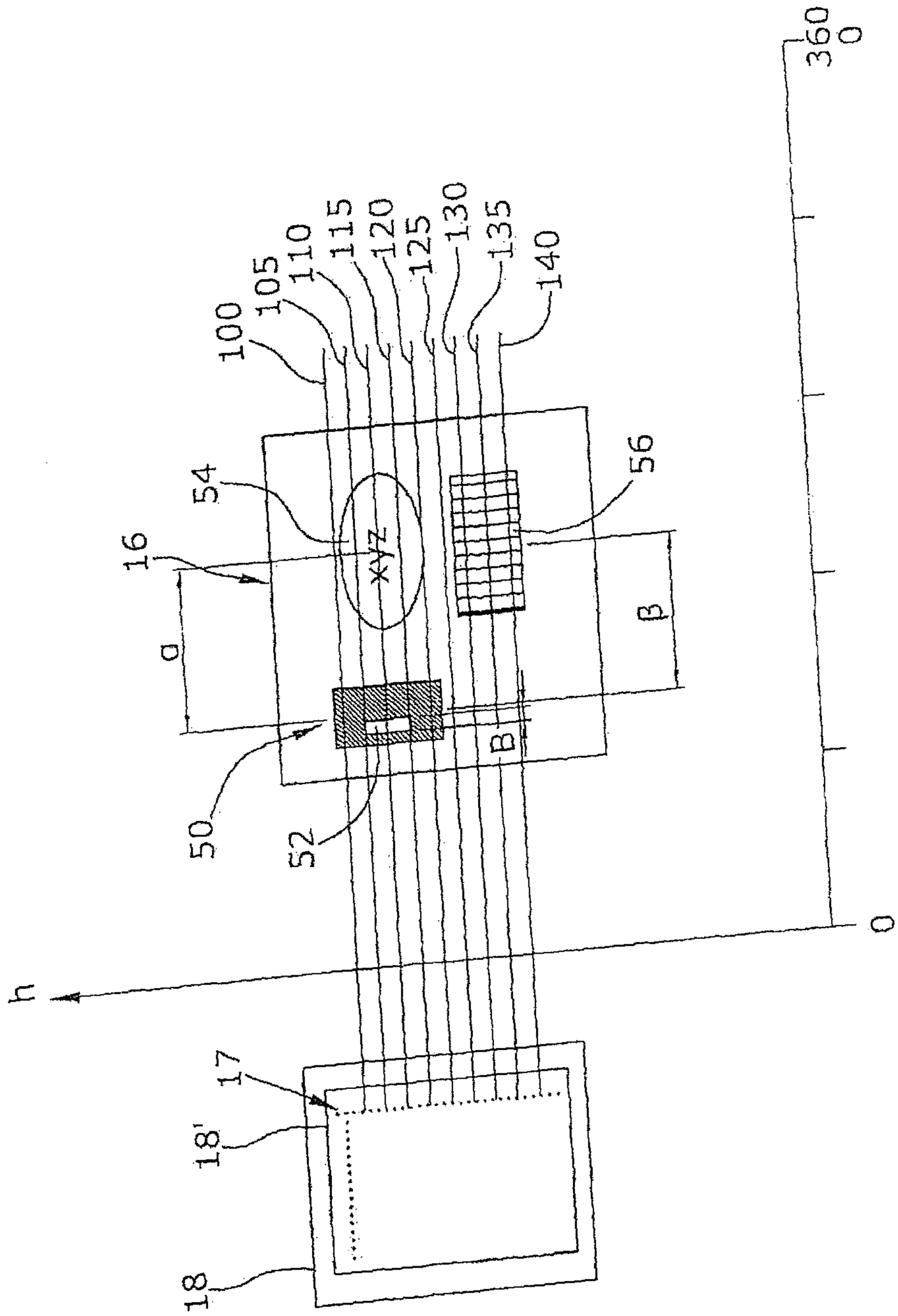
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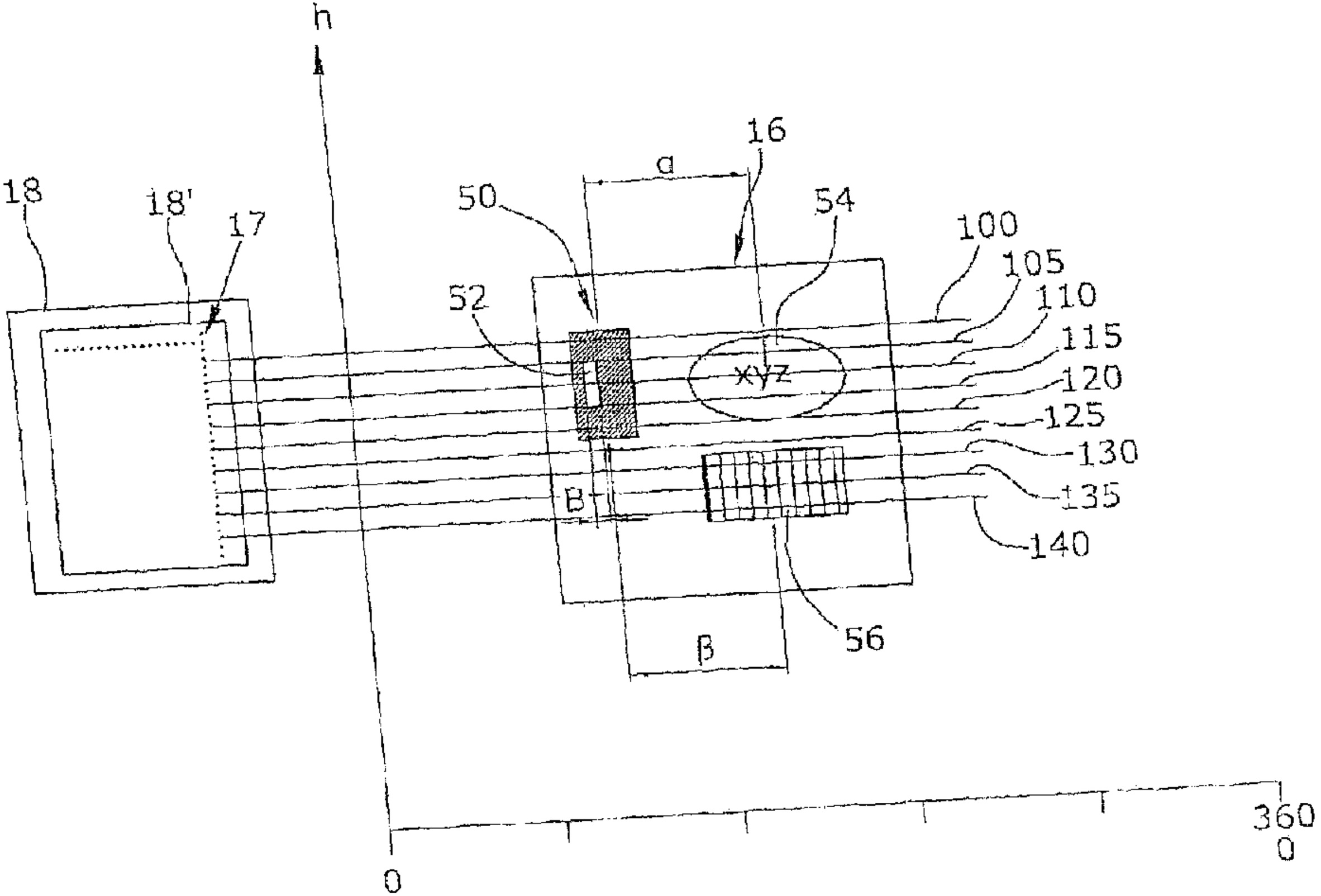
Fig.3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