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(54) System for adjusting the angular orientation of printing heads

(57) System for adjusting the angular orientation in a first plane of a plurality of print head cartridges (7) or groups of cartridges (7) arranged adjacent to each other on a carriage (4) which can be reciprocated in an Y-direction, wherein each of said cartridges or group of cartridges is mounted on said carriage (4) to be tiltable in said first vertical plane, wherein for each of said cartridges or groups of cartridges said carriage is provided with first means for adjusting said angular orientation of the repective cartridge or group of cartridges, said system being provided with second means (71) arranged remote from said carriage for adjusting said angular orientation of said cartridge or group of cartridges, said second adjusting means being arranged for being selectively operatively coupled with said first adjusting means of a selected one of said cartridges or group of cartridges.

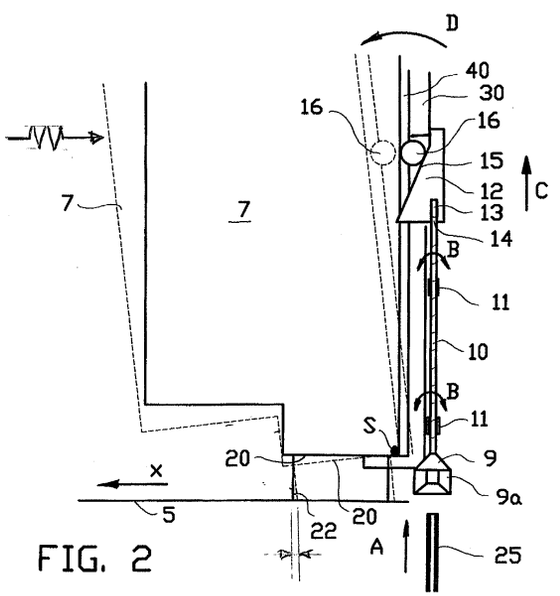

FIG. 2

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Description

[0001] The invention relates to a system for adjusting the angular orientation of print head cartridges arranged on a carriage of a printer, such as a laserjet printer or an inkjet printer.

[0002] Print head cartridges are usually arranged on a carriage that is reciprocated in the so-called Y-direction over the width of the surface that is to be printed. The carriage is provided with means for receiving and holding the cartridge with the print head nozzles directed towards said surface. During printing, the surface to be printed, such as a paper web, is moved in the X-direction, which is perpendicular to the Y-direction.

[0003] Nowadays high-resolution printing processes require a high accuracy in the position of the print head nozzles with respect to the paper. It may therefore be desirable to be able to compensate for possibly occurring misalignment of the print head nozzles with the imaginary X-lines and/or Y-lines of the input image template or grid to adjust the position of the print head nozzles in the X- and Y-direction with respect to the carriage.

[0004] It has been suggested to adjust the position of print head nozzles in the X-direction of one print head of a pair by using a cam-lever mechanism arranged on the carriage. A stationary lever arm can be operated to extend into the path of the cam-lever to rotate the cam-lever about a Z-axis extending perpendicular to the paper. The cam on the cam-lever is than urged against the print head cartridge so that the cartridge is tilted about an axis parallel to the Y-direction. This known adjusting mechanism with two levers is quite complex and occupies much space, in particular the cam-lever which projects from the carriage in the X-direction. In addition, due to its constructional width, the known adjusting mechanism cannot properly be arranged on the carriage for two adjacent print heads. In any event, arranging a plurality of such adjusting mechanisms on carriages carrying a plurality of print heads would increase the weight of the carriage in an unacceptable manner.

[0005] It is an object of the invention to improve on this.

[0006] It is a further object of the invention to provide an adjusting mechanism for print heads on a carriage of a printer by which the weight of the carriage is increased to a limited degree only, even in the case of a plurality of print heads.

[0007] It is a further object of the invention to provide an adjusting mechanism for print heads on a carriage of a printer that functions with a high degree of accuracy and with which the position of the print head nozzles in the X-direction can be fine-tuned.

[0008] From one aspect, the invention provides a system for adjusting the angular orientation in a first plane perpendicular to the X-direction of a plurality of print head cartridges or groups of cartridges arranged adjacent to each other on a carriage which can be reciprocated in the Y-direction, wherein each of said cartridges or group of cartridges is mounted on said carriage to be tiltable in said first vertical plane, wherein for each of said cartridges or groups of cartridges said carriage is provided with first means for adjusting said angular orientation of the respective cartridge or group of cartridges, said system being provided with second means arranged remote from said carriage for adjusting said angular orientation of said cartridge or group of cartridges, said second adjusting means being arranged for being selectively operatively coupled with said first adjusting means of a selected one of said cartridges or group of cartridges.

[0009] The division of the adjusting mechanism into first adjusting means on every cartridge or group of cartridges of a plurality of cartridges or groups of cartridges on the carriage and second adjusting means positioned remote from the carriage and which can be selectively operatively coupled with a selected first adjusting means, makes it possible to keep the construction of the adjusting means on the carriage simple and requires only one second adjusting means for all first adjusting means.

[0010] By selectively coupling the selected first adjusting means and the second adjusting means, the adjusting means can be operated positively and therefore in a controlled manner, permitting a fine-tuning of the relative position of the cartridges, in particular their nozzles, in the X-direction. In addition, the weight of the carriage will not be increased to too high a degree.

[0011] In a further development, the second adjustment means are pivotable in a plane perpendicular to the Y-direction between a retracted position and a coupled position, so that the space occupied by the movement and presence of the second adjustment means may be kept within limits. Advantageously, the second adjustment means may then be movable towards the coupled position in a direction towards the nozzle side of the cartridge. In this way, the path of movement of the second adjustment means is kept within the usual boundaries of the printer.

[0012] In a further development, each one of said cartridges or group of cartridges is provided with said first adjusting means, so that an optimal adjustability is realised, with only one second adjusting means.

[0013] The second adjusting means can be arranged at one end of the path of reciprocal movement of said carriage. In an advantageous manner, the second adjusting means may then be arranged in a print head cleaning unit, so that the space already occupied by the cleaning unit is used more efficiently.

[0014] In a further development, the first adjusting means are adapted for tilting said cartridge by being moved in said first plane, so that the space occupied in the Y-direction is kept within limits. The heads can be placed closer to each other.

[0015] The first adjusting means may then be adapted for tilting said cartridge by being moved substantially

vertically, that is perpendicular to the paper web to be printed, whereby the space in horizontal directions is kept within limits.

[0016] Advantageously, said first adjusting means are adapted for tilting said cartridge by being moved according to a substantially linear path, so that as little space as possible is required.

[0017] In a constructionally simple and reliably operating embodiment, said first adjusting means comprise a first stop surface on said cartridge and a movable wedge-shaped second stop surface in contact therewith.

[0018] In a further development, said first and said second adjusting means comprise first and second cooperating coupling means and means for bringing the first and second coupling means into and out of operative engagement with each other. Thus, said first adjusting means may comprise a spindle forming a rotational unity with said first coupling means, said first and said second coupling means having matching unround cross-sections. In this way, a quick and reliable coupling can be established.

[0019] The process of coupling can be improved when said second coupling means form a male part, and even more when said male part is provided with a pilot surface.

In a further development said first and second coupling means have hexagonal cross-sections so as to improve a rotational engagement between the male and female parts.

[0020] Advantageously, the system according to the invention further comprises means for adjusting the position of said second adjustment means in the X-direction, so that deviations in the position in the X-direction of the first adjusting means (for instance due to a different size of the cartridge or staggered placement of the cartridges) can be compensated.

[0021] Below, the invention will be elucidated with reference to the attached drawings, in which:

Figure 1 schematically shows a top view of a printer carriage in a printer above a paper web;

Figure 2 schematically shows a side view of a cartridge adjustment arrangement according to the invention;

Figures 3A,B are views in perspective of opposite sides of a holder for a cartridge in a system according to the invention; and

Figure 4 is a schematic side view of a system according to the invention.

[0022] In the top view of figure 1, a printing station 1 is shown, arranged over and aside of a support 2 for a paper web 5 which is moved in the direction X, which may be horizontal. The printing station 1 comprises a guide 6 for a carriage 4 on which a plurality of cartridges or print heads 7 are supported and which is movable in the direction Y, which may also be horizontal.

[0023] A cleaning station 3 is arranged adjacent to the support 2. The cleaning station is arranged below the guide extension 6b, which is aligned with guide portion 6a which is positioned over the support 2.

[0024] As has been schematically shown in figure 4, the cleaning station 3 has a cleaning head 50 arranged on top of a vertical bar 51 which is movable up and down in the direction I by operating means that are not further shown.

[0025] All print heads 7 are indirectly supported in frames 30 which are fixedly mounted on the carriage 4 and support sub-frames 40 onto which the print heads 7 are mounted. The sub-frames 40 are tiltable in the direction D about an axis S parallel to the Y direction with respect to the frames 30.

[0026] This tilting movement is more clearly shown in figure 2, where a print head 7 is schematically depicted in two orientations, namely a standard, vertical orientation shown in full lines and a tilted orientation, shown in broken lines. At its lower side, the print head is provided with a nozzle plate 20 having nozzles which, when activated, discharge ink in the Z-directions.

[0027] The frame 30 supports a linearly vertical shiftable wedge 12, which has an inclined wedge plane 15 and a threaded hole 13. A top end 14 of a spindle 10 is threadedly received in hole 13 and is rotatably guided in bearings 11 on frame 30, vide also figure 3B. At the lower end of the spindle 10 a hexagonal socket 9 is fixed, in which the upper end of a hexagonal rod 25 is insertable when displaced upwards in the direction A. This inserting is improved by pilot faces 9a.

[0028] The sub-frame 40 is provided with a horizontally extending bar 16 which is in engagement with wedge face 15.

[0029] As can be seen in figure 3A, the sub-frame 40 is accommodated in frame 30 which has two horizontal legs 41 which serve as support for a print head which is not shown. The sub-frame 40 is provided with 2 stops on extending bar 16 for defining the standard orientation of the print head. The sub-frame 40 can be tilled around axes S and the sub-frame 40 together with the head and moves in the direction D.

[0030] In the cross-section of the cleaning unit 3 shown in figure 4, the walls 3a-b limit a housing 60 in which the cleaning head 50 and operative means for it, as well as an adjusting mechanism for the movement of the hexagonal rod 25 are accommodated. This mechanism includes a motor 61 accommodated in housing part 23 and which drives a shaft 62 supported in bearings 64 arranged in walls 3a,b of the housing 60. When activated, the motor 61 rotates the shaft 62 in the directions E, the cams 63a,b being displaced in the linear directions F. Cam 63a is connected to bracket 72 of a sub-frame 71, which bracket is rotatable about axis T in the directions H. The sub-frame 71 comprises an L-strip

73 which is provided with a slot 75 in which a cam 66 mounted on a wheel 65 is slidingly received. The wheel 65 is rotatable in the directions G by a motor which is not shown.

[0031] The sub-frame 71 carries a motor 74 for driving a shaft 26 carrying hexagonal rod 25. The shaft 26 is supported on a spring 27 for biasing the outer end of the rod 25 upwards during engagement of the pilot faces 9a of the socket 9.

[0032] In or before operation, the print heads 7 may be moved by the carriage 4 towards the cleaning unit 60. When it has been established that one, some or all of the print heads need to be adjusted in their orientation in the X-direction, the carriage 4 is driven to position the frame 30 of the print head 7 in question in front of the mechanism 70. Then the motor for the wheel 65 is activated, so that the cam 66 moves and thus the slot 75 and consequently the sub-frame 73 is rotated upwards in the direction H about axis T so that the upper end of rod 25 moves upwards (A) and operatively and matingly engages socket 9 on the frame 30 in question. Then motor 74 is activated so as to rotate rod 25 and therewith rod 10 in the direction B. As a result, the upper end 14 will rotate within threaded hole 14, whereby the wedge 12 will move upwards or downwards in the direction C. Consequently, the bar 16 will be urged sidewards away from the frame 30 or -under the influence of biasing means arranged between the frames 30 and 40 but not shown- move back to the desired extent.

[0033] By way of example, and referring to figure 2, the sub-frame 40 and therewith the print head 7 can be tilted in the direction D about fulcrum S so that the nozzles 21 change their orientation from a -by way of example- vertical discharging orientation to a more slanting orientation. This results in an X-displacement of the ejected inkdots on the receiving medium 5. The desired degree of rotation is determined by control means which are not shown and which operate the adjusting mechanism in response to measurements on the printing results.

[0034] When the adjustment operation for one print head has been completed, the same operation can be repeated for another one of the print heads, if so desired.

[0035] In case the print heads are replaced by print heads of different dimensions, the location of the rod 25 may be adapted by activating motor 61 to move the bracket 72 in the direction F to a position in which the path of movement of the upper end of rod 25 will coincide with socket 9.

Claims

1. System for adjusting the angular orientation in a first plane of a plurality of print head cartridges or groups of cartridges arranged adjacent to each other on a carriage which can be reciprocated in an Y-direction, wherein each of said cartridges or group of cartridges is mounted on said carriage to be tiltable in a first vertical plane perpendicular on the Y-direction, wherein for each of said cartridges or groups of cartridges said carriage is provided with first means for adjusting said angular orientation of the respective cartridge or group of cartridges, said system being provided with second means arranged remote from said carriage for adjusting said angular orientation of said cartridge or group of cartridges, said second adjusting means being arranged for being selectively operatively coupled with said first adjusting means of a selected one of said cartridges or group of cartridges.

2. System according to claim 1, wherein the second adjusting means are pivotable in a plane perpendicular to the Y-direction between a retracted position and a coupled position.

3. System according to claim 2, wherein the second adjustment means are movable towards the coupled position in a direction towards the nozzle side of the cartridge.

4. System according to claim 1, 2 or 3, wherein each one of said cartridges or group of cartridges is provided with said first adjusting means.

5. System according to any one of the preceding claims, wherein said second adjusting means are arranged at one end of the path of reciprocal movement of said carriage.

6. System according to claim 5, wherein said second adjusting means are arranged in a print head cleaning unit.

7. System according to any one of the preceding claims, wherein said first adjusting means are adapted for tilting said cartridge by being moved in said first vertical plane.

8. System according to claim 7, wherein said first adjusting means are adapted for tilting said cartridge by being moved substantially vertically, that is perpendicular to the paper web to be printed.

9. System according to any one of the preceding claims, wherein said first adjusting means are adapted for tilting said cartridge by being moved according to a substantially linear path.

10. System according to claim 7, 8 or 9, wherein said first adjusting means comprise a first stop surface on said cartridge and a movable wedge-shaped second stop surface in contact therewith.

11. System according to any one of the preceding

claims, wherein said first and said second adjusting means comprise first and second cooperating coupling means and means for bringing the first and second coupling means into and out of operative engagement with each other.

12. System according to claim 11, wherein said first adjusting means comprise a spindle forming a rotational unity with said first coupling means, said first and said second coupling means having matching unround cross-sections.

13. System according to claim 11, wherein said second coupling means form a male part.

14. System according to claim 13, wherein said male part is provided with a pilot surface.

15. System according to claim 12, 13 or 14, wherein said first and second coupling means have hexagonal cross-sections.

16. System according to any one of the claims 12-15, wherein said second coupling means are rotatable.

17. System according to any one of the preceding claims, further comprising means for adjusting the position of said second adjustment means in the Y-direction.

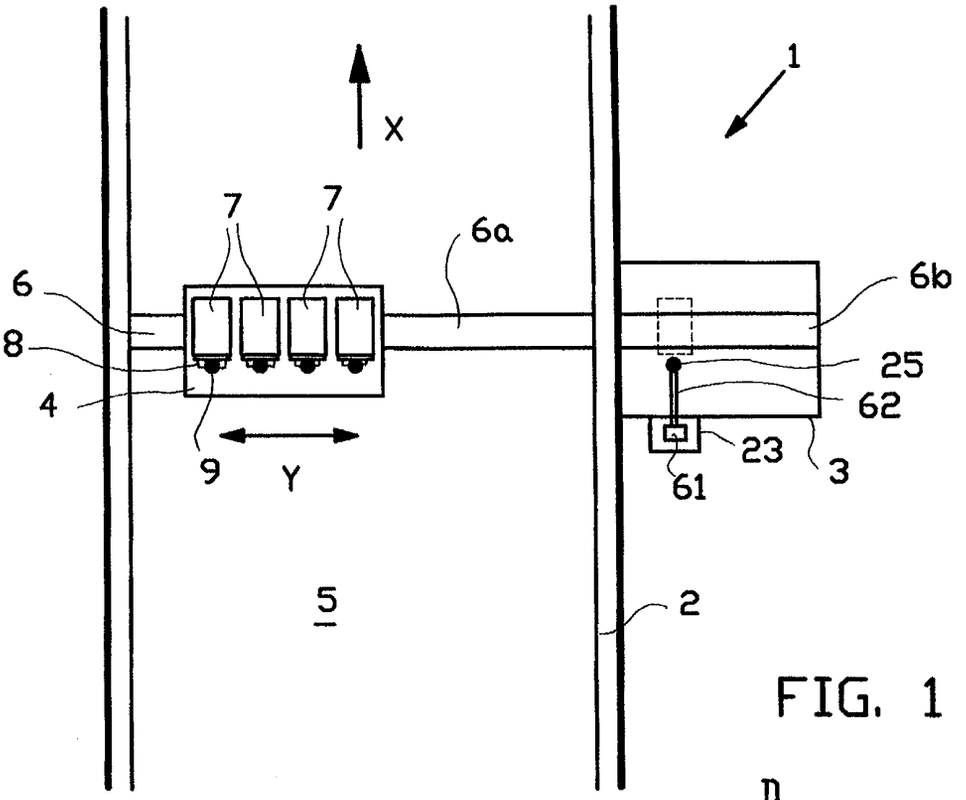
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FIG. 1

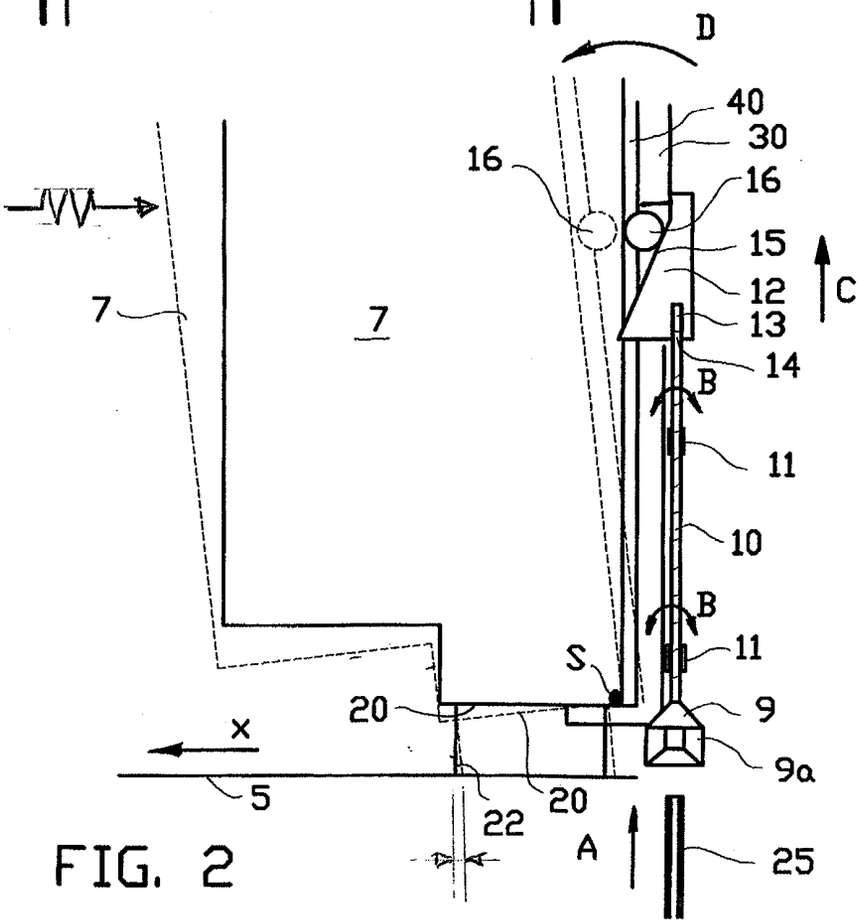
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FIG. 2

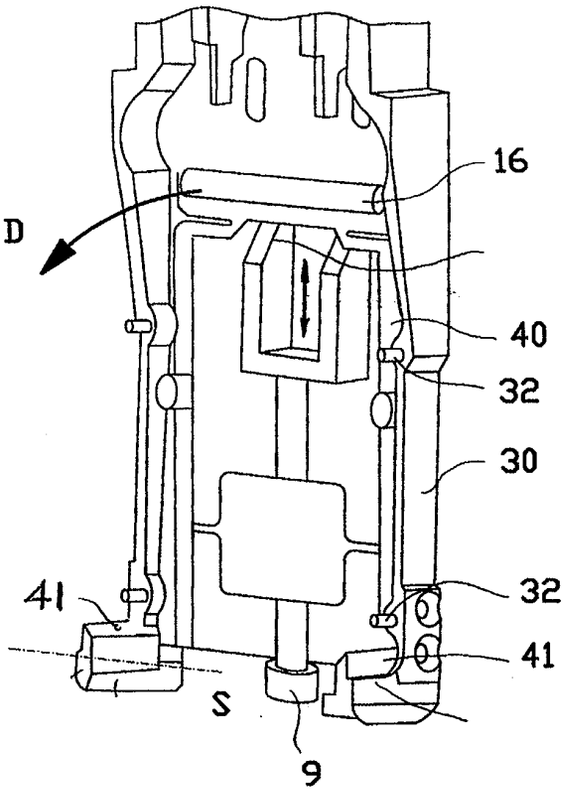

FIG. 3A

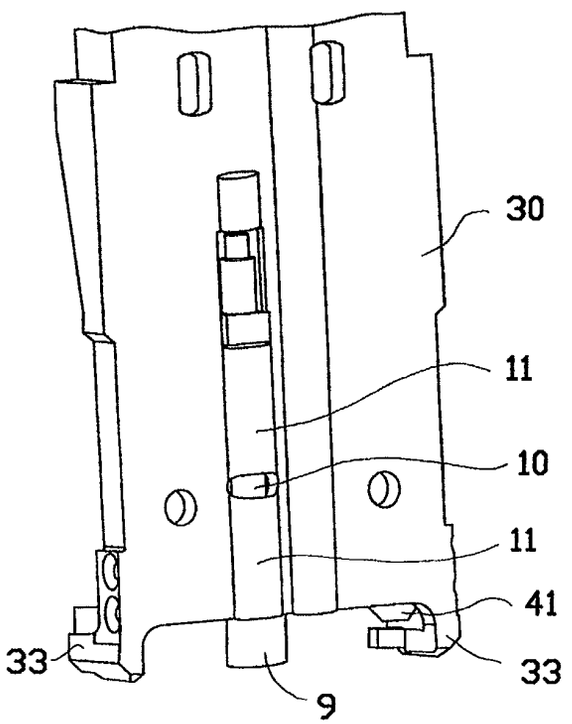

FIG. 3B

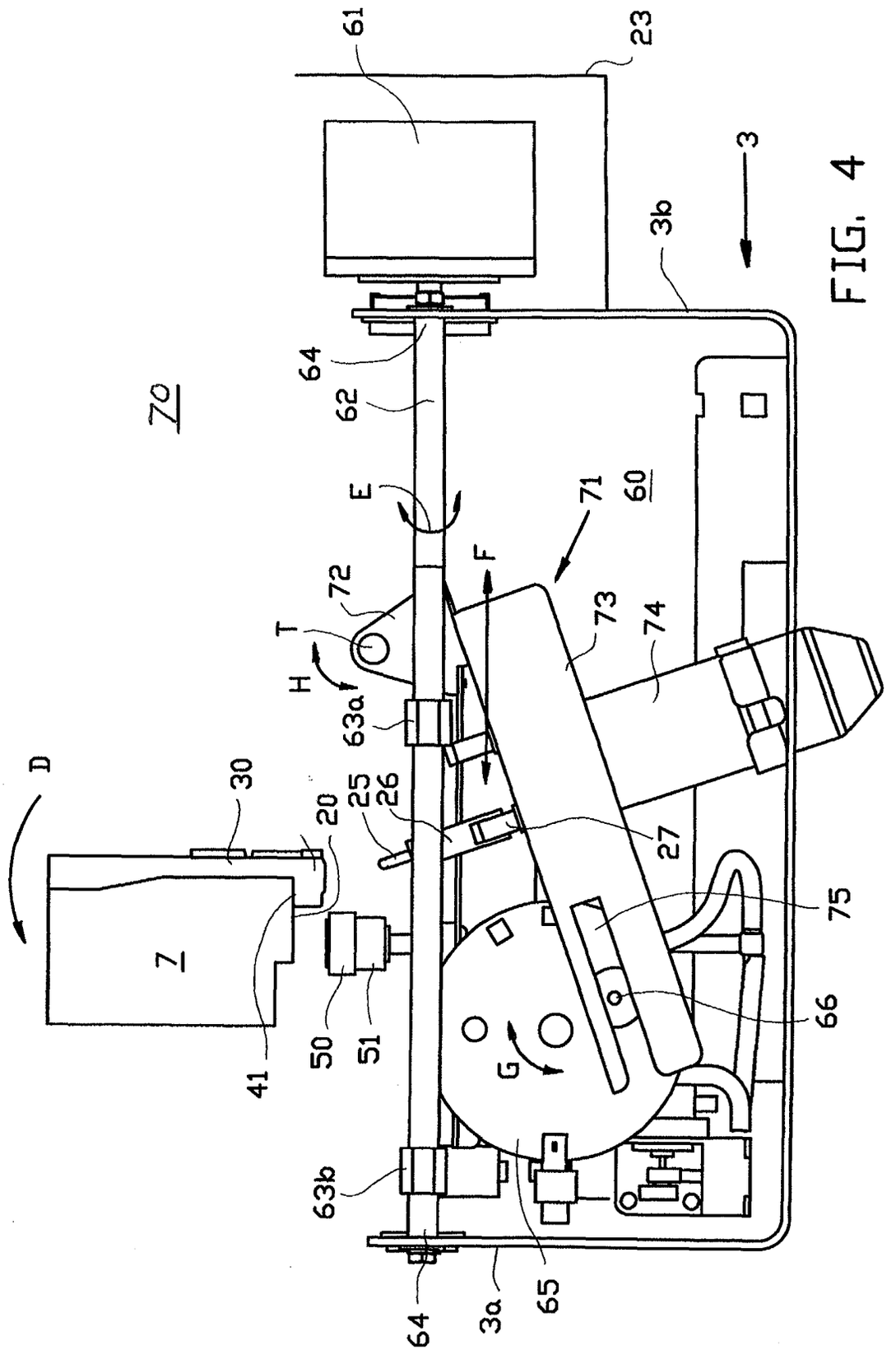
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FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 04 07 5148

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 April 2004	Van den Meerschaut,G

CATEGORY OF CITED DOCUMENTS

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