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(54) **INKJET RECORDING APPARATUS**

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(51) **Int. Cl.**

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B41J 23/02	(2006.01)
B41J 29/02	(2006.01)
B41J 29/38	(2006.01)

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(58) **Field of Classification Search**

CPC B41J 2/16532; B41J 29/38; B41J 29/02; B41J 23/025

USPC 347/37, 108

See application file for complete search history.

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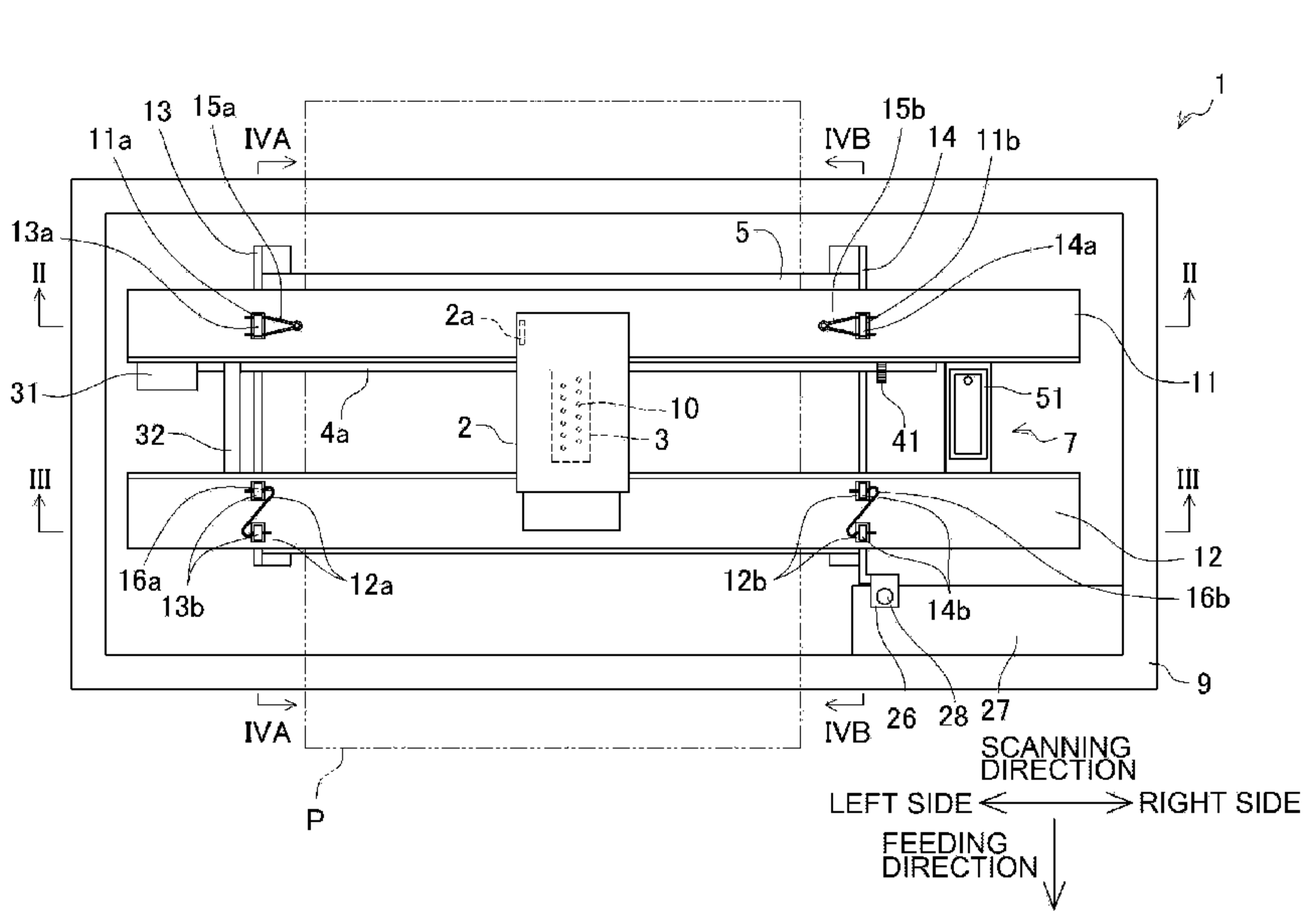
(57) **ABSTRACT**

The liquid ejection apparatus with a liquid jetting head and support members is described. A first support member and a second support member support a guide and feeding roller in a scanning direction and are attached to a housing of the liquid ejection apparatus. The housing at the location to which the first support member is attached is easier to deform in the scanning direction than housing at the location to which the second support member is attached. Further, the housing at the first location may include a projection. The first support member may be attached to the projection.

13 Claims, 6 Drawing Sheets



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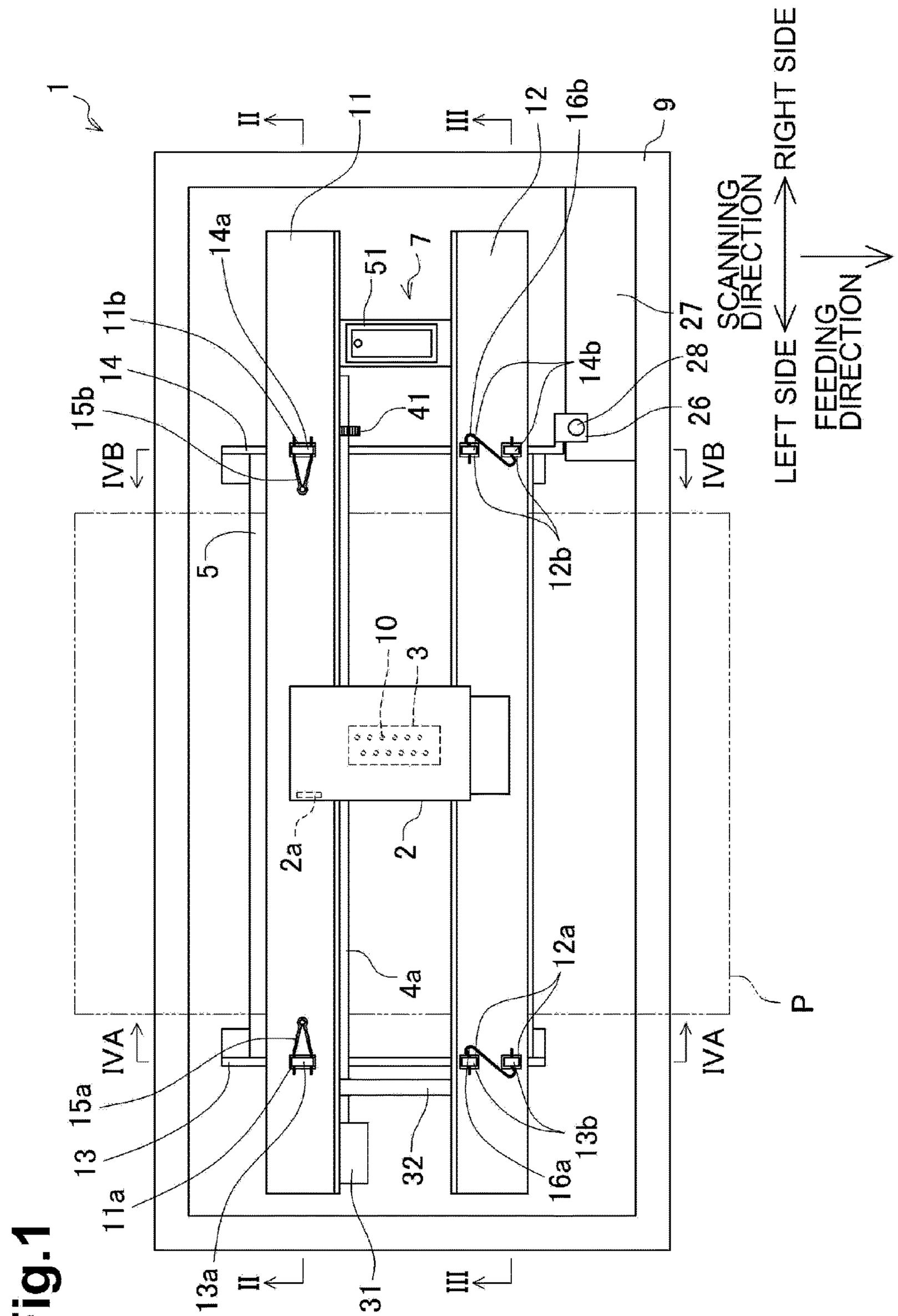
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II
11
III
12
16b
9
14a
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7
11b
14
15b
IVB
41
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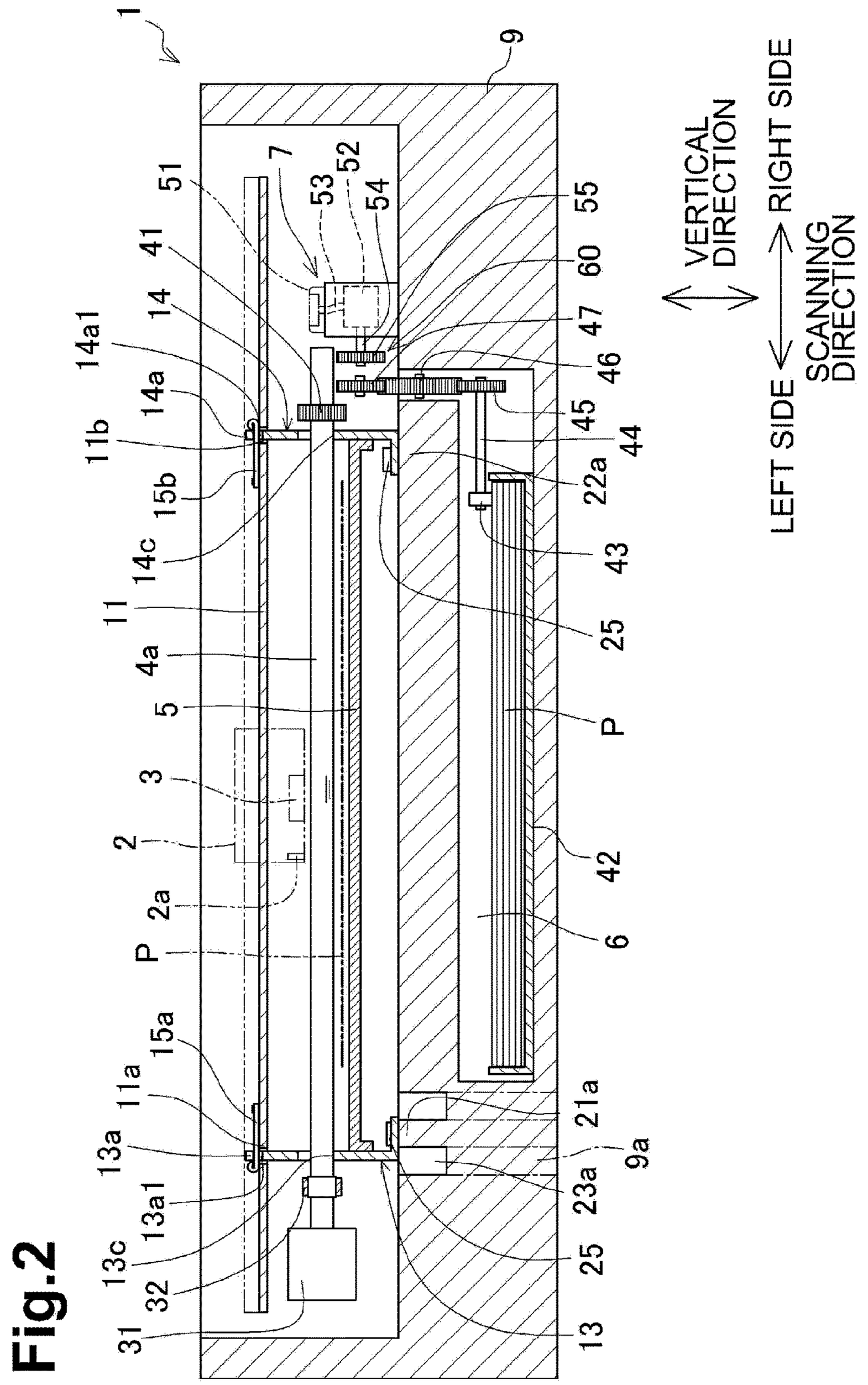
2a
2
4a
12a
13
15a
IVA
11a
13a
31
32
16a
13b
12b
14b
28
26
27
P
RIGHT SIDE
SCANNING DIRECTION
LEFT SIDE
FEEDING DIRECTION

Fig.1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14
14a1
14a
11b
15b
14c
11
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5
3
2
2a
P
47
46
45
44
22a
43
25
P
42
6
15a
11a
13a
13a1
13c
32
31
21a
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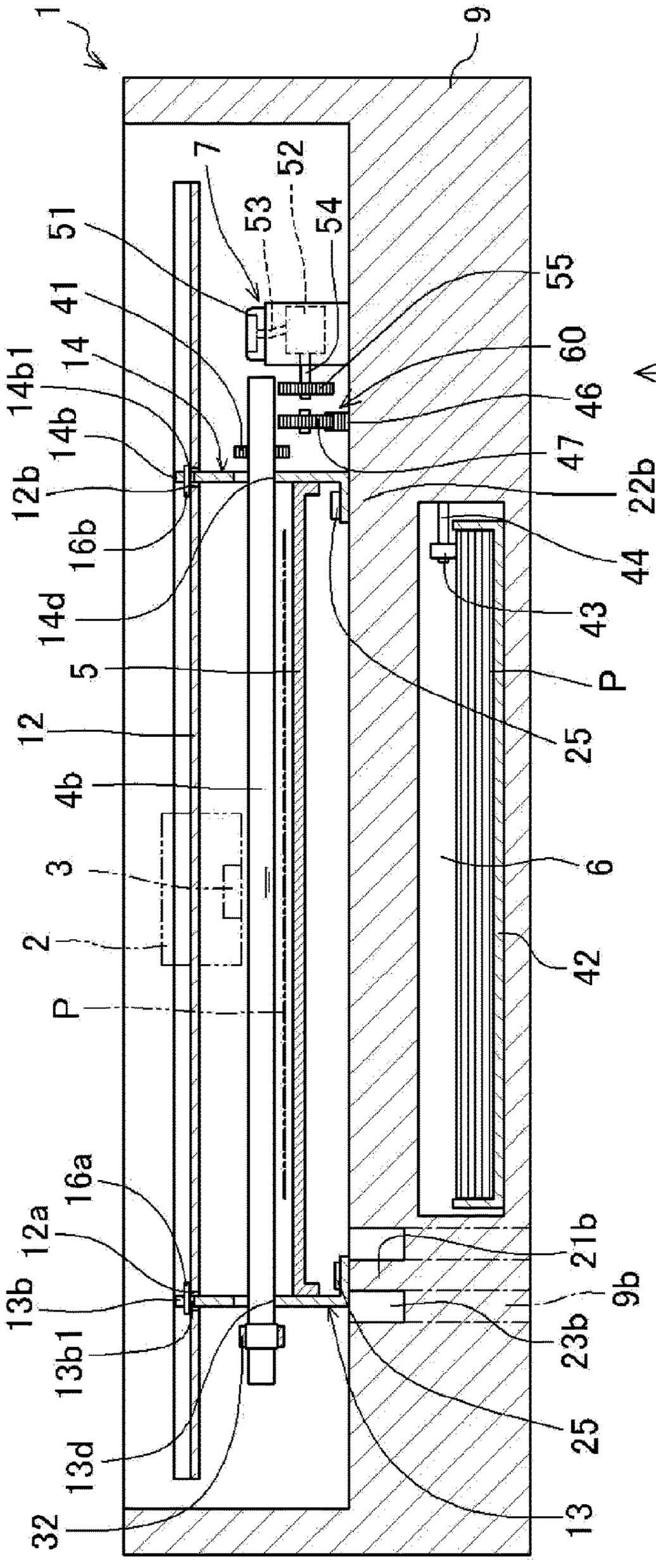
13
VERTICAL DIRECTION
RIGHT SIDE
LEFT SIDE
SCANNING DIRECTION

Fig.2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41
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12b
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14d
5
12
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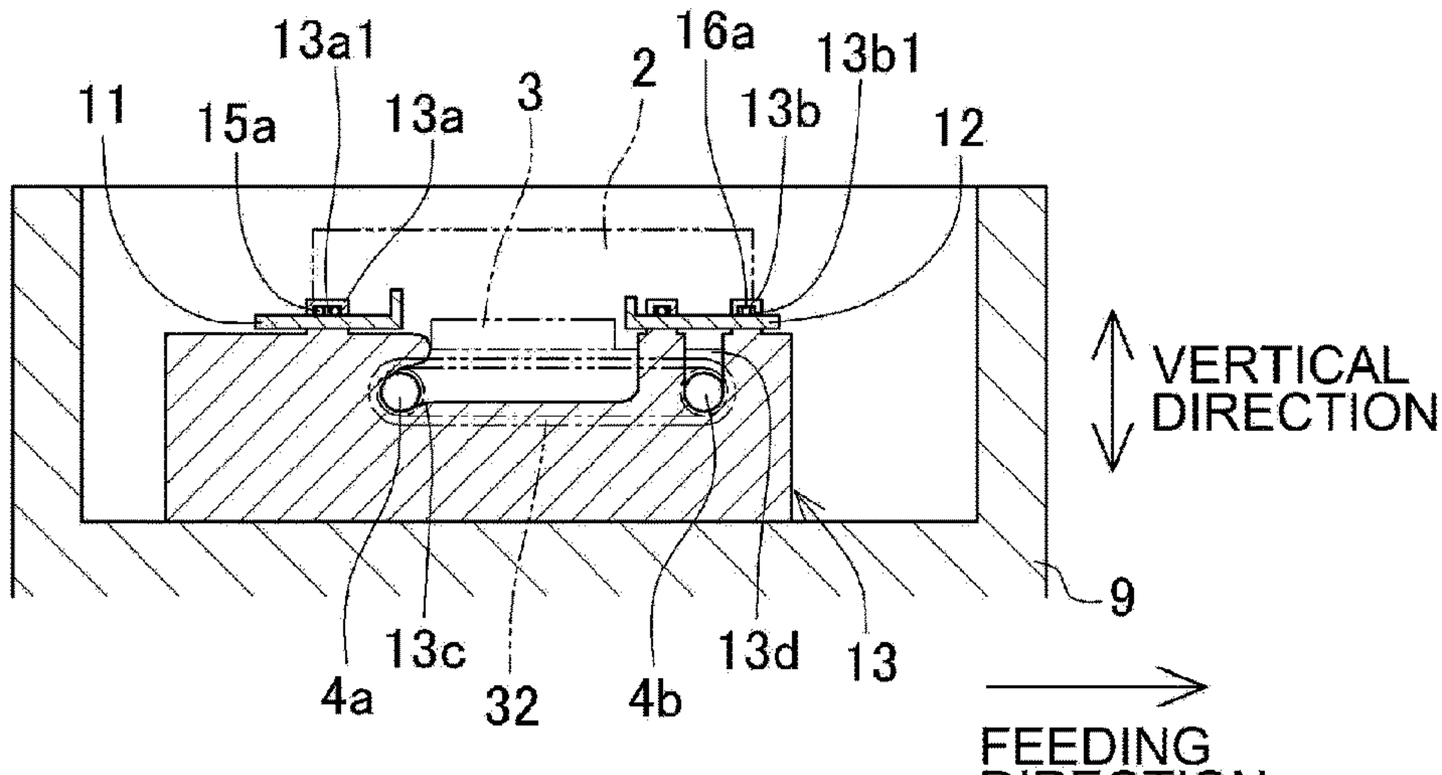
3
2
P
55
60
46
47
22b
44
43
P
25
6
42
16a
12a
13b
13b1
13d
32
21b
9b
23b
25
13
VERTICAL DIRECTION
RIGHT SIDE
LEFT SIDE
SCANNING DIRECTION

Fig.3

Fig.4A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15a
13a1
13a
3
2
16a
13b
13b1
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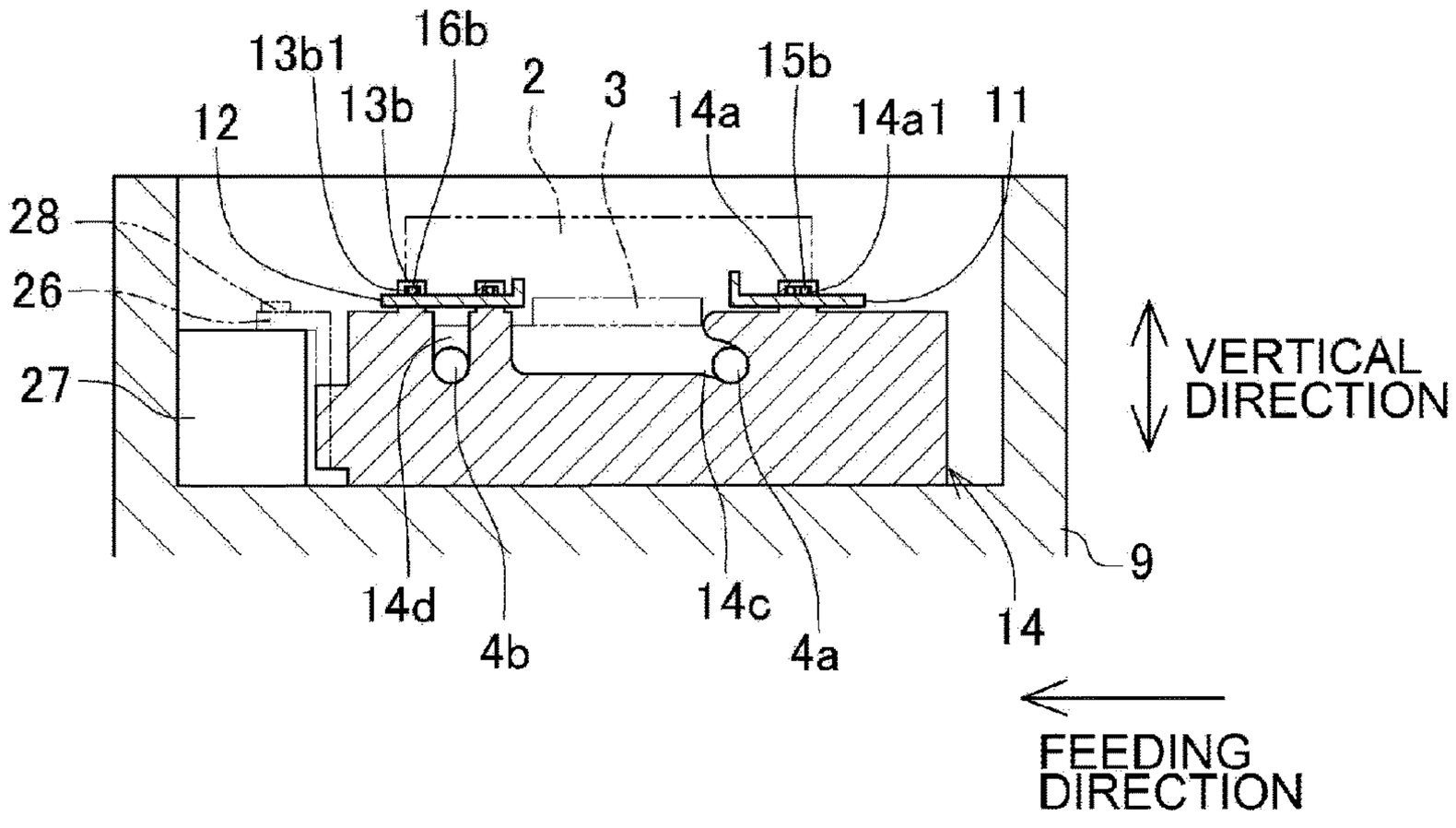
VERTICAL DIRECTION
9
4a
13c
32
4b
13d
13
FEEDING DIRECTION

Fig.4B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13b1
13b
16b
2
3
14a
15b
14a1
11
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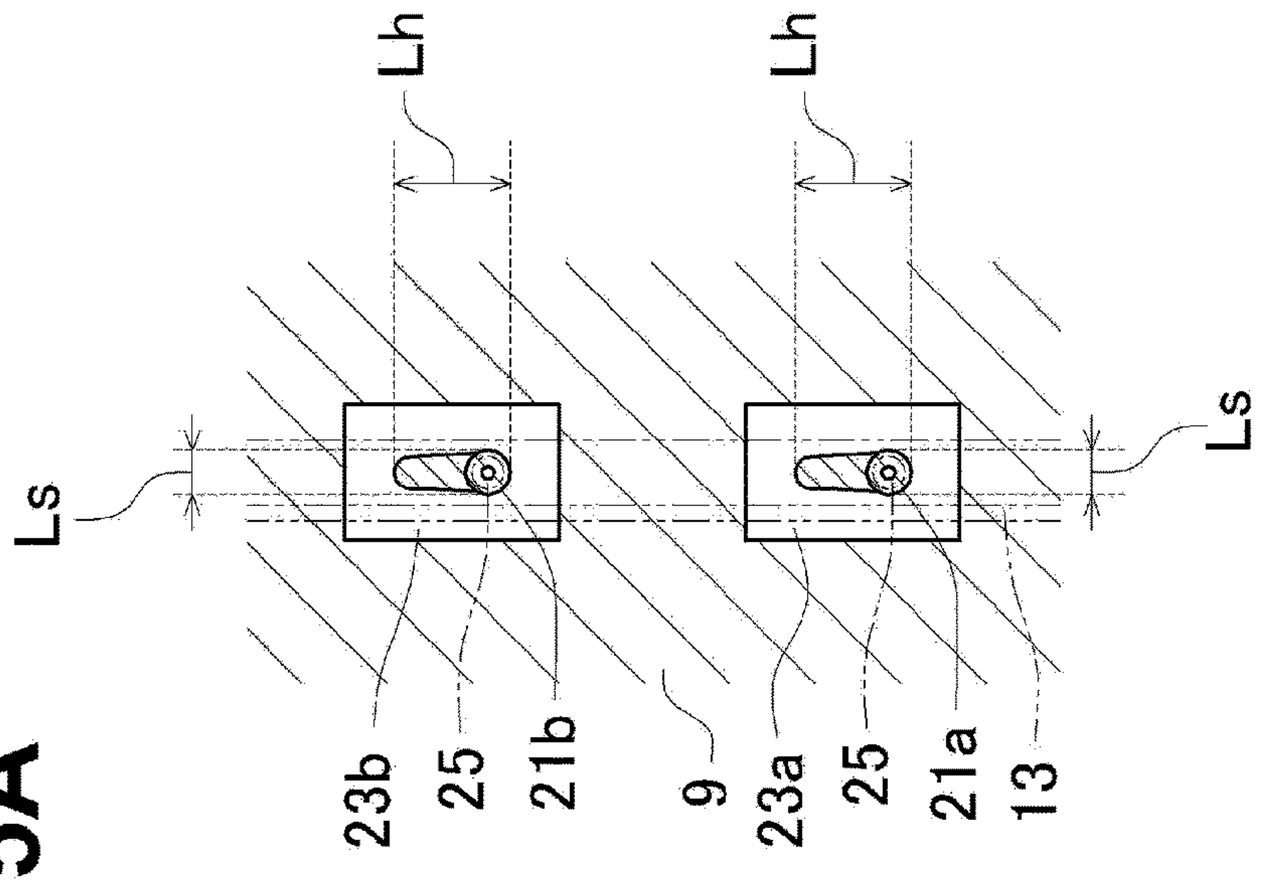
4b
14c
4a
14
FEEDING DIRECTION

Fig.5A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Lh
Ls
Ls
23b
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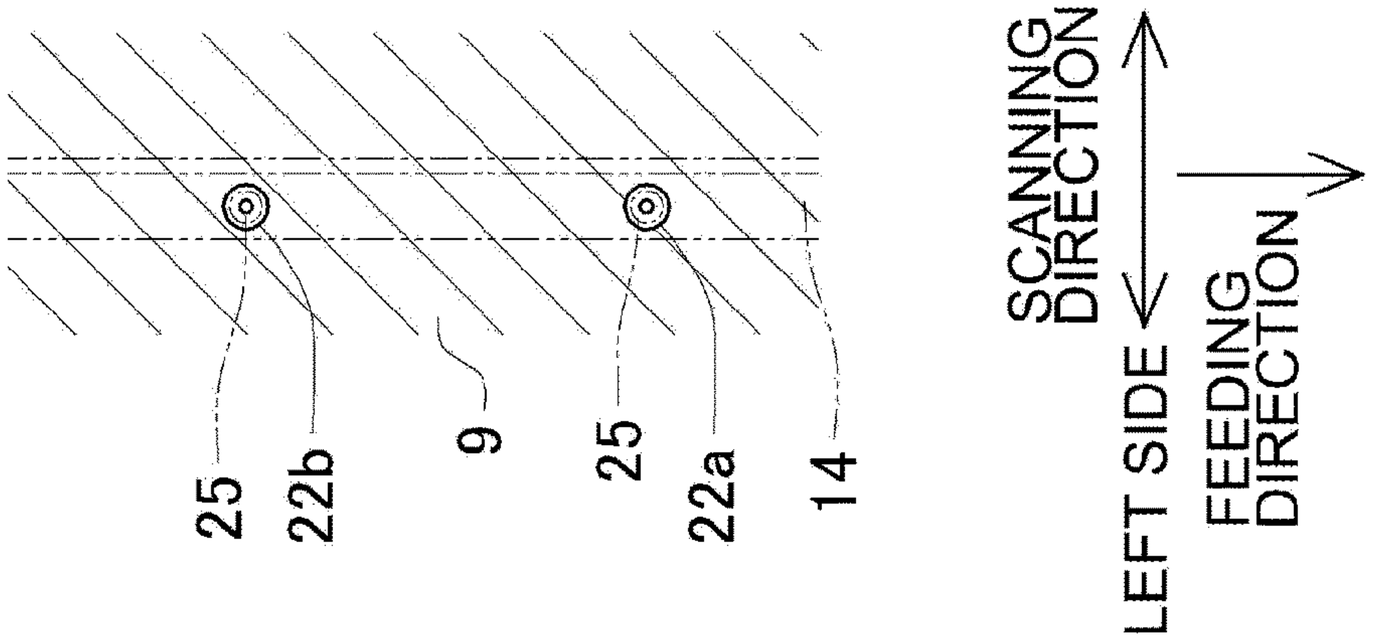
21b
9
23a
25
21a
13

Fig.5B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22b
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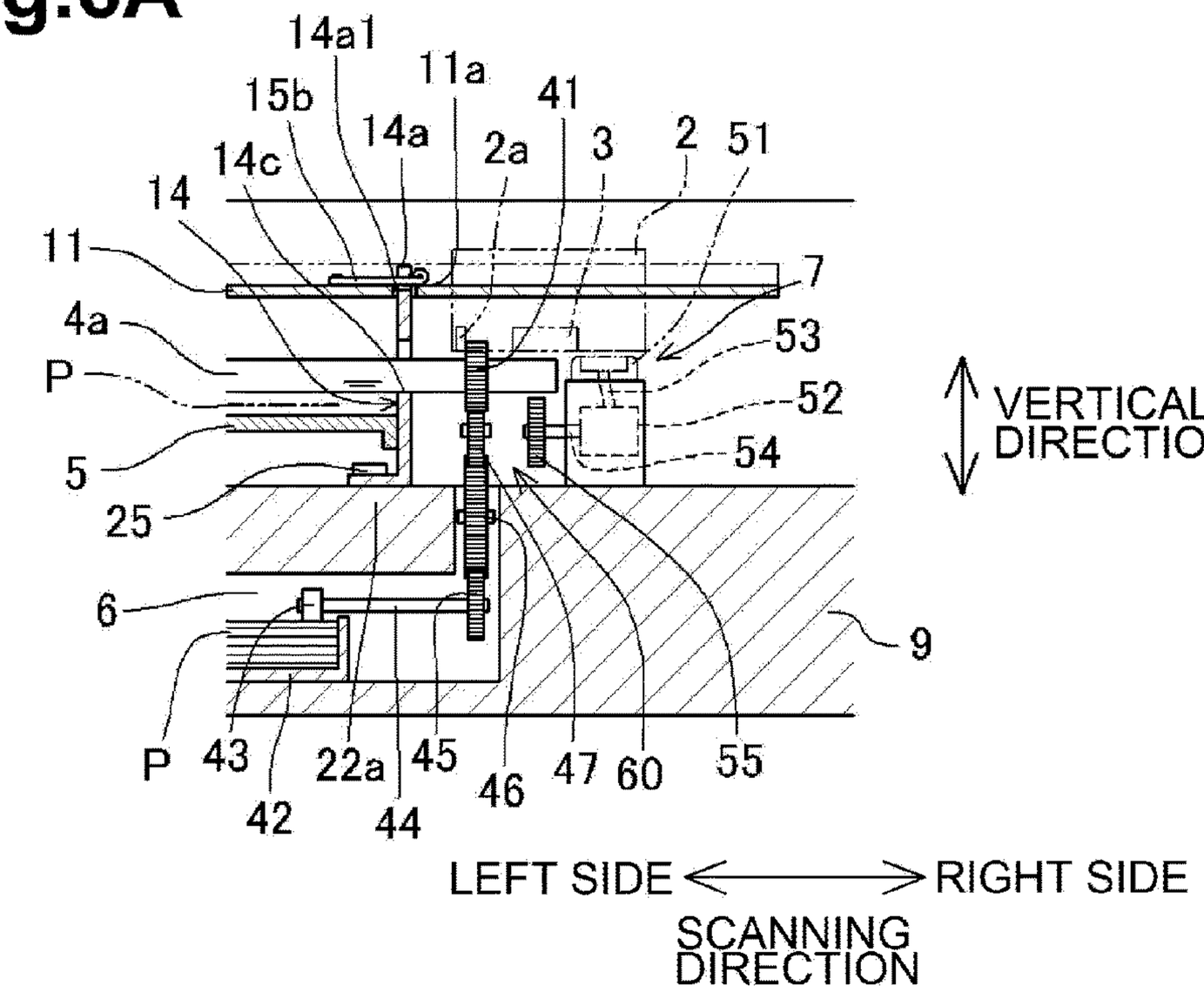
25
22a
14
SCANNING DIRECTION
RIGHT SIDE
LEFT SIDE
FEEDING DIRECTION

Fig.6A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11a
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14a
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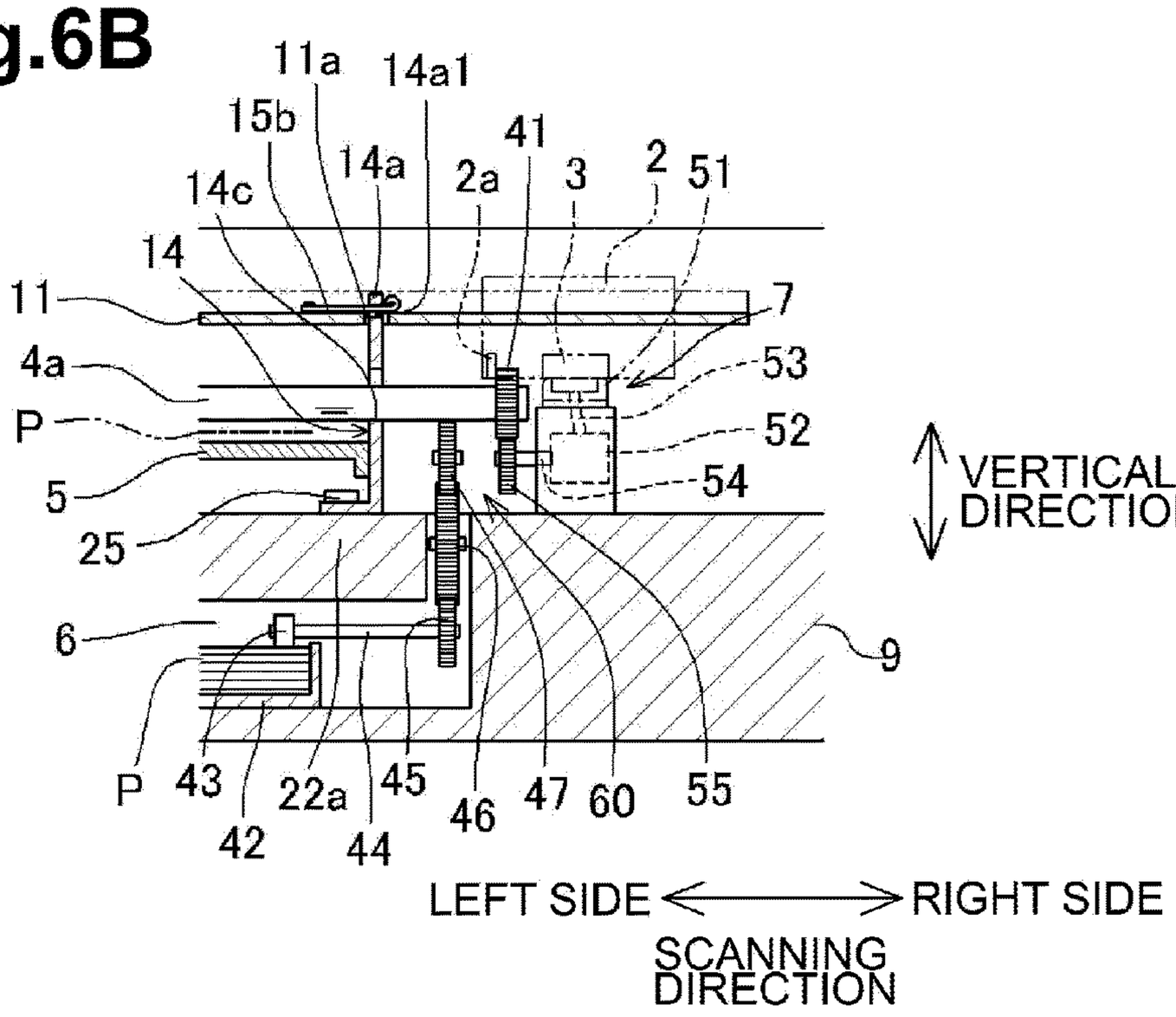
4a
53
P
52
5
54
25
6
9
P
43
22a
45
46
47
60
55
42
44
VERTICAL DIRECTION
LEFT SIDE
RIGHT SIDE
SCANNING DIRECTION

Fig.6B


11a
14a1
15b
41
14a
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51
14c
14
11
7
4a
53
P
52
5
54
25
6
9
P
43
22a
45
46
47
60
55
42
44
VERTICAL DIRECTION
LEFT SIDE
RIGHT SIDE
SCANNING DIRECTION

INKJET RECORDING APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATION

This application *is a reissue of U.S. Pat. No. 9,044,951 issued Jun. 2, 2015, filed on Mar. 5, 2014 as U.S. patent application Ser. No. 14/197,783, which* claims priority from Japanese Patent Application No. 2013-048044 filed on Mar. 11, 2013, which is incorporated herein by reference in its entirety.

FIELD OF DISCLOSURE

The disclosure herein relates to a liquid ejection apparatus configured to eject liquid from nozzles thereof.

BACKGROUND

A known liquid ejection apparatus is configured to eject liquid from nozzles thereof. A liquid ejection apparatus, e.g., a multi-function device, includes a printer section configured to perform printing by ejecting ink from nozzles thereof. In the multi-function device, a carriage on which a liquid ejection head, e.g., a recording head, is mounted, is configured to move in a scanning direction while being guided by a guide portion, e.g., two guide rails. The two guide rails are fixed to a frame disposed below the guide rails. More specifically, the frame is a plate-like member including metallic material. The frame includes a bottom plate extending in the scanning direction and fixed to an upper surface of a base, e.g., a housing, including resin material. The frame further includes a side plate integrally provided with the bottom plate at each end of the frame in the scanning direction. The side plates are provided by bending the plate-like member upward with respect to the bottom plate. The two guide rails are fixed to upper end portions of the side plates. The side plates of the frame support a feeding roller configured to feed a recording sheet.

The resin material of the housing has a higher coefficient of linear expansion than the metallic material of the frame. Therefore, the housing readily expands and contracts, for example, with ambient temperature changes. However, as described above, the frame includes the bottom plate and the two side plates that are integrally provided by bending the plate-like member including the metallic material at each end thereof with respect to the scanning direction. The frame has a relatively high rigidity. Therefore, even when the housing is deformed, for example, with ambient temperature changes, the positional relationship between two side plates of the frame is unlikely to change. Accordingly, the positional relationship between the guide rails fixed to the side plates and the feeding roller supported by the side plates is unlikely to change. Consequently, the positional relationship between the recording head mounted on the carriage configured to move in the scanning direction while being guided by the guide rails, and a medium, e.g., a recording sheet, fed by the feeding roller is unlikely to change. Thus, reduction in the printing quality is prevented or reduced.

Nevertheless, the frame includes the bottom plate elongated in the scanning direction, so that the frame becomes relatively heavy in weight. Therefore, the liquid ejection apparatus including such frame becomes heavy in weight. A space is required in the printer section to place the bottom plate extending in the scanning direction. In view of reductions of weight and size of the liquid ejection apparatus, two separate members corresponding to the two side plates may be provided in place of the frame including the bottom plate and the two side plates. The two members may be fixed to the housing. In this case, however, there is not a portion corresponding to the bottom plate between the two members. Therefore, when the housing expands and contracts, for example, with ambient temperature changes, the positional relationship between the two members is likely to change. Therefore, the positional relationship between the feeding roller supported by the two members and the guide rails is likely to change. Consequently, the positional relationship between the liquid ejection head and the medium may change, so that the printing quality may possibly be reduced.

SUMMARY

A liquid ejection apparatus with a liquid jetting head and support members is described. A first support member and a second support member support at least one of a guide and feeding roller in a scanning direction and are attached to a housing of the liquid ejection apparatus. The housing at the location to which the first support member is attached is easier to deform in the scanning direction than housing at the location to which the second support member is attached. Further, the housing at the first location may include a projection. The first support member may be attached to the projection.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference now is made to the following description taken in connection with the accompanying drawings.

FIG. **1** is a diagram depicting a printer in an illustrative embodiment according to one or more aspects of the disclosure.

FIG. **2** is a sectional view of the printer, taken along the line II-II of FIG. **1**.

FIG. **3** is a sectional view of the printer, taken along the line III-III of FIG. **1**.

FIG. **4**A is a sectional view of the printer, taken along the line IVA-IVA of FIG. **1**.

FIG. **4**B is a sectional view of the printer, taken along the line IVB-IVB of FIG. **1**.

FIG. **5**A is a diagram depicting an upper surface of a base of the printer near first fixture portions of the printer.

FIG. **5**B is a diagram depicting the upper surface of the base near second fixture portions of the printer.

FIG. **6**A is a partially sectional view of the printer depicting a state of a gear mechanism of the printer when a pickup roller of the printer is rotated.

FIG. **6**B is a partially sectional view of the printer depicting a state of the gear mechanism when a suction purge is performed.

DETAILED DESCRIPTION

As depicted in FIGS. **1-4**, a liquid ejection apparatus, e.g., a printer **1**, may comprise a base, e.g., a housing **9**, comprising synthetic resin material, a carriage **2**, an inkjet head **3**, driven portions, e.g., a first feeding roller **4**a and a second

feeding roller **4**b, a medium support member, e.g., a platen **5**, a tray accommodation portion **6**, and another driven portion, e.g., a maintenance unit **7**. The right side and the left side of the printer **1** may be defined herein with respect to a scanning direction and may be indicated in the relevant figures.

The carriage **2** may be supported by two guide rails **11** and **12** extending in the scanning direction from below. The carriage **2** may be configured to move in the scanning direction while being guided by the guide rails **11** and **12**. The guide rails **11** and **12** may be disposed with a distance therebetween in a feeding direction perpendicular to the scanning direction. A portion of each guide rail **11** and **12** near its left end may be supported by a first support member **13**. A portion of each guide rail **11** and **12** near its right end may be supported by a second support member **14**.

The support members **13** and **14** may comprise metallic material. The support members **13** and **14** may extend in a perpendicular direction, e.g., a vertical direction, perpendicular to the scanning direction and the feeding direction. A lower end portion of each support member **13** and **14** may be bent inward with respect to the scanning direction. Each support member **13** and **14** may have generally an L-shape when viewed from the feeding direction. The support members **13** and **14** may be disposed with a distance therebetween in the scanning direction. The "lower end portion" as used herein is an example of attachment portions of the support members **13** and **14** that are configured to be attached to housing **9**. Depending on the orientation of the support members **13** and **14** and how they are attached to housing **9**, the attachment portions of support members **13** and **14** may be identified by a descriptive orientation other than "lower".

The support members **13** and **14** may extend across the guide rails **11** and **12** in the feeding direction. Each support member **13** and **14** may comprise protrusions **13**a and **14**a, respectively, that may be disposed at upper end portions thereof opposing the guide rail **11** to partially protrude upwardly from the guide rail **11**. The protrusions **13**a and **14**a. The guide rail **11** may have through holes **11**a and **11**b at portions opposing the protrusions **13**a and **14**a, respectively. The protrusions **13**a and **14**a may be inserted into the through holes **11**a and **11**b, respectively, to extend or protrude above the guide rail **11**. Portions of the protrusions **13**a and **14**a above the guide rail **11** may have through holes **13**a**1** and **14**a**1**, respectively, passing through in the scanning direction. The through holes **13**a**1** and **14**a**1** may be configured to receive springs **15**a and **15**b, respectively, that may be fixed to the upper surface of the guide rail **11**. Thus, the support members **13** and **14** may be fixed to the guide rail **11** at the protrusions **13**a and **14**a, respectively.

The first support member **13** may comprise two protrusions **13**b that may be disposed with a distance therebetween in the feeding direction. The two protrusions **13**b may be disposed at upper end portions of the first support member **13** opposing the guide rail **12** to partially protrude upwardly from the guide rail **12**. The guide rail **12** may have two through holes **12**a at portions opposing the protrusions **13**b. Each protrusion **13**b may be inserted into the corresponding through hole **12**a, to extend or protrude above the guide rail **12**. A portion of each protrusion **13**b extending above the guide rail **12** may have a through hole **13**b**1** passing through in the scanning direction. The through holes **13**b**1** of the protrusions **13**b may be configured to receive a spring **16**a that may be fixed to the upper surface of the guide rail **12**. The spring **16**a may extend between the two protrusions **13**b. Thus, the first support member **13** may be fixed to the guide rail **12** at the protrusions **13**b.

The second support member **14** may comprise two protrusions **14**b that may be disposed with a distance therebetween in the feeding direction. The two protrusions **14**b may be disposed at upper end portions of the second support member **14** opposing the guide rail **12** to partially protrude upwardly from the guide rail **12**. The guide rail **12** may have two through holes **12**b at portions opposing the protrusions **14**b. Each protrusion **14**b may be inserted into the corresponding through hole **12**b, to extend or protrude above the guide rail **12**. A portion of each protrusion **14**b extending above the guide rail **12** may have a through hole **14**b**1** extending or passing through in the scanning direction. The through holes **14**b**1** of the protrusions **14**b may be configured to receive a spring **16**b that may be fixed to the upper surface of the guide rail **12**. The spring **16**a may extend across the space between two protrusions **13**b. Thus, the second support member **14** may be fixed to the guide rail **12** at the protrusions **14**b.

A lower end portion (e.g., one end portion in the perpendicular direction), of each support member **13** and **14** may be fixed to the housing **9** of the printer **1**. More specifically, the housing **9** may comprise two first fixture portions **21**a and **21**b at portions of the upper surface of the housing **9** opposing lower end portions of the first support member **13** extending in the scanning direction. The first fixture portions **21**a and **21**b may be disposed with a distance therebetween in the feeding direction at respective locations on the housing **9**. The lower end portions of the first support member **13** extending in the scanning direction may be fixed to the first fixture portions **21**a and **21**b with fastening members, e.g., bolts **25**, that may extend in the vertical direction. The housing **9** may further comprise two second fixture portions **22**a and **22**b at portions of the upper surface of the housing **9** opposing lower end portions of the second support member **14** extending in the scanning direction at respective locations on the housing **9**. The second fixture portions **22**a and **22**b may be disposed with a distance therebetween in the feeding direction. The lower end portions of the second support member **14** extending in the scanning direction may be fixed to the second fixture portions **22**a and **22**b with fastening members, e.g., the bolts **25**, that may extending in the vertical direction.

As depicted in FIGS. **2** and **5**A, the housing **9** may have recesses **23**a and **23**b at portions **9**a and **9**b thereof surrounding the peripheries of the first fixture portions **21**a and **21**b, respectively. Each recess **23**a and **23**b may entirely surround the periphery of the respective first fixture portion **21**a and **21**b. Thus, the first fixture portions **21**a and **21**b may protrude upward (e.g., toward an opposite end in the perpendicular direction) from the portions **9**a and **9**b, respectively, having the recesses **23**a and **23**b formed around the first fixture portions **21**a and **21**b. As depicted in FIGS. **2** and **5**B, a recess might not be provided at the portions **9**a and **9**b of the housing **9** surrounding the peripheries of the second fixture portions **22**a and **22**b. The second fixture portions **22**a and **22**b may be generally the same level as the peripheries of the second fixture portions **22**a and **22**b. The upper surface of the housing **9** may be hatched in FIGS. **5**A and **5**B, to facilitate the understanding of the drawings. Further, to facilitate the understanding positions where the support members **13** and **14** may be fixed to the upper surface of the housing **9**, the positions of the support members **13** and **14** and the bolts **25** may be depicted in two-dot chain lines in FIGS. **5**A and **5**B.

In the illustrative embodiment, the first fixture portions **21**a and **21**b may deform more readily in the scanning direction and the feeding direction than the second fixture portions **22**a and **22**b. As depicted in FIG. **5**A, a length Lh of each of the first fixture portions **21**a and **21**b, in the feeding direction, that may protrude upward from their peripheries may be longer than a length Ls of each of the first fixture portions **21**a and **21**b in the scanning direction. Thus, the first fixture portions **21**a and **21**b may be more difficult to deform in the feeding direction than in the scanning direction.

A portion of the second support member **14** extending in the vertical direction may extend longer toward a downstream side in the feeding direction than a lower end portion thereof extending in the scanning direction. The second support member **14** may comprise an attachment portion **26** disposed at a downstream end portion of the vertical portion of the second support member **14** in the feeding direction. As described above, the second support member **14** may be fixed to the second fixture portions **22**a and **22**b at lower end portions of the second support member **14**. In addition, the attachment portion **26** may be fixed to a fixture portion **27** of the housing **9** with a bolt **28**. In other words, the second support member **14** may be fixed to the housing **9** at the attachment portion **26**a on an upper side, e.g., opposite end side, of the lower end portions fixed to the second fixture portions **22**a and **22**b, at a position different from the protrusions **14**a and **14**b fixed to the guide rails **11** and **12**, respectively.

The inkjet head **3** may be received on the carriage **2**. The inkjet head **3** may be configured to eject ink from nozzles **10** formed on the lower surface of the inkjet head **3**. The first feeding roller **4**a may be disposed on an upstream side of the inkjet head **3** in the feeding direction. The second feeding roller **4**b may be disposed on a downstream side of the inkjet head **3** in the feeding direction. The feeding rollers **4**a and **4**b may be configured to feed a recording sheet P in the feeding direction. In the illustrative embodiment, a combination of the first feeding roller **4**a and the second feeding roller **4**b may be an example of a feeding roller.

The first support member **13** may comprise a roller support portion **13**c at a portion downstream of the protrusion **13**a in the feeding direction. The first support member **13** may further comprise a roller support portion **13**d at a portion between the two protrusions **13**b in the feeding direction The second support member **14** may comprise a roller support portion **14**c at a portion downstream of the protrusion **14**a in the feeding direction. The second support member **14** may further comprise a roller support portion **14**d at a portion between the two protrusions **14**b in the feeding direction. A portion of the first feeding roller **4**a near its left end portion may be supported by the roller support portion **13**c and a portion of the first feeding roller **4**a near its right end portion may be supported by the roller support portion **14**c. A portion of the second feeding roller **4**b near its left end portion may be supported by the roller support portion **13**d and a portion of the second feeding roller **4**b near its right end portion may be supported by the roller support portion **14**d.

A motor **31** may be connected to the left end portion of the first feeding roller **4**a. The first feeding roller **4**a may be configured to rotate as the motor **31** rotates. An endless belt **32** may be wound around the feeding rollers **4**a and **4**b at a portion between the first support member **13** and the motor **31** in the scanning direction (e.g., on a side opposite to the second fixture portions **22**a and **22**b relative to the first fixture portions **21**a and **21**b). As the first feeding roller **4**a rotates, the rotation of the first feeding roller **4**a may be transmitted to the second feeding roller **4**b via the belt **32**, and thus the second feeding roller **4**b may rotate.

A gear **41** may be mounted to the first feeding roller **4**a to the right side of the second fixture portions **22**a and **22**b and the second support member **14** in the scanning direction (e.g., a side opposite to the first fixture portions **21**a and **21**b). The gear **41** may be configured to rotate together with the first feeding roller **4**a and to move in the scanning direction along the first feeding roller **4**a. The gear **41** may be urged by a spring (not depicted) toward the left side in the scanning direction. When the gear **41** does not contact a pressing portion **2**a of the carriage **2**, the gear **41** may be placed at a position to engage with none of gears **47** and **55**, as depicted in FIG. **2**.

The platen **5** may be disposed opposite to the lower surface of the inkjet head **3** having the nozzles **10**. The platen **5** may be configured to support the recording sheet P fed by the feeding rollers **4**a and **4**b from below. The platen **5** may be fixed to the support members **13** and **14**. The tray accommodation portion **6** may be provided in the housing **9** at a position lower than the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b. The tray accommodation portion **6** may be positioned almost directly below the platen **5**. The tray accommodation portion **6** may be configured to removably accommodate a sheet tray **42**. The sheet tray **42** may be configured to hold one or more recording sheets P stacked in the vertical direction.

A driven portion, e.g., a pickup roller **43**, may be disposed in the tray accommodation portion **6**. The pickup roller **43** may be configured to contact the upper surface of the topmost recording sheet P held in the sheet tray **42** when the sheet tray **42** is attached to the tray accommodation portion **6**. The pickup roller **43** may be coupled, via a shaft **44** that may extend in the scanning direction, to a gear **45** that may be disposed to the right side of the second fixture portions **22**a and **22**b and the second support member **14** (e.g., a side opposite to the first fixture portions **21**a and **21**b). The gear **45** may engage with a gears **46** disposed above the gear **45**. The gears **46** may engage with a gear **47** disposed above the gear **46**.

The carriage **2** may comprise the pressing portion **2**a that may be disposed at a left end position of the carriage **2** in the scanning direction below the guide rail **11**. The pressing portion **2**a may be configured to oppose the gear **41** in the scanning direction. When the carriage **2** is moved to the right of the second support member **14** as depicted in FIG. **6**A, the gear **41** may be pushed by the pressing portion **2**a to move rightward in the scanning direction, so that the gear **41** may be placed at a position to engage with the gear **47**. In this state, as the motor **31** is rotated, the rotation of the motor **31** may be transmitted to the pickup roller **43**, via the first feeding roller **4**a, the gear **41**, **45**-**47** and the shaft **44**. Thus, the pickup roller **43** may rotate. As the pickup roller **43** rotates, the recording sheet P held in the sheet tray **42** may be fed toward the first feeding roller **4**a. A feeding path of the recording sheet P from the sheet tray **42** to the first feeding roller **4**a may be similar to a known feeding path. Therefore, a detail description of the feeding path may be omitted herein.

The maintenance unit **7** may comprise a nozzle cap **51** and a suctioning pump **52**. The nozzle cap **51** may be disposed to be placed generally directly below the inkjet head **3** when the carriage **2** is moved nearly to the rightmost position. When the carriage **2** is moved to a position where the inkjet head **3** opposes the nozzle cap **51**, as depicted in FIG. **6**B, an upper end portion of the nozzle cap **51** may contact the

lower surface of the inkjet head **3**. Thus, the nozzles **10** may be covered with the nozzle cap **51**. The suctioning pump **52** may comprise a tube pump. The suctioning pump **52** may be connected to the nozzle cap **51** via a tube **53**. The suctioning pump **52** may be coupled, via a shaft **54** extending in the scanning direction, to the gear **55** that may be disposed between the maintenance unit **7** and the second fixture portions **22**a and **22**b (e.g., on a side opposite to the first fixture portions **21**a and **21**b relative to the second fixture portions **22**a and **22**b). In the illustrative embodiment, the gears **55**, **41** and **45-47** may constitute a gear mechanism **60**.

As the carriage **2** is moved in the scanning direction to a position where the inkjet head **3** is covered with the nozzle cap **51**, as depicted in FIG. **6**B, the gear **41** may be pushed by the pressing portion **2**a to move rightward in the scanning direction, so that the gear **41** may be placed to engage with the gears **55**. In this state, as the motor **31** is rotated, the rotation of the motor **31** may be transmitted to the suctioning pump **52**, via the first feeding roller **4**a, the gears **41** and **55** and the shaft **54**, so that the suctioning pump **52** may be driven. Thus, a so-called suction purge may be performed in which ink in the inkjet head **3** may be suctioned from the nozzles **10**.

In the printer **1**, the synthetic resin material of the housing **9** may have a higher coefficient of linear expansion than that of a metallic material of the support members **13** and **14**. Therefore, the housing **9** may more readily expand and contract, for example, with ambient temperature changes, as compared with the support members **13** and **14**.

In the illustrative embodiment, as described above, the housing **9** may have the recesses **23**a and **23**b at the portions **9**a and **9**b surrounding the peripheries of the first fixture portions **21**a and **21**b, respectively. Thus, the first fixture portions **21**a and **21**b may more readily deform in the scanning direction than the second fixture portions **22**a and **22**. Therefore, the housing **9** may expand and contract in the scanning direction with almost no change in the positional relationship between the first support member **13** fixed to the first fixture portions **21**a and **21**b and the second support member **14** in the scanning direction as the first fixture portions **21**a and **21**b deform in the scanning direction. Therefore, when the housing **9** expands and contracts with temperature changes, the positional relationship between the first support member **13** and the second support member **14** in the scanning direction may be difficult or unlikely to change.

Thus, the positional relationship of the guide rails **11** and **12** fixed to the support members **13** and **14**, the feeding rollers **4**a and **4**b supported by the support members **13** and **14**, and the platen **5** fixed to the support members **13** and **14** may be unlikely to change. Therefore, the positional relationship between the inkjet head **3** mounted on the carriage **2** configured to move in the scanning direction while being guided by the guide rails **11** and **12**, and the recording sheet P supported by the platen **5** and fed by the feeding rollers **4**a and **4**b may also be difficult or unlikely to change. Consequently, reduction in the printing quality in the printer **1** may be prevented or reduced.

In the illustrative embodiment, the first support member **13** and the second support member **14** may be non-integral with each other. Therefore, the weight of the printer **1** may be reduced, as compared with a case in which a frame integrally formed with a portion corresponding to the first support member **13**, a portion corresponding to the second support member **14** and a portion connecting the first and second support portions **13** and **14** is provided in place of the support members **13** and **14**.

As described above, when the first fixture portions **21**a and **21**b are configured to deform readily in the scanning direction, the strength of the first fixture portions **21**a and **21**b may be reduced. In the illustrative embodiment, the length Lh of the first fixture portions **21**a and **21**b in the feeding direction may be set longer than the length Ls of the first fixture portions **21**a and **21**b in the scanning direction, as described above. Therefore, the first fixture portions **21**a and **21**b may be configured to be more difficult to deform in the feeding direction than in the scanning direction.

In the illustrative embodiment, each of the support members **13** and **14** may extend in the feeding direction across the two guide rails **11** and **12**. Therefore, when the housing **9** expands and contracts, for example, with ambient temperature changes even through the first fixture portions **21**a and **21**b are difficult to deform in the feeding direction, the positional relationship between the two guide rails **11** and **12** in an arrangement direction of the guide rails **11** and **12** might not be readily changed, as compared with a case in which a support member is separately provided for each guide rail **11** and **12**, e.g., each of the support members **13** and **14** might not extend in the feeding direction across the two guide rails **11** and **12**.

In the illustrative embodiment, the gear mechanism **60** comprising the gears **41**, **45-47** and **55** may be disposed to the right side of the second fixture portions **22**a and **22**b and the second support member **14** in the scanning direction. Unlike the illustrative embodiment, the gear mechanism **60** comprising the gears **41**, **45-47** and **55** may be disposed to the left side of the first fixture portions **21**a and **21**b and the first support member **13** in the scanning direction. In this case, when the first fixture portions **21**a and **21**b are deformed in the scanning direction in association with the expansion and contraction of the housing **9**, for example, with ambient temperature changes, the gears **41**, **45-47** and **55** may possibly be inclined with the movement of the first fixture portions **21**a and **21**b or the first support member **13** fixed to the first fixture portions **21**a and **21**b. Consequently, distance between the shafts of the gears **41**, **45-47** and **55** is reduced, so that significant load may possibly be applied to the gears **41**, **45-47** and **55**, or distance between the shafts of the gears **41**, **45-47** and **55** may become too wide, so that gear skipping or damages on tooth tips may possibly be caused.

In the illustrative embodiment, the gear mechanism **60** may be disposed to the right side of the second fixture portions **22**a and **22**b that may be configured to be more difficult to deform in the scanning direction than the first fixture portions **21**a and **21**b, and the second support member **14** fixed to the second fixture portions **22**a and **22**b. Therefore, such an inclination of the gears **41**, **45-47** and **55** as described above might not be caused readily. Thus, occurrences of such problems as described above, e.g., reduction or increase of the distance between the shafts of the gears **41**, **45-47** and **55**, in the gear mechanism **60** may be reduced or prevented.

In the illustrative embodiment, the belt **32** configured to connect the first feeding roller **4**a and the second feeding roller **4**b may be disposed to the left side of the first fixture portions **21**a and **21**b and the first support member **13**. Therefore, when the first fixture portions **21**a and **21**b are deformed in association with the expansion and contraction of the housing **9**, for example, with ambient temperature changes, the belt **32** may possibly be slanted or twisted with the movement of the first fixture portions **21**a and **21**b and the first support member **13**. However, even when the belt **32**

is slightly slanted or twisted, such a problem that a significant load is applied to the belt **32** may be unlikely to occur.

When the first support member **13** and the second support member **14** are separated from each other as in the illustrative embodiment, the first support member **13** and the second support member **14** may be more likely to move or vibrate in the scanning direction when the carriage **2** moves in the scanning direction, as compared with a case in which the first support member **13** and the second support member **14** are integrally formed. In the illustrative embodiment, lower end portions of the second support member **14** may be fixed to the second fixture portions **22**a and **22**b. In addition, the attachment portion **26** that may be disposed at a portion of the second support member **14** extending in the vertical direction may be fixed to the fixture portion **27** of the housing **9**. Thus, the movement or vibration of the second support member **14** in the scanning direction may be reduced or prevented.

In the illustrative embodiment, each support member **13** and **14** may have generally an L shape when viewed from the feeding direction with a portion thereof extending in the vertical direction and a lower end portion thereof bent inward in the scanning direction. Therefore, distance between the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b, respectively, in the scanning direction may be reduced, as compared with a case in which the lower end portion of each support member **13** and **14** is bent outward in the scanning direction. An amount of expansion and contraction of a portion of the housing **9** between the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b when the housing **9** expands and contracts, for example, with ambient temperature changes may become smaller as the distance between the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b in the scanning direction is shorter. Therefore, in the example embodiment in which the distance between the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b may be relatively short, the positional relationship between the first support member **13** and the second support member **14** may be more unlikely to change when the housing **9** expands and contracts, for example, with ambient temperature changes. Further, the size of the printer **1** may be reduced in the scanning direction because the distance between the first fixture portions **21**a and **21**b and the second fixture portions **22**a and **22**b in the scanning direction may be relatively short.

In the illustrative embodiment, the first support member **13** may be fixed to the first fixture portions **21**a and **21**b with the bolts **25** extending in the vertical direction. Therefore, the first support member **13** may make close contact with the first fixture portions **21**a and **21**b in the vertical direction, so that the first support member **13** may be difficult to move in the vertical direction relative to the first fixture portions **21**a and **21**b. In the illustrative embodiment, the first fixture portions **21**a and **21**b may be configured to deform readily in the scanning direction and configured to be more difficult to deform in the feeding direction and the vertical direction than in the scanning direction. Therefore, it may be preferable that the bolts **25** used to fix the first support member **13** to the first fixture portions **21**a and **21**b extend in the vertical direction, as in the illustrative embodiment, perpendicular to the scanning direction.

Various changes, arrangements and modifications may be applied to the above-described illustrative embodiment. Like reference numerals may be used for like corresponding components and a detailed description thereof with respect to the modifications may be omitted herein.

In the above-described illustrative embodiment, the lower end portions of the support members **13** and **14** may be bent inward in the scanning direction. Alternatively, the lower end portions of the support members **13** and **14** may be bent outward in the scanning direction.

In this case also, the first support member **13** may be fixed to the first fixture portions **21**a and **21**b using the bolts **25** extending in the vertical direction, similar to the above-described illustrative embodiment, so that the first support member **13** may become difficult to move in the vertical direction.

Further, each support member **13** and **14** might not be limited to have a generally an L shape when viewed from the feeding direction. Alternatively, each support member **13** and **14** may have a different shape. In this case, bolts configured to fix the first support member **13** to the first fixture portions **21**a and **21**b, and configured to fix the second support member **14** to the second fixture portions **22**a and **22**b may extend in a direction other than the vertical direction, e.g., the feeding direction or the scanning direction. However, it may be preferable that the bolts extend in a direction perpendicular to the scanning direction, e.g., the feeding direction.

In the above-described illustrative embodiment, lower end portions of the second support member **14** may be fixed to the second fixture portions **22**a and **22**b of the housing **9**. In addition, the attachment portion **26** that may be disposed at a portion of the second support member **14** extending in the vertical direction may be fixed to the fixture portion **27** of the housing **9**. Alternatively, the second support member **14** might not comprise the attachment portion **26** and may be fixed to the housing **9** at the second fixture portions **22**a and **22**b.

In the above-described illustrative embodiment, the gear mechanism **60** may be disposed to the right side of the second fixture portions **22**a and **22**b and the second support member **14**. The belt **32** may be disposed to the left side of the first fixture portions **21**a and **21**b and the first support member **13**. Alternatively, the gear mechanism **60** may be disposed to the left side of the first fixture portions **21**a and **21**b and the first support member **13**, and the belt **32** may be disposed to the right side of the second fixture portions **22**a and **22**b and the second support member **14**, unlike the above-described embodiment.

In the above-described illustrative embodiment, the first feeding roller **4**a and the second feeding roller **4**b may be connected via the belt **32**. Alternatively, the gear mechanism **60** may further comprise a gear configured to connect the first feeding roller **4**a and the second feeding roller **4**b, and the belt **32** may be omitted. The gear mechanism **60** may be configured to transmit the rotation of the motor **31** to a driven portion other than the pickup roller **43**, the suctioning pump **52**, and the feeding rollers **4**a and **4**b. The gear mechanism **60** configured to transmit the power of the motor **31** to the maintenance unit **7** and the pickup roller **43** might not be provided but another drive source may be provided for the maintenance unit **7** and the pickup roller **43**.

In the above-described illustrative embodiment, the platen **5** may be directly fixed to the support members **13** and **14**. Alternatively, the platen **5** may be indirectly fixed to the support members **13** and **14**, via members fixed to the support members **13** and **14**.

Further, the platen **5** might not have to be fixed to the support members **13** and **14**. In this case also, the positional relationship between the guide rails **11** and **12** and the feeding rollers **4**a and **4**b may be unlikely to change, as

described above, so that the positional relationship between the inkjet head **3** and the recording sheet P may be unlikely to change.

In the above-described illustrative embodiment, the carriage **2** may be configured to be guided along the scanning direction while being supported by the two guide rails **11** and **12**. Alternatively, the carriage **2** may be configured to be guided along the scanning direction while being supported by, for example, one guide rail. Further, a guide portion, e.g., a guide bar, that may extend in the scanning direction and be inserted through the carriage **2** may be supported by the support members **13** and **14**. The carriage **2** may be supported by the guide bar and configured to be guided along the scanning direction. In this case, the guide bar may be fixed to the support members **13** and **14** by inserting the guide bar to openings in the support members **13** and **14**.

In the above-described illustrative embodiment, the length Lh of each of the first fixture portions **21**a and **21**b in the feeding direction may be longer than the length Ls of each of the first fixture portions **21**a and **21**b in the scanning direction. Therefore, the first fixture portions **21**a and **21**b may be more difficult to deform in the feeding direction than in the scanning direction. Alternatively, the first fixture portions **21**a and **21**b may be configured to be more difficult to deform in the feeding direction than in the scanning direction with a structure different from the above-described structure.

Further, the first fixture portions **21**a and **21**b might not have to be more difficult to deform in the feeding direction than in the scanning direction. For example, the length Lh of each first fixture portion **21**a and **21**b in the feeding direction and the length Ls of each first fixture portion **21**a and **21**b in the scanning direction may be set to almost the same, so that each first fixture portion **21**a and **21**b may be configured to deform by approximately same amount in the feeding direction and the scanning direction.

In the above-described illustrative embodiment, the recess **23**a and **23**b may be disposed at the portions **9**a and **9**b of the housing **9** surrounding the first fixture portions **21**a and **21**b, respectively, so that the first fixture portions **21**a and **21**b may protrude upward from the portions **9**a and **9**b, respectively. Alternatively, for example, the portions **9**a and **9**b of the housing **9** surrounding the first fixture portions **21**a and **21**b might not have recesses but the first fixture portions **21**a and **21**b according to the above-described illustrative embodiment may protrude upward from the surface of housing **9**.

In the above-described illustrative embodiment, the first fixture portions **21**a and **21**b may be configured to deform readily in the scanning direction because the first fixture portions **21**a and **21**b may protrude more upward than the portions **9**a and **9**b surrounding the first fixture portions **21**a and **21**b, respectively. Alternatively, the first fixture portions **21**a and **21**b may be configured to readily deform in the scanning direction with a different structure.

In the illustrative embodiment, the disclosure may be applied to the inkjet printer **1** configured to perform printing by ejecting ink from the nozzles onto the recording sheet. Alternatively, the disclosure may be applied to liquid ejection apparatuses, other than the inkjet printer **1**, configured to eject liquid other than ink onto a medium.

While the disclosure has been described in detail with reference to the specific embodiments thereof, this is merely an example, and various changes, arrangements and modifications may be applied therein without departing from the spirit and scope of the disclosure.

What is claimed is:

1. A liquid ejection apparatus comprising:

a liquid jetting head;

a carriage configured to move in a scanning direction and configured to support the liquid jetting head;

a guide extending in the scanning direction, the guide being configured to support the carriage through the carriage's movement in the scanning direction, the guide being formed of a first material;

a feeding roller extending in the scanning direction and configured to feed a medium in a feeding direction, the feeding direction being **[**is**]** perpendicular to the scanning direction, the feeding roller having a first side and a second side spaced from each other in the scanning direction;

a first support member supporting the feeding roller at the first side of the feeding roller and supporting the guide, the first support member including an attachment portion;

a second support member supporting the feeding roller at the second side of the feeding roller and supporting the guide, the second support member including an attachment portion; and

a housing being formed of a second material, the housing including a first **[**location**]** *fixture portion* to which the attachment portion of the first support member is fixed and including a second **[**location**]** *fixture portion* to which the attachment portion of the second support member is fixed, the *first fixture portion being located at a* first location **[**and the**]**, *the second fixture portion being located at a* second location being spaced from **[**each other**]** *the first location* in the scanning direction,

[wherein the housing at the first location is easier to deform in the scanning direction than the housing at the second location**]** *wherein the housing includes a first surface that surrounds the first fixture portion and is lower than the first fixture portion in a direction perpendicular to both the scanning direction and the feeding direction, the first surface being further away than the first support member in the scanning direction from the second support member,*

wherein the housing includes a second surface to which the second support member is attached,

wherein the first surface is lower than the second surface,

wherein the guide comprises a first guide member and a second guide member, which are arranged in the feeding direction, the first support member and the second support member extends in the feeding direction across the first guide member and the second guide member and being fixed by the first guide member and the second guide member, and

wherein the first fixture portion is more difficult to deform in the feeding direction than in the scanning direction.

2. The liquid ejection apparatus according to claim **1**,

wherein the second material of the housing has higher coefficient of linear expansion than the first material of the guide.

[3. The liquid ejection apparatus according to claim **1**,

wherein the attachment portion of the first support member is fixed to the housing at the first location in a direction perpendicular to both the scanning direction and the feeding direction, the portion of the housing at the first location being a first fixture portion, and

wherein the attachment portion of the second support member is fixed to the housing at the second location in the direction perpendicular to both the scanning

direction and the feeding direction, the portion of the housing at the second location being a second fixture portion.]

[4. The liquid ejection apparatus according to claim 3, wherein the first fixture portion protrudes from a part of the housing surrounding the first fixture portion toward the first support member in the first direction.]

[5. The liquid ejection apparatus according to claim 3, wherein the guide comprises a first guide member and a second guide member, which are arranged in the feeding direction, the first support member and the second support member extends in the feeding direction across the first guide member and the second guide member and being fixed by the first guide member and the second guide member, and

wherein the first fixture portion is more difficult to deform in the feeding direction than in the scanning direction.]

6. The liquid ejection apparatus according to claim [5] *1*,

[wherein the first fixture portion protrudes from a part of the housing surrounding the first fixture portion toward a side of the first support member in the first direction, and]

wherein a length of the first fixture portion in the feeding direction is longer than in the scanning direction [so that the deformation of the first fixture portion in the feeding direction is easier than in the scanning direction].

7. The liquid ejection apparatus according to claim [3] *1*, further comprising:

a motor connected to the feeding roller,

a driven portion configured to be driven by the motor, and

a gear mechanism configured to transmit a rotatory power to the driven portion,

wherein the driven portion and the gear mechanism is disposed on an opposite side of the second fixture portion with respect to the first fixture portion.

8. The liquid ejection apparatus according to claim 7, wherein the feeding roller comprises:

a first feeding roller connected to the motor,

a second feeding roller which is away from the first feeding roller in the feeding direction, and

a belt configured to transmit a rotatory power of the first feeding roller to the second feeding roller,

wherein the belt is disposed on an opposite side of the second fixture portion with respect to the first fixture portion.

9. The liquid ejection apparatus according to claim [3] *1*, wherein the second support member is fixed with a particular part of the housing, *and*

wherein the particular part is further away from the attachment portion of the second support member toward an opposite side of the second support member in the [perpendicular] direction *perpendicular to both the scanning direction and the feeding direction*.

10. The liquid ejection apparatus according to claim [3] *1*, wherein the first support member is fixed with the first fixture portion by a bolt extending [a particular] *in the* direction perpendicular to *both* the scanning direction *and the feeding direction*.

11. [The liquid ejection apparatus according to claim 10,]

A liquid ejection apparatus comprising:

a liquid jetting head;

a carriage configured to move in a scanning direction and configured to support the liquid jetting head;

a guide extending in the scanning direction, the guide being configured to support the carriage through the carriage's movement in the scanning direction, the guide being formed of a first material;

a feeding roller extending in the scanning direction and configured to feed a medium in a feeding direction, the feeding direction being perpendicular to the scanning direction, the feeding roller having a first side and a second side spaced from each other in the scanning direction;

a first support member supporting the feeding roller at the first side of the feeding roller and supporting the guide, the first support member including an attachment portion;

a second support member supporting the feeding roller at the second side of the feeding roller and supporting the guide, the second support member including an attachment portion; and

a housing being formed of a second material, the housing including a first fixture portion to which the attachment portion of the first support member is fixed and including a second fixture portion to which the attachment portion of the second support member is fixed, the first fixture portion being located at a first location, the second fixture portion being located at a second location being spaced from the first location in the scanning direction,

wherein the first support member is fixed with the first fixture portion by a bolt extending in the direction perpendicular to both the scanning direction and the feeding direction,

wherein each of the first support member and the second support member extends in the [perpendicular] direction *perpendicular to both the scanning direction and the feeding direction*, and each of the first support member and the second support member has an L-shape with each's attachment portion extending into an inner side of the housing in the scanning direction,

wherein the attachment portion of the first support member is fixed with the first fixture portion by the bolt, and

wherein the attachment portion of the second support member is fixed with the second fixture portion by the bolt.

12. The liquid ejection apparatus according to claim 1, further comprising:

a medium support member configured to support the medium fed by the feeding roller, the medium support member fixed on the first support member and the second support member.

13. The liquid ejection apparatus according to claim 1, wherein the first support member and the second support member are non-integral with each other.

14. A liquid ejection apparatus comprising:

a liquid jetting head;

a carriage configured to move in a scanning direction and configured to support the liquid jetting head;

a guide extending in the scanning direction, the guide being configured to support the carriage through the carriage's movement in the scanning direction, the guide being formed of a first material;

a feeding roller extending in the scanning direction and configured to feed a medium in a feeding direction, the feeding direction being is perpendicular to the scanning direction, the feeding roller having a first side and a second side spaced from each other in the scanning direction;

a first support member supporting the feeding roller at the first side of the feeding roller and supporting the guide, the first support member including an attachment portion;

a second support member supporting the feeding roller at the second side of the feeding roller and supporting the guide, the second support member including an attachment portion; and

a housing being formed of a second material, the housing including a first fixture portion to which the attachment portion of the first support member is fixed and including a second fixture portion to which the attachment portion of the second support member is fixed, the first fixture portion being located at a first location, the second fixture portion being located at a second location being spaced from the first location in the scanning direction,

wherein the housing includes a first horizontal surface that surrounds the first fixture portion and is lower than the first fixture portion in a direction perpendicular to both the scanning direction and the feeding direction, the first horizontal surface being further away than the first support member in the scanning direction from the second support member,

wherein the housing includes a second horizontal surface to which the second support member is attached,

wherein the first horizontal surface is lower than the second horizontal surface,

wherein the guide comprises a first guide member and a second guide member, which are arranged in the feeding direction, the first support member and the second support member extends in the feeding direction across the first guide member and the second guide member and being fixed by the first guide member and the second guide member, and

wherein the first fixture portion is more difficult to deform in the feeding direction than in the scanning direction

wherein the guide comprises a first guide member and a second guide member, which are arranged in the feeding direction, the first support member and the second support member extends in the feeding direction across the first guide member and the second guide member and being fixed by the first guide member and the second guide member, and

wherein the first fixture portion is more difficult to deform in the feeding direction than in the scanning direction.

15. The liquid ejection apparatus according to claim 1,

wherein expansion and contraction of the housing relative to the guide due to heat occurs at the first support member.

16. The liquid ejection apparatus according to claim 1,

wherein the first surface is a first horizontal surface, and

wherein the second surface is a second horizontal surface.

* * * * *