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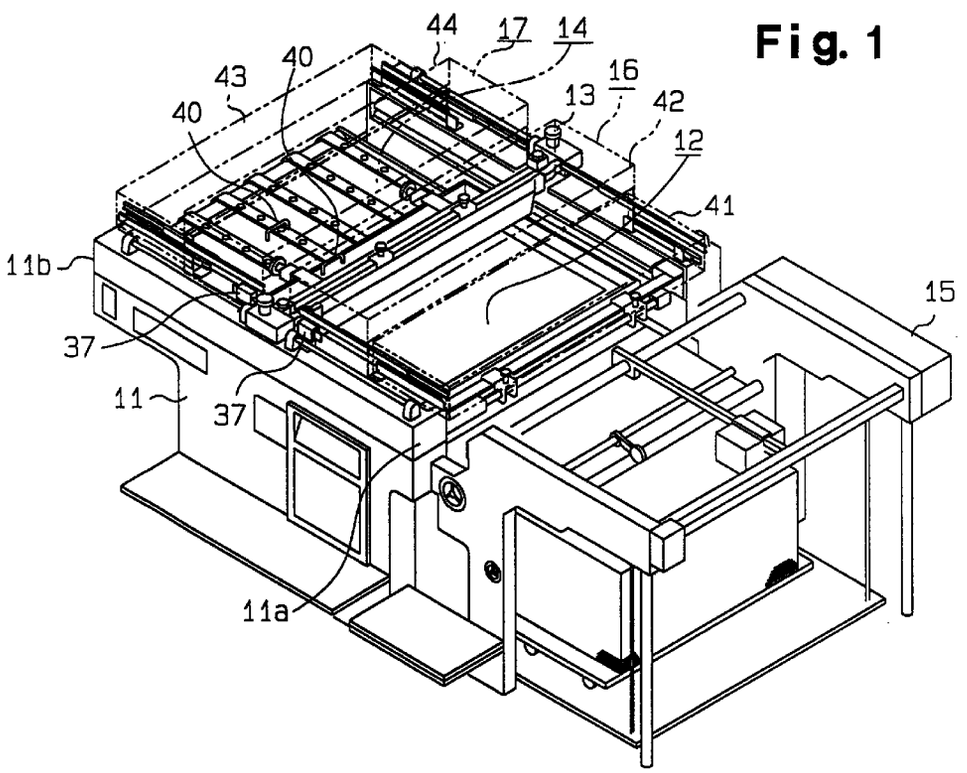
(54) Sliding cover for printing machine

(57) A sheet printing machine having a centrally located printing mechanism (13) is described. A conveying device (12) is located upstream and a delivering device (14) is located downstream of the printing mechanism (13). A slidable cover (16) alternatively covers or exposes the conveying device (12). Another cover (17) alternatively covers or exposes the delivering device (14). Each cover is made of a larger section and a smaller section being designed to slide within the larger section.

Fig. 1



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Description

The present invention relates to a safety cover for a silk-screen printing machine. More particularly, it pertains to a safety cover closed during machine operation and opened during aligning adjustments and maintenance work.

A silk-screen printing machine generally includes a sheet conveying device, a sheet delivering device, and a print frame, which are exposed from the upper side of the machine. A safety cover is disposed on a machine frame to protect the operator from the movement of these devices during machine operation. The safety cover is opened during alignment of printing position, setting of printing pressure, removal of jammed sheets, machine maintenance, etc. Conventionally, hood-type covers such as those shown in Fig. 11 have been used as safety covers. The hood-type cover comprises two cover bodies 54 having the same dimensions and shape. The base end of each cover body 54 is pivotably supported by a damper (not shown) at the center of the upper side of a printing machine 55. An open position, exposing the top portion of the printing machine 55, and a close position, covering the top portion, can be selected by manually lifting or lowering the distal end of each cover body 54.

However, conventional hood-type covers, such as those just described, interfere with printing adjustments and maintenance work conducted near where the covers are hinged. In addition, the weight of the covers themselves makes the manual opening and closing of the covers burdensome.

It is an object of the present invention is to provide a safety cover capable of being displaced to a position where the cover does not interfere with printing adjustments, maintenance work, etc.

Another object of the present invention is to provide a safety cover allowing easy opening and closing.

To achieve the above objects, a printing machine is provided with a slidable first cover and second cover. The printing machine has a printing mechanism located at a substantially center position on a frame, a conveying device disposed upstream of the printing mechanism and a delivering device disposed downstream of the printing mechanism. The printing mechanism performs printing operation on sheets supplied to the printing mechanism by the conveying device and the delivering device delivers the printed sheets. The first cover and second cover are mounted on the frame. The first cover slides between a position shielding the conveying device and a position exposing the conveying device. The second cover slides between a position shielding the delivering device and a position exposing the delivering device.

The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiment together with the accompanying drawings in which:

Fig. 1 is a perspective view showing covers of a printing machine in a completely closed state according to an embodiment of the present invention;

Fig. 2 is a perspective view showing the covers in a half opened state;

Fig. 3 is a perspective view showing the covers in a completely opened state;

Fig. 4 is a cross-sectional view showing a slide mechanism of the cover shown in Fig. 1;

Fig. 5 is a side view of Fig. 4;

Fig. 6 is an enlarged partial view taken on line VI-VI of Fig. 4;

Fig. 7 is a partial side view of Fig. 2;

Fig. 8 is a partial side view of Fig. 3;

Fig. 9 is a diagrammatic side elevation view showing the main devices of the printing machine;

Fig. 10 is a block diagram showing a controller of a printing machine; and

Fig. 11 is a perspective view showing conventional covers.

Hereinafter, an embodiment according to the present invention will be described with reference to the drawings.

As shown in Fig. 9, a printing machine comprises a printing mechanism 13, a sheet conveying device 12, and a sheet delivering device 14. The printing mechanism 13 is disposed at the center of a machine frame 11 with the conveying device 12 provided at its upstream side and the delivering device 14 provided at its downstream side. A sheet feeder 15 is provided at the upstream side of the conveying device 12 for feeding sheets of material such as paper. The printing mechanism 13, conveying device 12, delivering device 14, and feeder 15 are driven by the drive section 21.

The printing mechanism 13 includes a print frame 29, a doctor 25, a squeegee 26, and a print cylinder 23. The print frame 29 is slidably mounted to the top portion of the machine frame 11. A silk-screen print 27 is fixed to the print frame 29. The doctor 25 and the squeegee 26 are disposed, movable in the vertical direction, on the machine frame 11 above the silk-screen print 27. The print cylinder 23 is pivotable and includes a gripper 24. The reciprocating pivot action of the print cylinder 23 is synchronized to the reciprocating movement of the

print frame 29. The gripper 24 is capable of grasping printing sheet. The squeegee 26 presses the silk-screen print 27 against the sheet on the rotating print cylinder 23. Printing sheets are stocked in the feeder 15.

The conveying device 12, disposed at the upstream side of the printing mechanism 13, includes a sheet conveying belt 22. The conveying belt 22, synchronized with the rotation of the print cylinder 23, feeds the sheet supplied by the feeder 15 to the printing mechanism 13. The delivering device 14, disposed at the downstream side of the printing mechanism 13, includes a sheet delivering belt 28. The delivering belt 28, synchronized with the rotation of the print cylinder 23, discharges the sheet printed in the printing mechanism 13 out of the printing machine.

A sheet, first stacked in a feeder 15, is supplied to the printing mechanism 13 via the conveying belt 22. In the printing mechanism 13, the print cylinder 23 is pivoted clockwise to clamp the sheet with the gripper 24. Meanwhile, ink is pushed toward the squeegee 26 by the doctor 25 on the silk-screen print 27. After the sheet is clamped by the gripper 24, the print cylinder 23 is immediately pivoted in the counterclockwise direction to cause the sheet to be wounded onto the cylinder 23. During the counterclockwise rotation, the sheet attached to the cylinder 23 is printed by the squeegee 26 via the silk-screen print 27.

The sheet is released from the gripper 24 when the gripper 24 reaches the delivering belt 28 during the counterclockwise rotation. The sheet is then sucked on to the delivering belt 28 and carried downstream to be discharged out of the printing machine.

A first cover 16, covering the conveying device 12, and a second cover 17, covering the delivering device 14, are slidably attached to the upper side of the frame 11. The first cover 16 comprises a first cover member 42 and a second cover member 41. The second cover 17 is provided with a first cover section 44 and a second cover section 43. The first cover 16 and the second cover 17 are located on opposite ends of the upper surface of the printing machine with the doctor 25 and the squeegee 26 in between. Figure 1 shows the upper side of the conveying device 12 and the delivering device 14 completely shielded by the first cover 16 and the second cover 17, respectively. In the first cover 16, the second member 41 is located on the upstream end and the first member 42 on the downstream end. In the second cover 17, the first section 44 is located on the upstream end and the second section 43 on the downstream end. The doctor 25 and the squeegee 26 of the printing mechanism 13, which require adjustments during machine operation, are not covered by the covers 16, 17.

The structure of the covers 16, 17 will now be described. The structure and functions of cover 16 are the same as cover 17. Therefore, cover 16 will mainly be explained. The same members among each cover will be denoted by the same numbers in the drawings.

As shown in Figs. 4-8, a pair of support rails 45 are fixed to each side of the upper surface of the frame 11 via brackets 46. The support rails 45 extend parallel to the sheet conveying direction and are spaced apart from each other by a predetermined distance. A movable main rail 47 is attached to each support rail 45 via an interposing member 48. As shown in Fig. 6, the support rail 45 and the main rail 47 have the same cross-sectional configuration. Each rail 45, 47 receives the interposing member 48 via ball bearings 49. The rolling of the ball bearings 49 allows the rails 45, 47 to slide relative to one another via the interposing member 48. Each main rail 47 is connected to the associated inner side of the vertical wall of the second member 41 and the second cover section 43. This structure constitutes slide mechanisms 18 and enables the second member 41 and the second section 43 to be slidable above the frame 11.

The second member 41 is slidable between a first operational position and a second operational position. The second member 41 shields the upstream half of the conveying device 12 at the first operational position (refer to Fig. 7) and overhangs from the frame 11 (refer to Fig. 8) exposing substantially all of the conveying device 12 at the second operational position. By positioning the second member 41 in its first operational position, an outer edge 41a of the second member 41 will be located above the vicinity of an upstream edge 11a of the frame 11. By positioning the second member 41 at the second operational position, an inner edge 41b of the second member 41 will be located above the vicinity of the upstream edge 11a.

The second section 43 is slidable between a first active position and a second active position. The second section 43 shields the downstream half of the delivering device 14 at the first active position and overhangs from the frame 11 exposing substantially all of the delivering device 14 at the second active position. By positioning the second section 43 at the first active position, an outer edge 43a of the second section 43 will be located above the vicinity of a downstream edge 11b of the frame 11 . By positioning the second section 43 at the second active position, an inner edge 43b of the second section 43 will be located above the vicinity of the downstream edge 11b.

Intermediate support rails 51, extending parallel to the main rails 47, are fixed to the outer side of the vertical walls of the second member 41 and second section 43. A secondary movable rail 53 is attached to its associated support rail 51 via an interposing member 52. As shown in Fig. 6, the support rail 51 and the secondary rail 53 have the same cross-sectional configuration. Each rail 51, 53 receives the interposing member 52 via ball bearings 50. The rolling of the ball bearings 50 allows the rails 51, 53 to slide relative to one another via the interposing member 52. Each secondary rail 53 is connected to an inner vertical wall of the first member 42 and first section 44. This structure constitutes slide

mechanisms 19 and enables the first member 42 and the first section 44 to be slidable above the frame 11.

The first member 42 is slidable between a first operational position and a middle operational position. The first member 42 shields the downstream half of the conveying device 12 at the first operational position (refer to Fig. 5) and shields the upstream half of the conveying device 12 at the middle operational position (refer to Fig. 7). By positioning the first member 42 at the first operational position, an outer edge 42a of the first member 42 will be located above the vicinity of the center of the conveying device 12. By positioning the first member 42 at the middle operational position, an inner edge 42b will be located above the vicinity of the center of the conveying device 12.

The first section 44 is slidable between a first active position and a second active position. The first section 44 shields the upstream half of the delivering device 14 at the first active position and shields the downstream half of the delivering device 14 at the middle active position. By positioning the first section 44 at the first active position, an outer edge 44a of the first section 44 will be located above the vicinity of the center of the delivering device 14 (Fig. 9). By positioning the first section 44 at the middle active position, an inner edge 44b will be located above the vicinity of the center of the delivering device 14.

Each cover member 41, 42 and each cover section 43, 44 is preferably made of a transparent acrylic resin. The second member 41 and the second section 43 are substantially equal in length with the associated first member 42 and first section 44 in the longitudinal direction parallel to the sheet conveying direction. The second member 41 and the second section 43 are formed slightly narrower in width and slightly smaller in height when compared to the associated first member 42 and the first section 44. Consequently, the configuration of each member and section 41, 42, 43, 44 allows the first member 42 and first section 44 to overlap and accommodate the associated second member 41 and second section 43 as shown in Fig. 7. The first member 42 and the first section 44 are provided with handles 40 on their top surfaces.

The conveying device 12 and the delivering device 14 are completely shielded in Fig. 1. From this state, the handles 40 on the covers 16, 17 are grasped and pushed in the direction away from the printing mechanism 13 to expose each device 12, 14. The first member 42 slides until it reaches the middle operational position and accommodates and overlaps the second member 41 as shown in Fig. 2. The first section 44 slides until it reaches the middle active position and accommodates and overlaps the second section 43 as shown in Fig. 2. The sliding action of the first member 42 and the first section 44 is enabled by the slide mechanisms 19. By further applying outward force to the handles 40, the first member 42 and the first section 44, enclosing the associated second member 41 and second section 43, slide integrally with the second member 41 and the second section 43 until members 41, 42 reach the second operational position and sections 43, 44 reach the second active position as shown in Fig. 3. In this position the members 41, 42 and the sections 43, 44 all extend outward from the frame 11 thus exposing substantially all of the conveying device 12 and delivering device 14. The structure of the covers 16, 17 with two shielding parts, having substantially the same length creates minimal overhanging of the covers 16, 17 compared with covers comprising only one shielding part.

Furthermore, application of force to the handles 40 in the opposite direction will allow each member 41, 42 and each section 43, 44 to slide back to the first action position from the second action position. Therefore, the slide mechanisms 18, 19 enables easy opening and closing of the covers 16, 17.

A detected piece 36 (Fig. 5) is fixed to the outer lateral wall of the second member 42 and the second section 44. An associated sensor 37 is fixed to brackets 38 secured to the frame 11 near the printing mechanism 13. A safety switch 35 comprises the sensor 37 and the detecting plate 36. The detected piece 36 abuts with the sensor 37 when the associated cover 16, 17 is completely closed. This results in a signal output from the sensor 37 of the safety switch 35.

As shown in the block diagram of Fig. 10, a start switch 33, a jog motion switch 34, and the safety switch 35 are connected to a controller 20. The start switch 33 and the jog motion switch 34 are on the operation panel 30. When a signal from the safety switch 35 is sent to the controller 20, the controller 20 accepts a signal sent from the start switch 33, and moves the drive section 21 in accordance with the signal. The drive section 21 then continuously drives the printing mechanism 13, conveying device 12, and delivering device 14. Therefore, the printing machine becomes operable only when the upper surface of its frame 11 is completely closed thus improving operator safety.

When there is no signal sent from the safety switch 35, the signal from the start switch 33 is invalidated and the motion of the drive section 21 is stopped. As a result, opening of the covers 16, 17 will automatically stop the operation of the drive section 21 thus improving operator safety. However, the controller 20 accepts the signal from the jog motion switch 34 and drives the printing mechanism 13, conveying device 12, and delivery device 14 in a jog motion in accordance with the signal. Jog motion operation is permitted when the covers 16, 17 are opened. This facilitates alignment, adjustments, and maintenance work on the printing machine.

As described above, the connection of each cover 16, 17 to the frame 11 via the slide mechanisms 18, 19 enables easy opening and closing of the covers 16, 17. Furthermore, each cover 16, 17 may be slid until a desired portion of the frame 11 is exposed. If necessary, the conveying device 12 and the delivering device 14 can completely be exposed. Therefore, the covers 16, 17 do not interfere with adjustment and maintenance work.

Although only one embodiment of the present invention has been described in detail herein, it should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit and scope of the invention. Particularly, it should be understood that the present invention may be embodied in the modes given below.

(1) The length of the second member and second section may be altered. This will alter the range of the portion covered by the second member or second section.

(2) Provide each cover with three or more parts. This will further minimize the amount of cover overhang from the frame.

Claims

1. A printing machine having a printing mechanism (13) located at a substantially center position on a frame(11), a conveying device (12) disposed upstream of the printing mechanism (13) and a delivering device (14) disposed downstream of the printing mechanism (13), wherein the printing mechanism (13) performs printing operation on a sheet supplied to the printing mechanism (13) by the conveying device (12) and the delivering device (14) delivers the printed sheet, said printing machine being characterized by:

   a first cover (16) mounted on the frame (11), said first cover (16) being slidable between a position to shield the conveying device (12) and a position to expose the conveying device (12); and
   a second cover (17) mounted on the frame (11), said second cover (17) being slidable between a position to shield the delivering device (14) and a position to expose the delivering device (14).

2. A printing machine according to Claim 1, wherein said first cover (16) includes a first cover member (42) and a second cover member (41);

   said first cover member (42) being slidable between a first operational position and a second operational position, said first cover member (42) shielding a half of the conveying device (12) at the downstream side of the conveying device (12) in a position close to the printing mechanism (13) when placed at the first operational position and exposing substantially all of the conveying device (12) when placed at the second operational position; and
   said second cover member (41) being slidable between a first operational position and a second operational position, said second cover member (41) shielding a half of the conveying device (12) at the upstream side of the conveying device (12) in a position spaced apart from the printing mechanism (13) when placed at the first operational position and exposing substantially all of the conveying device (12) when placed at the second operational position;
   wherein said first cover member (42) overlaps the second cover member (41) when both cover members (41, 42) are placed at the second operational position.

3. A printing machine according to Claim 1, wherein said second cover (17) includes a first cover section (44) and a second cover section (43);

   said first cover section (44) being slidable between a first active position and a second active position, said first cover section (44) shielding a half of the delivering device (14) at the upstream side of the delivering device (14) in a position close to the printing mechanism (13) when placed at the first active position and exposing substantially all of the delivering device (14) when placed at the second active position; and
   said second cover section (43) being slidable between a first active position and a second active position, said second cover section (43) shielding a half of the delivering device (14) at the downstream side of the delivering device (14) in a position spaced apart from the printing mechanism (13) when placed at the first active position and exposing substantially all of the delivering device (14) when placed at the second active position;
   wherein said first cover section (44) overlaps the second cover section (43) when both cover sections (43, 44) are placed at the second active position.

4. A printing machine according to Claim 2, wherein said first cover member (42) is slidably mounted on the second cover member (41).

5. A printing machine according to Claim 3, wherein said first cover section (44) is slidably mounted on the second cover section (43).

6. A printing machine according to Claim 4 further comprising:

   a pair of support rails (45) mounted on the upper surface of the frame (11) and located spaced apart from each other by a predetermined distance, said rails (45) extending parallel to each other in a conveying direction of the sheet;

a pair of movable main rails (47) slidably attached to the associated support rails (45) and connected to opposite sides of the second cover member (41), respectively;

a pair of intermediate support rails (51) connected to opposite sides of second cover member (41), respectively, and extending parallel to the main movable rails (47); and

a pair of secondary movable rails (53) slidably attached to the associated intermediate support rails (51) and connected to opposite sides of the first cover member (42), respectively.

7. A printing machine according to Claim 5 further comprising:

a pair of support rails (45) mounted on the upper surface of the frame (11) and located spaced apart from each other by a predetermined distance, said rails (45) extending parallel to each other in a conveying direction of the sheet;

a pair of movable main rails slidably attached to the associated support rails (45) and connected to opposite sides of the second cover section (43), respectively;

a pair of intermediate support rails (51) connected to opposite sides of second cover section (43), respectively and extending parallel to the main movable rails (47); and

a pair of secondary movable rails (53) slidably attached to the associated intermediate support rails (51) and connected to opposite sides of the first cover section (44), respectively.

8. A printing machine according to Claim 1 further comprising:

a pair of detected pieces (36) connected to the first and the second covers (16, 17), respectively; and

a pair of sensors (37) disposed near the printing mechanism (13), each sensor (37) detecting one piece (36) in accordance with movement of the associated cover members to transmit a predetermined signal.

9. A printing machine according to Claim 8 further comprising:

a drive section (21) for driving the printing mechanism (13), conveying device (12) and delivering device (14); and

a controller (20) for controlling the drive section (12);

wherein said controller (20) operates to drive the printing mechanism (13), conveying device (12) and delivering device (14) in response to the signal from each sensor (37).

Fig. 1

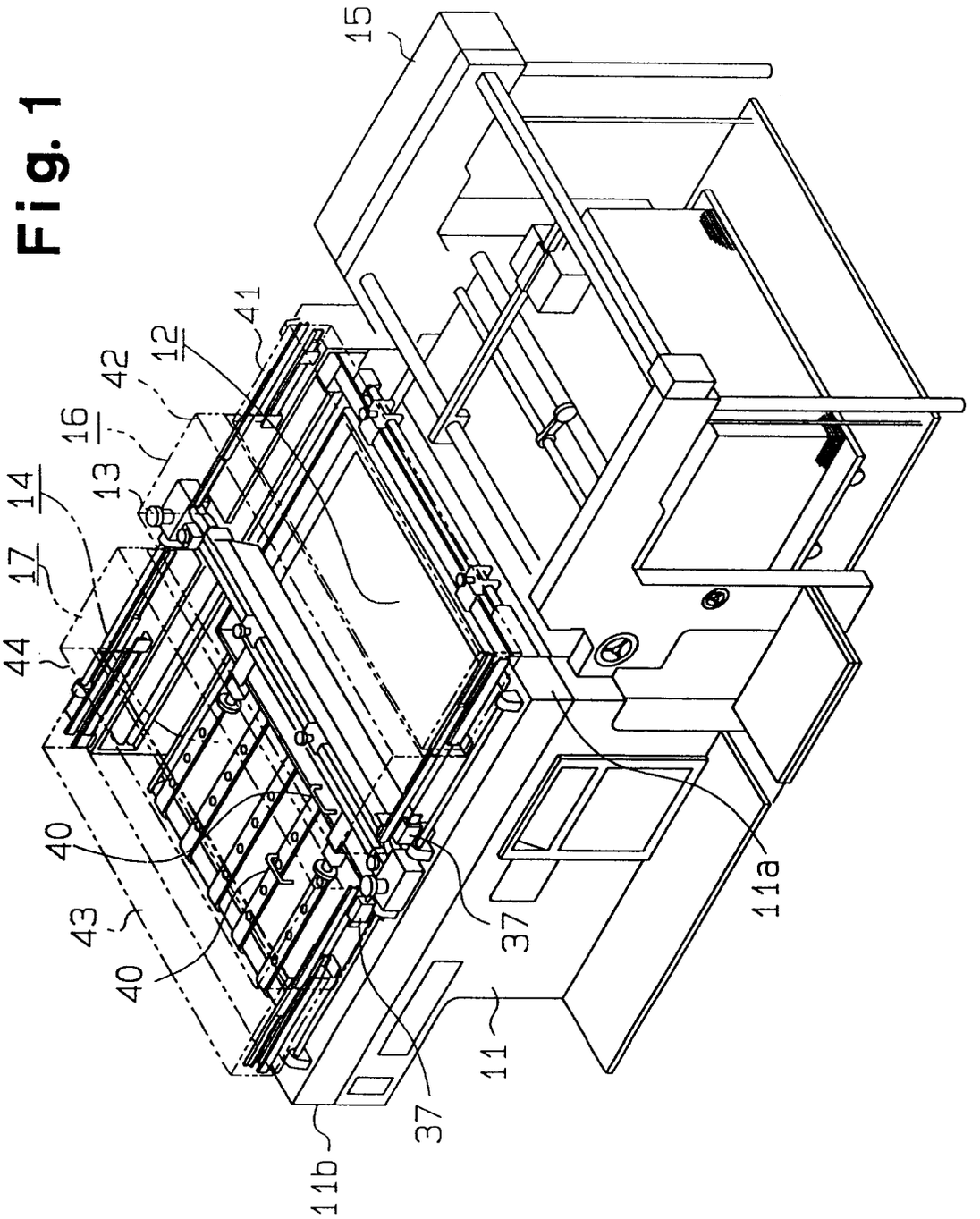

Fig. 2

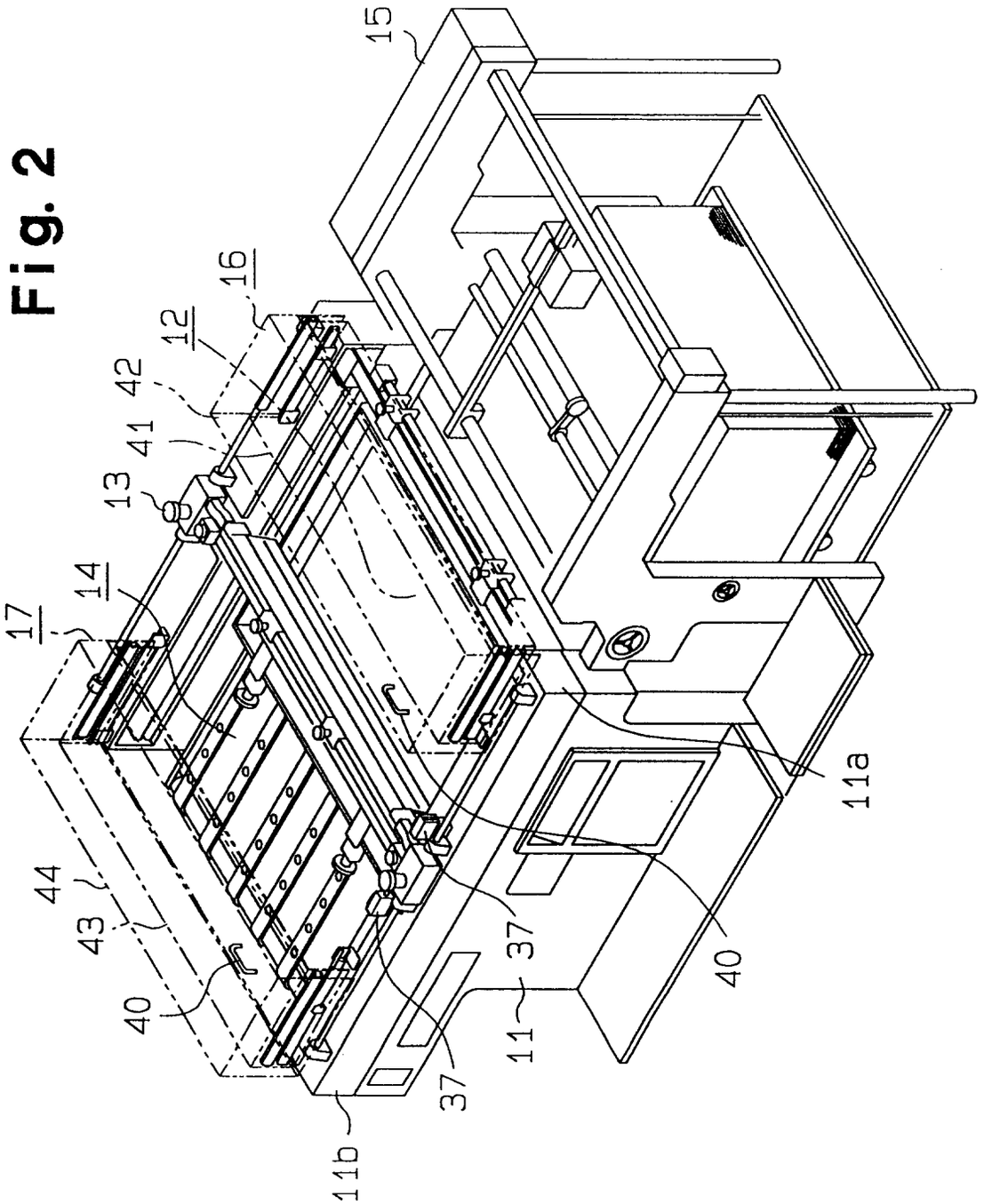

Fig. 3

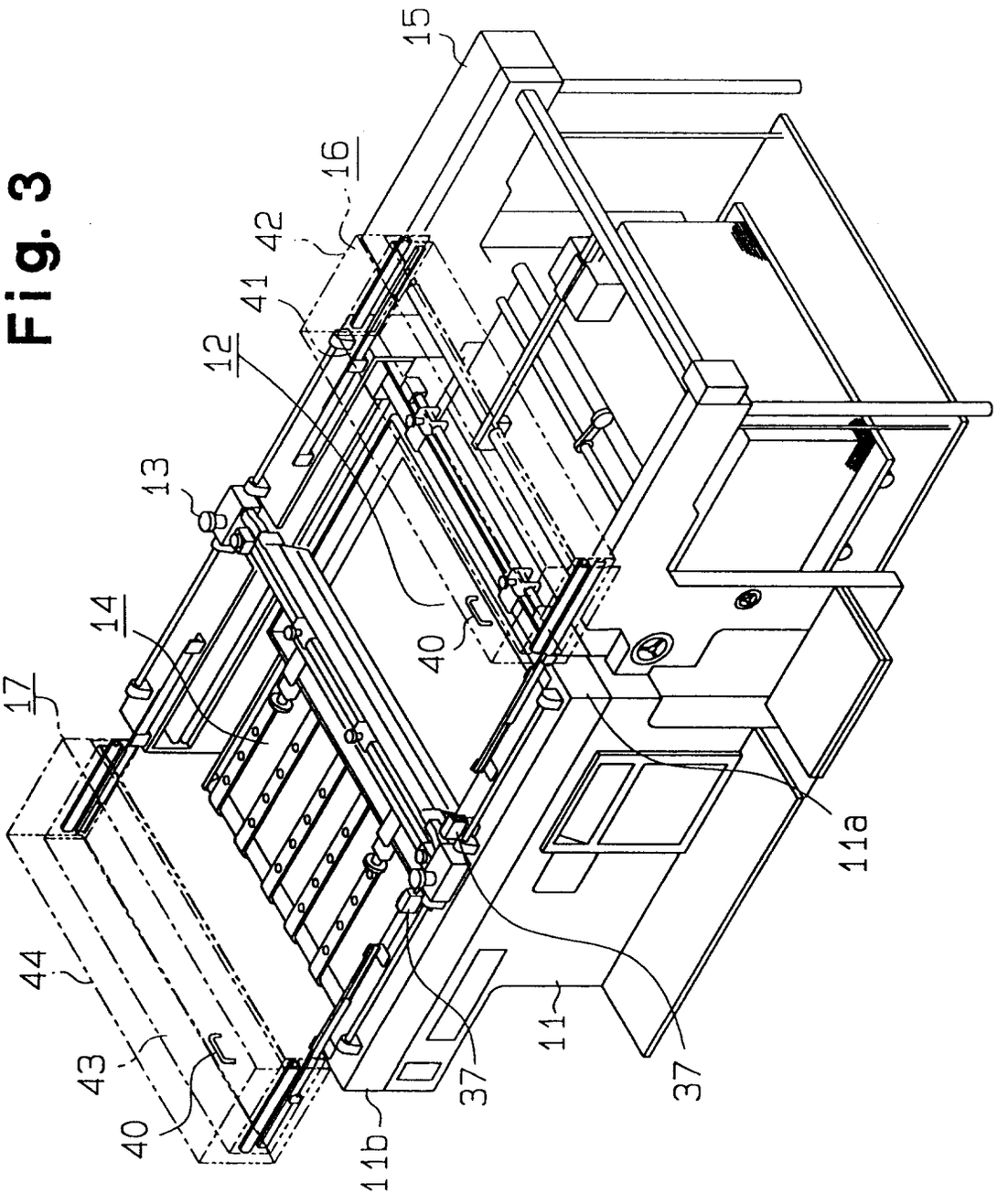

Fig. 4

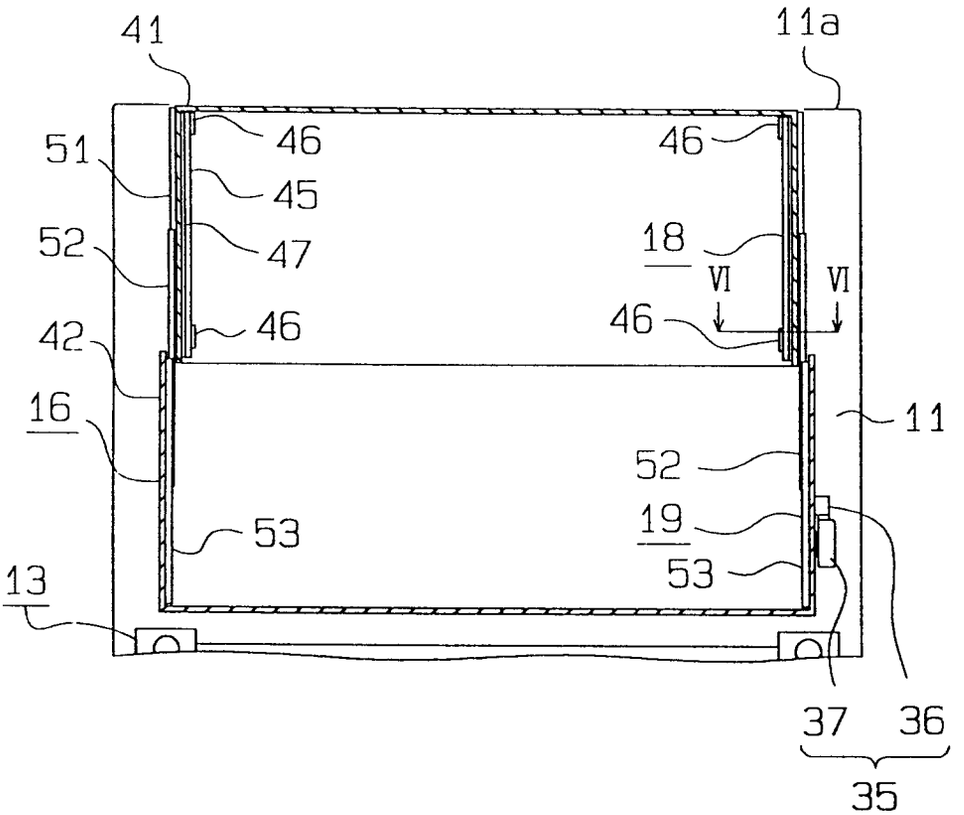
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Fig. 5

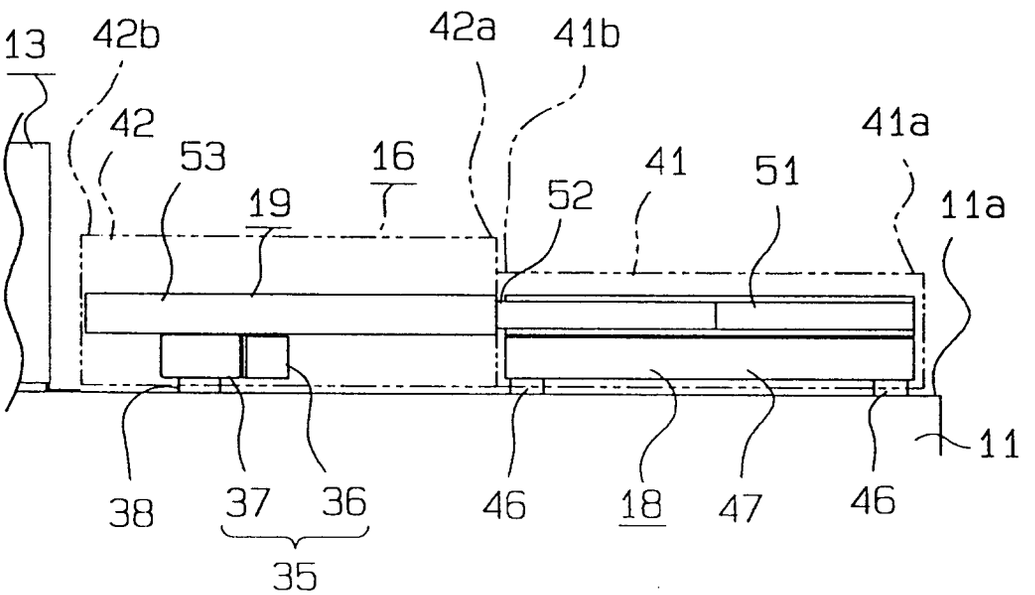
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Fig. 6

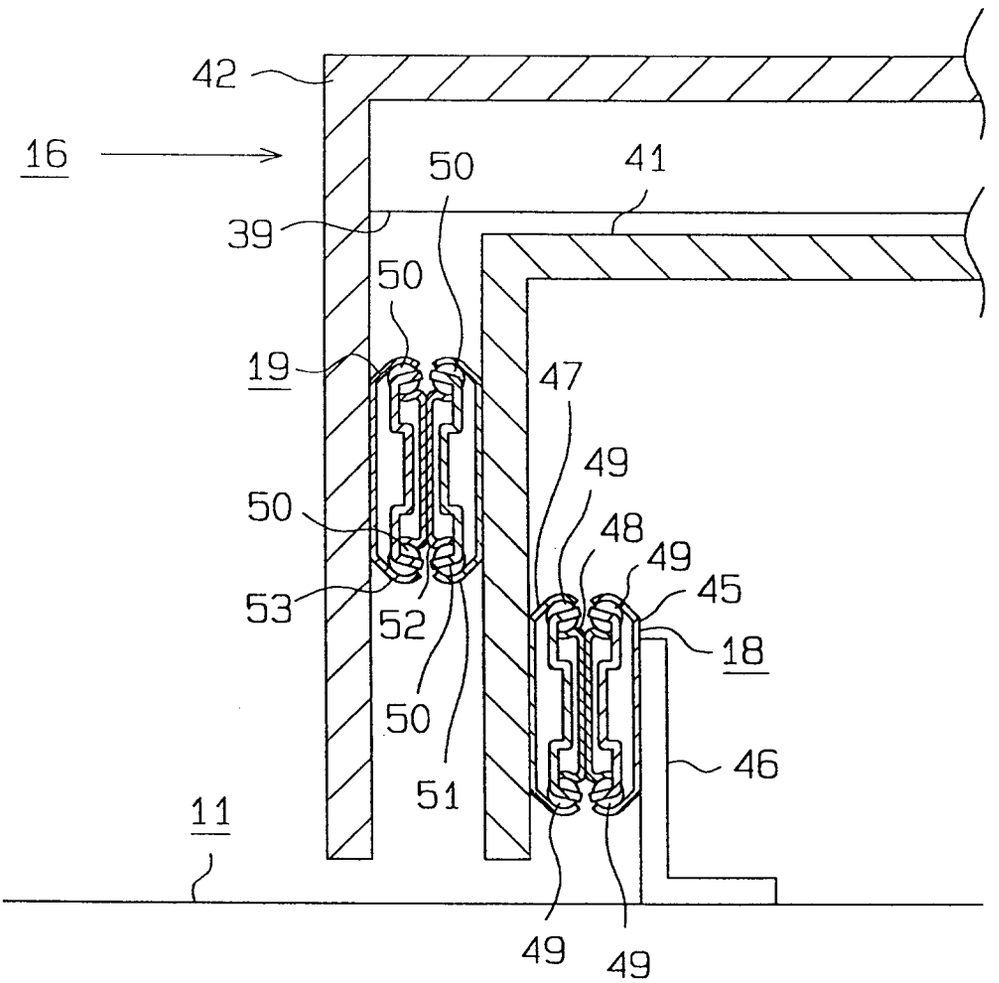

Fig. 7

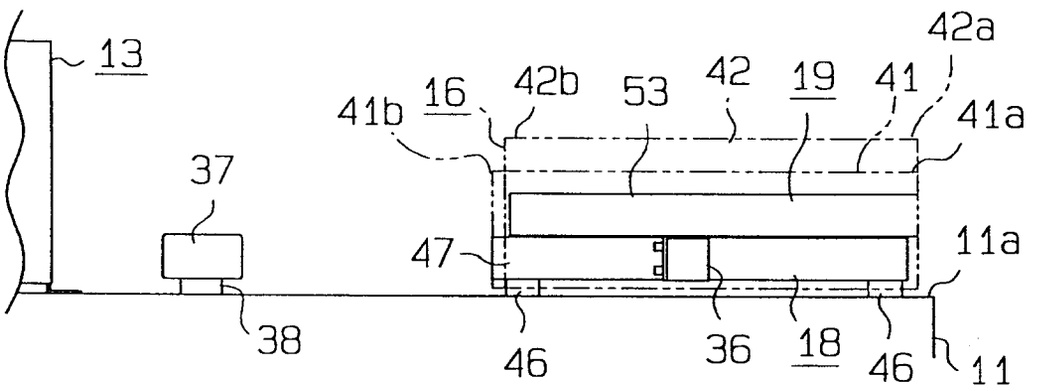
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Fig. 8

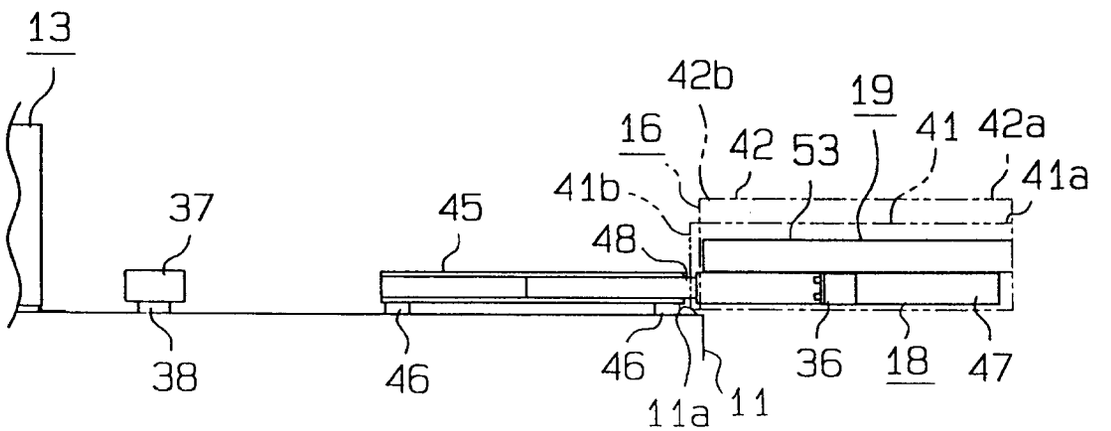
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Fig. 9

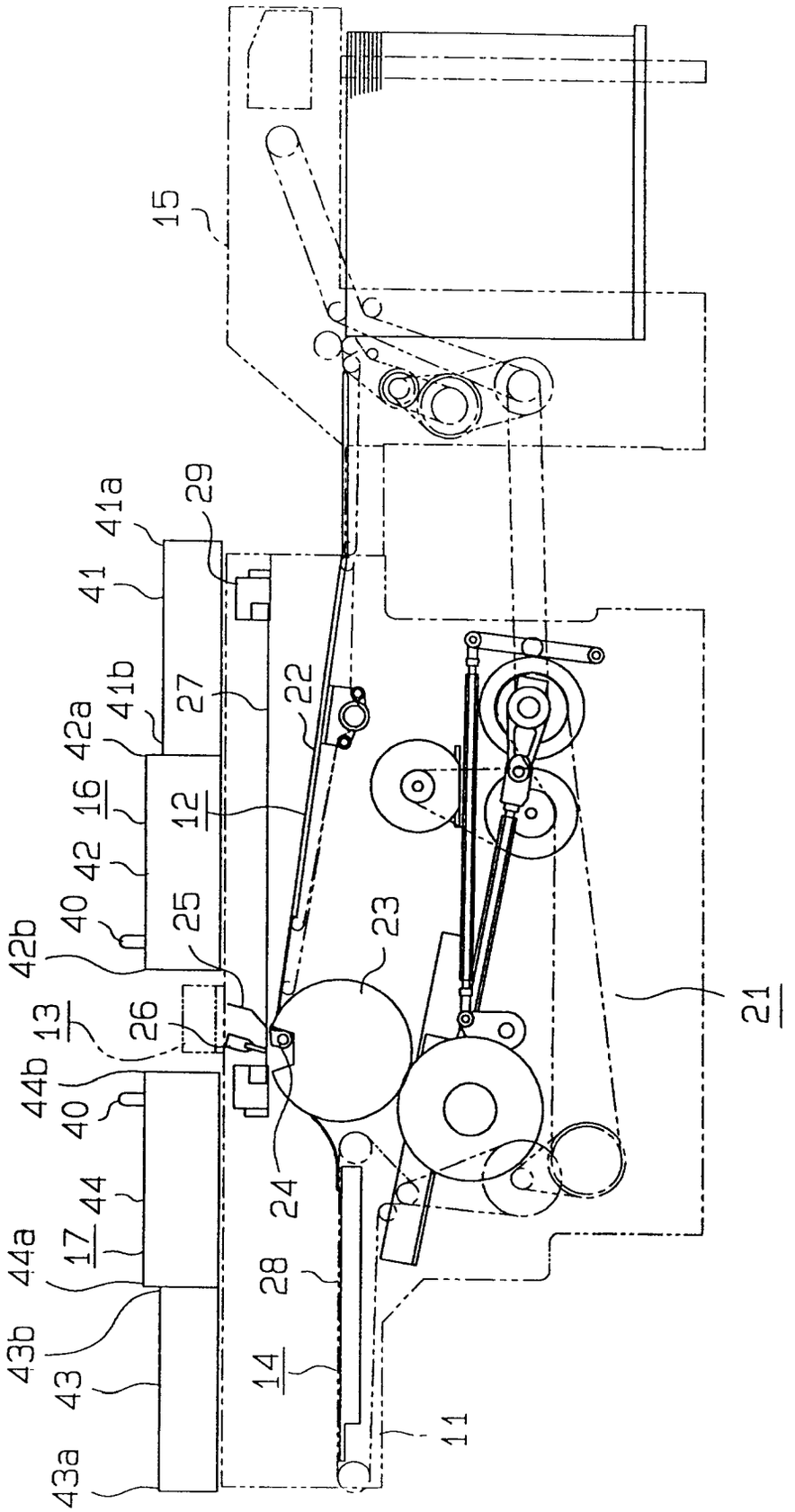
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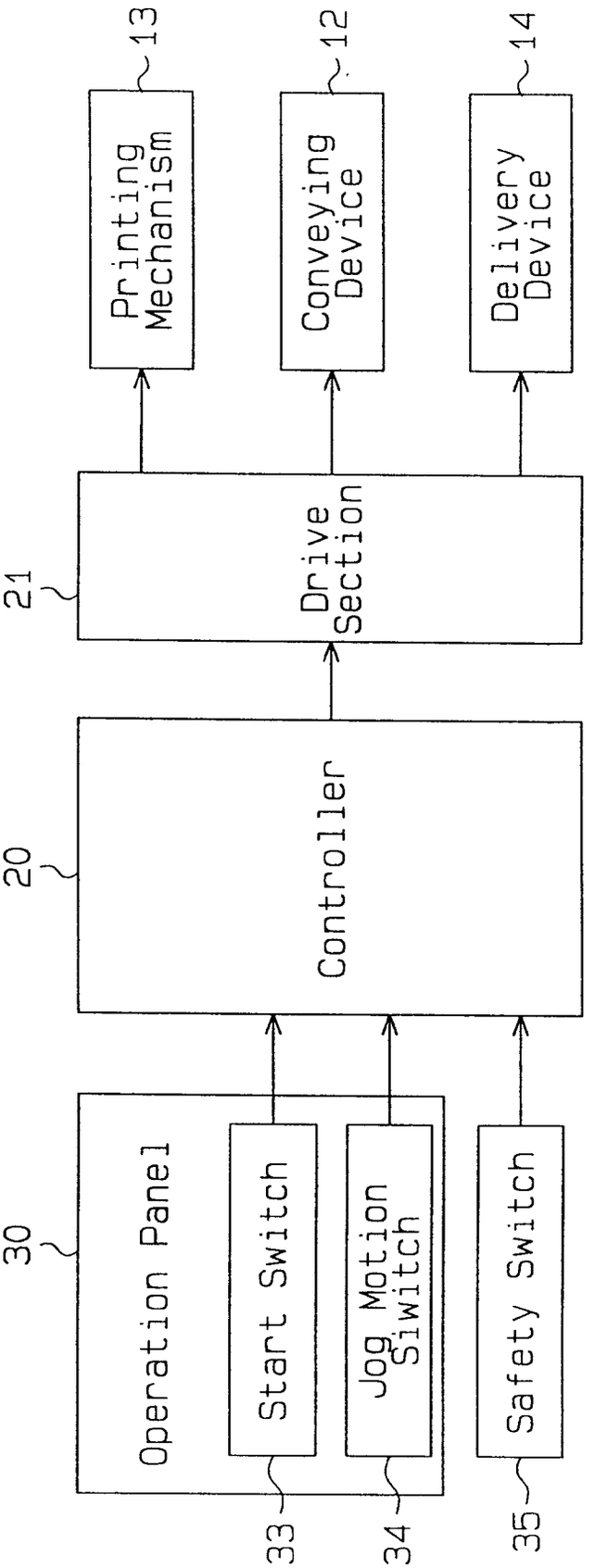
Fig. 10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Printing Mechanism
Conveying Device
Delivery Device
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Drive Section
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Controller
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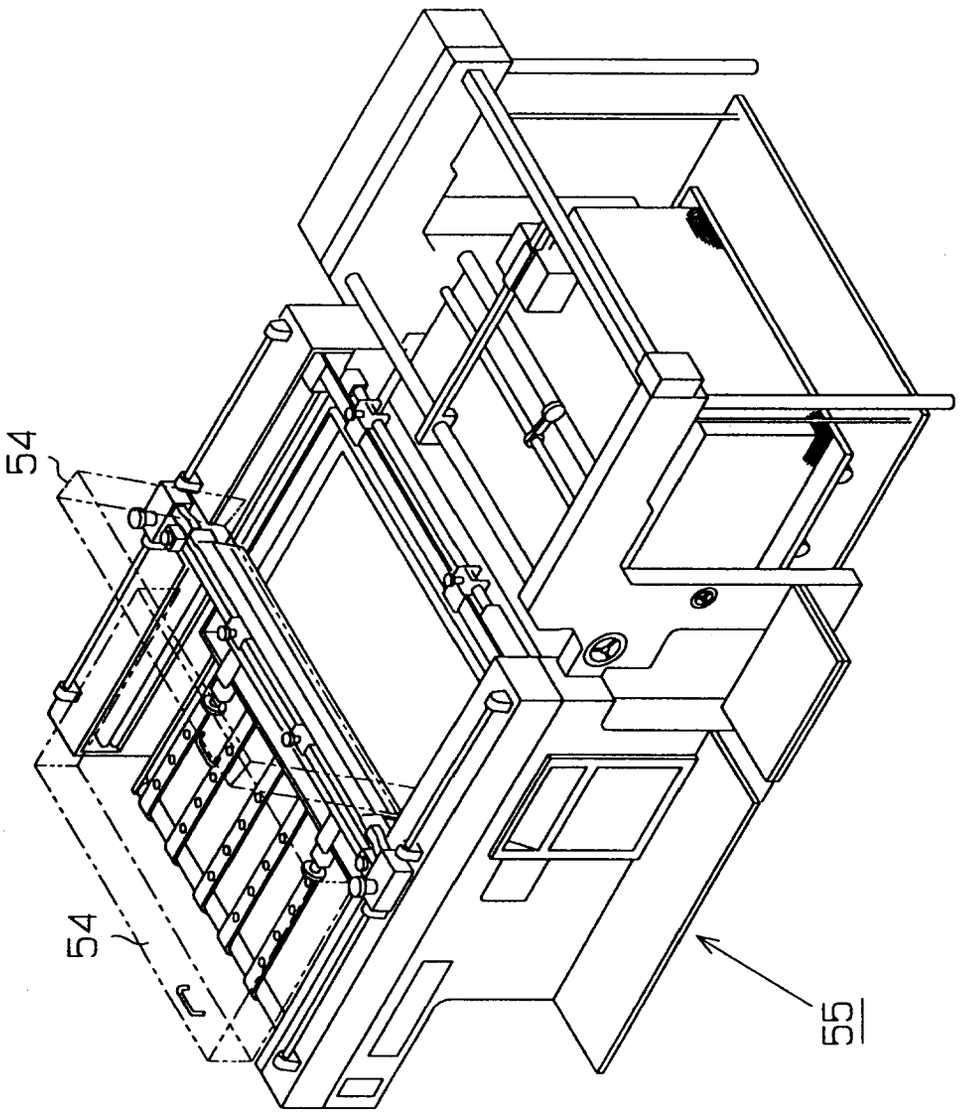
Operation Panel
Start Switch
Jog Motion Siwitch
Safety Switch
33
34
35

Fig. 11



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 6569

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-5 048 417 (EVERROAD MICHAEL A) 17 September 1991 * abstract; figure 1 * ---	1	B41F33/00
A	US-A-5 129 161 (SZARKA SANDOR) 14 July 1992 * abstract; figure 1 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 July 1996	Madsen, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)