(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 492 386 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.08.2012 Bulletin 2012/35

(51) Int Cl.:
D05B 19/14 *(2006.01)* ***D05B 39/00*** *(2006.01)*

(21) Application number: **12155864.7**

(22) Date of filing: **17.02.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **24.02.2011 JP 2011037977**

(71) Applicant: **Aisin Seiki Kabushiki Kaisha**
Aichi 448-8650 (JP)

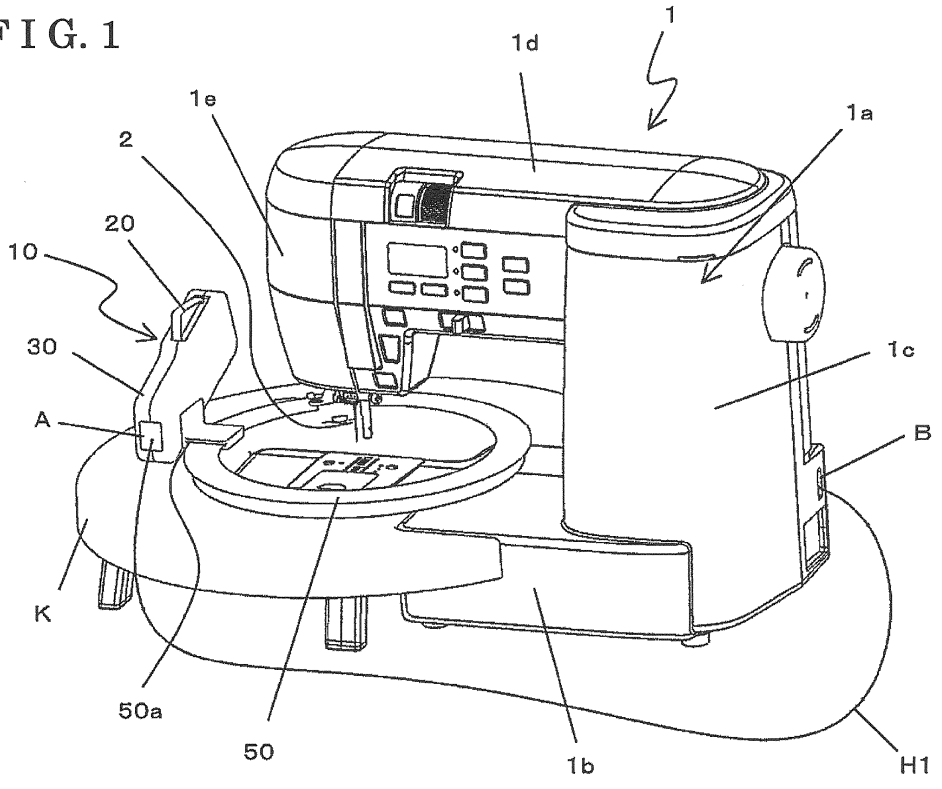
(72) Inventors:
- **Ando, Takaki**
  Kariya-shi, Aichi 448-8650 (JP)
- **Kawai, Yasunori**
  Kariya-shi, Aichi 448-8650 (JP)

(74) Representative: **Lacey, Dean Andrew**
Serjeants LLP
25 The Crescent
King Street
Leicester
LE1 6RX (GB)

(54) **Sewing machine**

(57) A sewing machine (1) for processing a needlework on a workpiece (100) by manually moving the workpiece (100) on a base portion (1b) to a desired position by an operator includes a sewing needle (2) processing the needlework on the workpiece (100) on the base portion (1 b), a drive source (3, 3a, 3b) actuating the sewing needle (2), a control portion (4) controlling the drive source (3, 3a, 3b), an operation portion (10) electrically connected to the control portion (4) and variably operating the sewing needle (2), and the operation portion (10) configured to be attached to a periphery (50a) of a frame portion (50) for providing a tensioned state of the workpiece (100).

FIG. 1



EP 2 492 386 A1

Description

TECHNICAL FIELD

[0001] This disclosure generally relates to a sewing machine.

BACKGROUND DISCUSSION

[0002] A sewing machine equipped with a function commonly known as a free-motion stitching function, the function configured to process embroidery by fitting a workpiece in a needlework frame and manually moving the needlework frame on a bed portion of the sewing machine, is known. For example, in JP2010-207542A (hereinafter referred to as Patent reference 1), a sewing machine including a sewing needle at a lower side of a sewing head portion, a darning foot which repeats pressing and detaching motions synchronized with a movement of the sewing needle on the workpiece, and a button-hole switch portion equipped near and facing the sewing needle configured to control a start and a stop of the button-hole stitching is disclosed. With the disclosed sewing machine, an operator of the sewing machine operates the button-hole switch equipped at a fixed position near the sewing needle with a finger tip to control the start and the stop of the free-motion stitching function on performing a free-motion stitching.

[0003] According to the known sewing machine in Patent reference 1, when the operator performs the free-motion stitching to process the embroidery to the workpiece, the operator normally uses the needlework frame for providing a tensioned state of the workpiece and manually move the needlework frame back and forth and around between hands of the operator to bring the needlework frame to a desired needlework position.

[0004] In such an occasion, the needlework operation becomes easier when the operator holds the needlework frame from opposite sides with both hands and moves the needlework frame to a desired position with respect to a base portion, for example, a bed portion or an extension table. With the sewing machine of the aforementioned configuration, the operator controls the start and stop switch for the free-motion stitching, the switch equipped on the button-hole switch lever that is fixed to a position near the sewing needle, by the finger tip of one hand while holding the needlework frame by both hands. As a result, the operator may face an operational difficulty. Thus, an operational improvement is desired so that the operator may process a needlework with an operational ease and accuracy. Without such improvement, the operator using a large size needlework frame may face a situation where the finger tip of the operator does not reach the start and stop switch for the free-motion stitching when the operator intends to process the needlework around the center of the needlework frame, especially for the operators with small fingers operating the aforementioned sewing machine.

[0005] A need thus exists for a sewing machine that improves ease of use on performing a free-motion stitching by moving the workpiece by hand and simultaneously enables more subtle adjustments of the sewing needle movements.

SUMMARY

[0006] According to an aspect of the disclosure, a sewing machine for processing a needlework on a workpiece by manually moving the workpiece on a base portion to a desired position by an operator includes a sewing needle processing the needlework on the workpiece on the base portion, a drive source actuating the sewing needle, a control portion controlling the drive source, an operation portion electrically connected to the control portion and variably operating the sewing needle, and the operation portion configured to be attached to a periphery of a frame portion for providing a tensioned state of the workpiece.

[0007] Instead of providing the operation portion at a fixed position on the sewing machine as with a conventional sewing machine, the operation portion is provided at the periphery of the frame portion for providing the tensioned state of the workpiece, so that the operator may operate the operation portion at a position close to a hand which the operator of the sewing machine holds and supports the frame portion. Having the operation portion close to the hand of the operator provides the operator more ease on controlling the movement of the sewing needle more sensitively relative to the conventional sewing machine. Even while the operator is using the needlework frame with a large diameter by holding the needlework frame with palms, the operator may control the operation portion with a fingertip, for example, of an index finger or a middle finger. As a result, when processing the needlework to the workpiece, the operator may control the movement of the sewing needle with more sensitivity and with ease, for processing the needlework of a desired design, having sewing patterns, embroideries and characters for example, at a desired position.

[0008] According to the further aspect of the disclosure, the sewing machine includes an attachment portion arranged between the operation portion and the frame portion for the operator to change a direction of an operational surface to and from a vertical direction and a horizontal direction relative to the frame portion on the base portion.

[0009] The attachment portion is provided between the operation portion and the frame portion for the operator to change the direction of the operational surface to and from a vertical direction and a horizontal direction relative to the frame portion on the base portion, so that the operator of the sewing machine using the frame portion manually may change the direction of the operational surface by changing the attachment portion for changing the position of the operation portion to and from a vertical direction and a horizontal direction relative to the frame portion according to the ease of use by the operator with

a simple structural understanding and an easy operation. The sewing machine provides selections according to the liking of operation by the operator for providing more ease of operation to the operator. As a result, the operator is provided with an advantage of having to control the needlework operation with more sensitivity for processing the needlework of a sensitive design.

[0010] According to another aspect of the disclosure, the sewing machine includes the operation portion equipped with an operation switch of variable resistance type.

[0011] When the operation portion adopts the operation switch of a variable resistance type, the operator may control the movement of the sewing needle in a continuously changing manner in, for example, a stitch width (a distance to move the sewing needle), a speed to move the sewing needle in an up and down direction, and the speed to move the sewing needle in the horizontal direction. As a result, the operator is provided with the advantage of having to control a more sensitive three-dimensional movement of the sewing needle.

[0012] According to the further aspect of the disclosure, the sewing machine includes the operation portion equipped with a retaining portion in a clip form configured to retain an object for retaining. The operation portion is configured to attach to and detach from an object retained by the retaining portion.

[0013] The operation portion equipped with the retaining portion in the clip form may attach to and detach from an object retained by the retaining portion. For example, the retaining portion may directly retain the workpiece when the operator process the needlework, for example an embroidery, to the workpiece without using the frame portion by retaining the workpiece directly by hand to provide the tensioned state of the workpiece. In this instance, the operator may retain the operation portion at a desired position, which is close to the hand retaining the workpiece. When the position of the workpiece is moved by hand, the operation portion is moved together with the workpiece being moved. In other words, the operation portion is positioned consistently close to the hand in order to sensitively control the movement of the sewing needle with ease.

[0014] According to another aspect of the disclosure, the sewing machine includes the operation portion equipped with the retaining portion in the clip form configured to directly retain the workpiece.

[0015] The operation portion equipped with the retaining portion in the clip form may directly retain the workpiece when the operator process the needlework, for example the embroidery, to the workpiece without using the frame portion by retaining the workpiece directly by hand to provide the tensioned state of the workpiece. In this instance, the operator may retain the operation portion at a desired position, which is close to the hand retaining the workpiece. When the position of the workpiece is moved by hand, the operation portion is moved together with the workpiece being moved. In other words, the operation portion is positioned consistently close to the hand in order to sensitively control the movement of the sewing needle with ease.

[0016] According to further aspect of the disclosure, the sewing machine includes the operation portion being detached from the frame portion configured to be placed within a pedal portion provided for a foot operation by the operator to variably control a movement of the sewing needle according to a foot operated amount by the operator.

[0017] The operation portion being detached from the needlework frame is disposed within the pedal portion that is configured to be stepped on by the operator for operation, so that the operator may control the sewing needle movement according to the amount the pedal portion is pressed by foot. As a result, the operator may select to use the operation portion as a foot controller to be controlled by foot depending on the ease of operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

[0019] Fig. 1 is a perspective view of a sewing machine according to a first embodiment;

[0020] Fig. 2 is a block diagram showing a control system configuration of the sewing machine illustrated in Fig. 1;

[0021] Fig. 3A is a drawing illustrating an attachment condition of an operation portion (i.e. an attachment configuration A) where the operation portion is attached laterally relative to a needlework frame;

[0022] Fig. 3B is a drawing illustrating an attachment condition of an operation portion (i.e. an attachment configuration B) where the operation portion is attached perpendicularly relative to the needlework frame;

[0023] Fig. 4 is a perspective view of the operation portion with the needlework frame where the operation portion is attached perpendicularly relative to the needlework frame;

[0024] Fig. 5 is a drawing describing a structure to attach the operation portion to the needlework frame in the attachment configuration A;

[0025] Fig. 6 is a drawing illustrating the operation portion illustrated in Fig. 1 being disassembled to describe an internal structures;

[0026] Fig. 7 is a perspective view of the operation portion integrated with the needlework frame according to a second embodiment;

[0027] Fig. 8 is a perspective view of the operation portion according to a third embodiment showing the position on the operation portion where to equip a retaining portion that retains the operation portion;

[0028] Fig. 9 is a drawing illustrating substantial parts of a clip structure of the retaining portion being enlarged;

[0029] Fig. 10 is a drawing describing the operation

portion according to a fourth embodiment to be contained internally in an upper case; and

[0030] Fig. 11 is a cross-sectional view of the upper case illustrated in Fig. 10 describing a position of the operation portion being contained therein.

DETAILED DESCRIPTION

[0031] Embodiments of a sewing machine 1 will be described as follows referring to Figures.

[0032] A first embodiment of the sewing machine 1 will be described as follows. Fig. 1 is a perspective view of the sewing machine 1 according to a first embodiment, and Fig. 2 is a block diagram showing a control system configuration of the sewing machine 1 illustrated in Fig. 1.

[0033] As shown in Fig. 1, the sewing machine 1 includes a main body 1a of the sewing machine 1 and an operation portion 10 with which an operator of the sewing machine 1 controls the movement of a sewing needle 2. The main body 1 a of the sewing machine 1 includes a bed portion 1b, which serves as a base portion, having a flat upper surface where a needlework, for example an embroidery, is processed, an upright arm portion 1c that vertically erects from an end of the bed portion 1b, a horizontal arm portion 1 d that extends from an upper end of the upright arm portion 1 c facing and being parallel to the bed portion 1b, and a sewing head portion 1 e that extends downward from a free end of the horizontal arm portion 1d being extended.

[0034] The sewing needle 2 to stitch the needlework, for example the embroidery, is attached to a lower portion of the sewing head portion 1e. With the sewing machine 1 having such a configuration, the sewing needle 2 is driven up and down or to right and left by drive sources 3 (a first drive source 3a and a second drive source 3b), which is controlled by a controller 4, which serves as a control portion, as shown in Fig. 2.

[0035] An extension table K may be attached to a free end of the bed portion 1 b, which serves as the base portion of the sewing machine 1 illustrated in Fig. 1, for ease of operation to process the needlework, for example the embroidery, to a workpiece 100. An upper surface of the extension table K is a continuous surface in a same level as an upper surface of the bed portion 1b. The extension table K is detachably attached to fit into the bed portion 1 b. On the extension table K and the bed portion 1 b, a needlework frame 50, which serves as a frame portion, is used when the needlework is processed. On the extension table K and the bed portion 1b, the operator may manually move the needlework frame 50, which provides a tensioned state of the workpiece 100 within the area being surrounded by the frame, to any desired direction, for example closer to the operator, to a feed direction, or to a right and left of the operator, for processing the needlework at a desired position.

[0036] The operation portion 10 according to the first embodiment is configured to manually adjust the movement of the sewing needle 2 so that the operation to process the needlework is easier when the operator of the sewing machine 1 performs a stitching method commonly known as a free-motion stitching where the operator manually moves the workpiece 100.

[0037] As shown in Fig. 1, the operation portion 10 is selectively attached to a periphery 50a of the needlework frame 50 in an annular form.

[0038] An exterior of the operation portion 10 is formed with a casing 30 made of two parts and shaped so that the operator may firmly hold the operation portion 10. The operation portion 10 is equipped with an operation switch 20 having an operational surface 20a that may be operated by the operator. The operation switch 20 is projected from a surface that is formed when the two parts of the casing 30 mate with each other in one direction. In Fig. 1, the operation switch is projected to a vertical direction relative to the surface that is formed when the two parts of the casing 30 mate. The casing 30 includes a first casing 31 having a U-shaped cross section and a second casing 32 likewise having a U-shaped cross section. The first casing 31 and the second casing 32 are joined at an end surface of each and retained in such state by means of a screw or similar fixing member. As shown in Fig. 1, the operation switch 20 is arranged on the surface of the operation portion 10 in the vertical direction, so that the operator may operate the operation switch 20 by using for example a tip of at least one of fingers, for example an index finger, a middle finger, or a thumb, while maneuvering the needlework frame 50 to a desired position. The operation switch 20 adopts a variable resistance type switch. The operation switch 20 may be configured with a switch type other than the variable resistance type when the switch may detect a movement of the operator. For example, the operation switch 20 may be of a pressure sensitive type, which provides continuously changing outputs with respect to the pressure being provided by a finger operation.

[0039] The operation portion 10 according to the first embodiment adopts a harness H1, a wire to establish an electrical connection between the main body 1a of the sewing machine 1. A method to establish the connection is not limited to such, for example, the connection between the operation portion 10 and the main body 1a of the sewing machine 1 may be established wirelessly by radio, without using the harness H1.

[0040] With the sewing machine1 being disclosed here, when the sewing machine 1 is operated, the operation of the operation switch 20 is converted to an electrical signal when the operator manually operates the operational surface 20a of the operation switch 20. The converted operational signal is fed via the harness H1 as an input to the controller 4, which serves as the control portion, built-in to the main body 1 a of the sewing machine 1. When the controller 4 receives the operational signal from the operation portion 10, the controller 4 sends an instruction to drive the first drive source 3a and the second drive source 3b so that the sewing needle 2 is controlled.

[0041] When the operation switch 20 as illustrated in Fig. 1 is pressed at the operational surface 20a by the operation of the operator, the operational surface 20a is pushed into the casing 30 by the pressure. The operation switch 20 is configured to return to the original position when the pressure is released. Such operational movements are converted to electrical signals and fed to the controller 4 as the operational signal input.

[0042] According to the first embodiment, the movement of the sewing needle 2 during the needlework operation is variably controlled with a stitch width, which is a distance that the sewing needle 2 moves horizontally relative to the bed portion 1b and the extension table K. Instead, the movement of the sewing needle 2 may be variably controlled, for example, with a sewing speed or a needle stop position.

[0043] The operation portion 10 may be attached in either a vertical position or a horizontal position relative to the needlework frame 50, depending on the ease of operation of the operator. The operation portion 10 may be attached to the periphery 50a of the needlework frame 50 in a horizontal configuration as Fig. 3A illustrates, or in a vertical configuration as Fig. 3B illustrates, and may change the configuration freely depending on the ease of operation of the operator. Fig. 3A illustrates an attachment configuration A, where the operation portion 10 is attached to the needlework frame 50 so that the operation switch 20 is operated by pressing in a horizontal direction. Fig. 3B illustrates an attachment configuration B, where the operation portion 10 is attached to the periphery 50a of the needlework frame 50 so that the operation switch 20 is operated by pressing in an upward and downward direction, that is in the vertical direction relative to the bed portion 1b.

[0044] A structure of the needlework frame 50 according to the first embodiment is described as follows. Fig. 4 is a perspective view of the operation portion 10 attached to the periphery 50a of the needlework frame 50 in the attachment configuration B. The needlework frame 50 tucks the workpiece 100 (shown in an imaginary line) between an upper frame and a lower frame to provide the tensioned state of the workpiece 100 within the area being surrounded by the frame. The needlework frame 50 includes an inner frame 51, which is a frame in a position inward in a radial direction of the needlework frame 50, and an outer frame 52, which is a frame in the position outward in the radial direction of the needlework 50, when the workpiece 100 is being tucked down between the aforementioned frames. When the workpiece 100 is held between the inner frame 51 and the outer frame 52 and a tightening screw 21 equipped on the outer frame 52 is tightened by turning in a clockwise direction, a diameter of the outer frame 52 is reduced with respect to the inner frame 51, so that the workpiece 100 is retained to the needlework frame 50. When the tightening screw 21 is turned in the direction opposite to the direction turned to tighten, the workpiece 100 may be removed from the needlework frame 50.

[0045] An attachment structure between the operation portion 10 and the needlework frame 50 is described next. As Fig. 4 illustrates, the operation portion 10 is attached to the periphery 50a of the needlework frame 50 via an attachment member 60 made of a metal (or of other material, for example, resin). In other words, between the operation portion 10 and the attachment member 60 are retained, and between the attachment member 60 and the needlework frame 50 are retained. The attachment details are described based on Fig. 5 as follows. Fig. 5 is a drawing describing the attachment structure with major portions being enlarged for the attachment configuration A.

[0046] In Fig. 5, the inner frame 51 of the needlework frame 50 includes a bottom surface 54 having a horizontal plane that is configured to be placed on and contact in a plane to the bed portion 1 b during the needlework operation, a top surface 55 at the side opposite to the bottom surface 54, a first extended portion 56 that extends horizontally inward in a radial direction from an inner portion of the top surface 55, and a second extended portion 57 that extends horizontally outward in a radial direction to a length nearly five times longer than the first extended portion 56 from an outer portion of the top surface 55. A top surface of the first extended portion 56 and a top surface of the second extended portion 57 are portions consisting of the top surface 55 of the needlework frame 50.

[0047] The attachment member 60, which fits to and retains the needlework frame 50, includes a frame retaining portion 61 that attaches to the first extended portion 56 and the second extended portion 57 at the top surface of the inner frame 51 and a casing retaining portion 62 that extends vertically from the frame retaining portion 61, which fits to at least one side of and retains the operation portion 10 in a vertical configuration or in a horizontal configuration. The frame retaining portion 61 attaches to the top surface side of the inner frame 51 by engaging with the first extended portion 56 and the second extended portion 57 of the inner frame 51. The casing retaining portion 62 includes a portion in a plate form extending from a one end side of the frame retaining portion 61 in a lateral direction. As shown in Fig. 5, the one end side is the side outward in a radial direction of the inner frame 51, when the attachment member 60 is attached to the inner frame 51. The aforementioned lateral direction is the direction in an axial direction of the inner frame 51, when the attachment member 60 is attached to the inner frame 51. According to the first embodiment, as shown in Fig. 5, the casing retaining portion 62 in a plate form, which extends from the one end side of the frame retaining portion 61, is equipped in a vertically upward direction in the axial direction of the inner frame 51. According to the first embodiment, the frame retaining portion 61 and the casing retaining portion 62 are integrally formed with a metal, which may be formed with other materials, for example, resin.

[0048] In addition, the casing retaining portion 62 in-

cludes a hook portion 63, which serves as an attachment portion, in a distal end side 62a. The attachment portion 63 is L-shaped and hooks and fits to the casing 30 of the operation portion 10 when attaching the operation portion 10 thereto. The hook portion 63, which projects outward in a radial direction relative to the casing retaining portion 62, is equipped in multiple numbers, for example two in the first embodiment, so that the operation portion 10 is stably retained. The hook portion 63 includes a third extended portion 64 that extends from a portion between the distal end side 62 and a proximal end side 62b of the casing retaining portion 62 and a fourth extended portion 65 that extends vertically upward from a distal end side of the third extended portion 64. In other words, the casing retaining portion 62, the third extended portion 64, and the fourth extended portion 65 together form a key shape. Surrounded by the third extended portion 64, the fourth extended portion 65 and the distal end side 62a of the casing retaining portion 62, a groove portion 66 is formed. The groove portion 66 is configured to retain the operation portion 10 by hooking at an opening 33, to be further described later, which is formed on a side of the casing 30 of the operation portion 10. On at least one side of the operation portion 10, two hooking structures of the aforementioned are formed between the casing retaining portion 62 and the casing 30. In Fig. 5, only one of the two hooking structures is shown.

[0049] An attachment portion of the casing 30 to be attached to the hook portion 63 of the attachment member is described next. As shown in Fig. 5, the first casing 31 and the second casing 32, each having a substantially U-shaped cross section, are joined at the fitting surface at each end and are retained by a method, for example, an ultrasonic welding, to form the casing 30. According to the first embodiment, the casing 30 is formed with the opening 33 on the side to be attached to the casing retaining portion 62. According to the first embodiment, as shown in Fig. 5, the opening 33 is formed on one side of the second casing 32, which is configured to be held firmly by the operator. At an end of the opening 33, a tucking portion 32a of the second casing 32 fits between the casing retaining portion 62 and the fourth extended portion 65 and is retained thereat. Fig. 5 illustrates that the tucking portion 32a is formed in the vertical direction similarly to the casing retaining portion 62 and the fourth extended portion 65.

[0050] To attach the operation portion 10 to the attachment member 60, the hook portion 63 projected outward is inserted into the opening 33 formed on the second casing 32 and slides the operation portion 10 vertically downward. In doing so, the tucking portion 32a is inserted to the groove portion 66 of the hook portion 63. As a result, the casing retaining portion 62 and the operation portion 10 are retained to each other.

[0051] An internal structure of the operation portion 10 is described next. As shown in Fig. 6, the operation portion 10 is internally equipped with switch elements 40, which compose the operation switch 20. The switch elements 40 are assembled to the second casing 32 side. After the switch elements 40 are assembled, the second casing 32 is covered with the first casing 31 and is retained in a closed state with a screw, by welding or other retaining means to form the operation portion 10.

[0052] The switch elements 40 include, as principal parts, a switch portion 41 that the operator operates with a finger, a variable resister board 42 equipped with variable resister portions 42a, 42b, referred to as resister board patterns as necessary, that detects a resistance value based on the pressed amount of the switch portion 41, a lever 43 for a contact fitting 43b equipped with the contact fitting 43b that divides the resistance value detected by the variable resister portions 42a, 42b relative to the pressed amount of the switch portion 41, and a spring 44 disposed between the second casing 32 and the switch portion 41 to bias the switch portion 41 pressed by the operator back to the original position.

[0053] The switch portion 41 is rotationally supported to rotate at a first rotational portion 32b, projecting internally from the second casing 32 as center, as shown in Fig. 6. The switch portion 41 includes an operational surface 41a having a smoothly slanted surface where the operator operates as a switch with a body portion, for example a left hand finger, when the operator operates the sewing machine 1. The operational surface 41 a is disposed in a state to project outward from a peripheral end of the casing 30 of the operation portion 10. The operator presses and releases the operational surface 41 a with, for example, a finger to operate the sewing machine 1, so that the operator may perform the needlework while keeping on checking the sewing state.

[0054] The spring 44 is assembled to the first rotational portion 32b and biases the switch portion 41 pressed by the operator to a direction to return to the original position, which is a clockwise direction in Fig. 6.

[0055] The lever 43 for the contact fitting 43b, which rotates in relation to a rotation of the switch portion 41, is rotationally supported with respect to the variable resister board 42 retained internally to the second casing 32 and rotates in an amount relative to the pressed amount of the switch portion 41. An end of the lever 43 for the contact fitting 43b is rotationally supported at a second rotational portion 43a as center and the other end is arranged to move by pressing the switch portion 41. In other words, one end of the lever 43 for the contact fitting 43b is rotationally supported and the other end is configured to move rotationally with respect to the variable resister board 42 being retained when the operational surface 41 a is pressed with the switch portion 41. The lever 43 for the contact fitting 43b returns to the original position with the biasing force of the spring 44 when the pressure from the pressing is released. The lever 43 for the contact fitting 43b is provided with the contact fitting 43b of electrically conductive material, for example copper, at a location between one end and the other end of the lever 43 for the contact fitting 43b. The contact fitting 43b is pushed to a direction of the variable resister

board 42 by rotating together with the lever 43 for the contact fitting 43b when the switch portion 41 is pressed for operation. The contact fitting 43b is connected to the variable resister portions 42a, 42b, provided on the variable resister board 42. When the lever 43 for the contact fitting 43b is pressed for operation, the contact fitting 43b moves slidingly on the variable resister portions 42a, 42b. Upon this movement of the contact fitting 43b, when a predetermined voltage, for example 5V, is applied to terminals at ends of the variable resister portions 42a, 42b, a short circuit position changes and an internal resistance of the variable resister board 42 changes. As a result, a voltage according to the operation amount of the operational surface 41 a is successively detected.

[0056] Although with the first embodiment, the switch portion 41 and the lever 43 for the contact fitting 43b are formed and assembled independently, the switch portion 41 and the lever 43 for the contact fitting 43b may be integrally formed and assembled as one component. In this instance, a total number of parts and total man-hour for assembly may be reduced.

[0057] The variable resister board 42 is provided internally in the operation portion 10 at a position where the switch portion 41 is being pushed in, in other words, on a rotational path of the switch portion 41 as Fig. 6 shows. The variable resister board 42 includes resistors 42c, the variable resistor portion 42a (the resister board pattern), which is electrically connected to the resistors 42c, the variable resistor portion 42b (the resister board pattern), which is electrically connected to the variable resistor portion 42a via the contact fitting 43b. The variable resistor portion 42a (the resister board pattern) and the variable resistor portion 42b (the resister board pattern) are electrically connected at a side where the switch portion 41 is provided. When the contact fitting 43b moves, the position connected with the variable resistor portions 42a, 42b, which is the short circuit position, changes, so that the resistance value between terminals that are not short circuited, which are a first terminal portion Ta and a second terminal portion Tb, changes. To each of the first terminal portion Ta and the second terminal portion Tb, an internal harness H2 of an electrically conductive material is connected, for example, by soldering. Each of the other end of the internal harnesses H2 are electrically connected to a first connector A, which is provided at an end in a longitudinal direction of the casing 30.

[0058] As shown in Fig. 1, at the first connector A, which is provided on the operation portion 10 and at a second connector B, which is provided on a side at a vertically lower location of the main body 1a of the sewing machine 1, opposite ends of the external harness H1 is detachably attached to provide an electrical connection. The second connector B is electrically connected by another harness with the controller 4, which is internally provided in the sewing machine 1.

[0059] The controller 4, which serves as the control portion, is electrically connected with the drive sources 3 (the first drive source 3a and the second drive source 3b), as shown in Fig. 2. The controller 4 controls the drive sources 3 according to the changes of internal resistance in the variable resister board 42, which is internally provided in the operation portion 10.

[0060] The drive sources 3 includes the first drive source 3a, which is the drive source to move the sewing needle 2 up and down, and the second drive source 3b, which drives the sewing needle 2 in a reciprocating motion in the horizontal direction for controlling the stitch width. The drive sources 3 are driven based on instructions from the controller 4.

[0061] In the first embodiment, the controller 4 sends an instruction based on the change in the resistance value of the variable resister board 42, which is internally provided in the operation portion 10, to the second drive source 3b for controlling the second drive source 3b. As a result, the operator may control the stitch width, the distance to move the sewing needle 2, by operating the operational surface 41 a of the operation portion 10. In addition to varying the distance to move the sewing needle 2, the second drive source 3b may be configured to vary a speed to move the sewing needle 2 in an up and down direction and the horizontal direction for providing more sensitive three-dimensional movement of the sewing needle 2.

[0062] With the sewing machine 1 according to the first embodiment, the operator of the sewing machine 1 may control the operation portion 10 at a position closer to a hand by using a finger, for example the index finger, while holding and supporting the needlework frame 50 manually. In this instance, a sensitive movement of the sewing needle 2 is controlled with ease. Even when the operator is using the needlework frame 50 with a large diameter, the sewing machine 1 according to the first embodiment is advantageous in that the operator may control the operation portion 10 at a position close to the hand holding the needlework frame 50 so that the operator may control the operation portion 10 at the fingertip. As a result, when processing needlework to the workpiece 100, the operator may control the movement of the sewing needle 2 with more sensitivity and with ease, for processing needlework of a desired design.

[0063] An attachment configuration to the needlework frame 50 of the operation portion 10 according to the first embodiment is selectable between the configuration in which the operational surface 41a is at a top or at a side depending on the ease of the operator. The operator may attach the operation portion 10 to the needlework frame 50 in the configuration of a choice based on the ease of operation. By selecting the attachment configuration such that provides the operational surface 41 a of the operation portion 10 near to the fingertip for operation, the operation to process sensitive needlework by the operator, who holds the needlework frame 50 with both hands and controls the movement of the sewing needle 2 using the fingertip, becomes easier.

[0064] Adopting the variable resistance type switch for the operation switch 20 is advantageous in providing a

sensitive movement of the sewing needle 2 (the stitch width of the sewing needle 2) in a continuously changing manner at a reduced cost.

[0065] The sewing machine 1 according to the second embodiment is described as follows. Fig. 7 is a perspective view of the operation portion 10 according to a second embodiment

[0066] Aside from the operation portion 10 being integrally formed in resin with the needlework frame 50, as shown in Fig. 7, the configuration of the second embodiment is similar to the configuration of the first embodiment. The second embodiment is mainly described with the differences from the first embodiment as follows.

[0067] The operation portion 10 according to the second embodiment is integrally formed with the inner frame 51 of the needlework frame 50, which extends outward in a radial direction from an outer periphery side of the inner frame 51. The operation switch 20 of the operation portion 10 is provided on a surface at the distal end of the portion extended from the inner frame 51. The external harness H1 for the electrical connection to the main body 1a of the sewing machine 1 is connected to one of the side portions of the portion extended from the inner frame 51.

[0068] According to the configuration according to the second embodiment, because the operation portion 10 is integrally formed with the inner frame 51 of the needlework frame 50, the attachment member 60 provided with the first embodiment for attaching the operation portion 10 to the needlework frame 50 is unnecessary. As a result, a configuration in a periphery of the needlework frame may be simplified, the cost to provide the configuration may be reduced, and the ease of operation by the operator moving the needlework frame 50 to process the needlework is improved.

[0069] The sewing machine 1 according to the third embodiment is described as follows. Fig. 8 is a perspective view describing characteristics of the operation portion 10 according to the third embodiment. Fig. 9 is a drawing illustrating substantial parts of a clip structure of a retaining portion 80 shown in Fig. 8 being enlarged.

[0070] Aside from having the retaining portion 80 in a clip structure being fixed to one side of the operation portion 10 as a difference, as shown in Fig. 8, the configuration of the third embodiment is similar to the configuration of the first embodiment. The third embodiment is mainly described with the differences from the first embodiment as follows.

[0071] The operation portion 10 according to the third embodiment detachably attaches to the needlework frame 50 with a clip structure, which is the retaining portion 80 such that retains the workpiece 100 for processing with an easy operation when the operator processes the needlework to the workpiece 100.

[0072] The retaining portion 80 is provided on one surface, the surface for example on a side, of the first casing 31, which is one member consisting of the casing 30 of the operation portion 10, as shown in Fig. 8. In detail, the retaining portion 80 is provided on the surface perpendicular to the surface where the operation switch 20 is provided.

[0073] The retaining portion 80 includes a first plate 81 having a pivot point 81 c at a location near the middle of a first end 81 a and a second end 81 b of the first plate 81 where the first plate 81 rotates as the center, a second plate 82 configured to hold the workpiece 100 between the first plate 81 at the first end 81a, and a biasing member 83, for example a torsion spring, for biasing the first end 81a of the first plate 81 in a direction of the second plate 82, which is a counterclockwise direction in Fig. 9, as main portions. According to the third embodiment, one surface (the surface on the side, for example) of the first casing 31 is serving the purpose of the second plate 82, as Fig. 8 shows.

[0074] When the operator presses the second end 81 b of the first plate 81 to the direction of the first casing 31, the first plate 81 rotates with the pivot point 81c as the center in clockwise direction in Fig. 9, that is in the direction where the first end 81 a of the retaining portion 80 detaches from the first casing 31 (the second plate 82) to define a space therebetween. When the workpiece 100 is inserted to the aforementioned space and the pressure at the second end 81 b is released, the first end 81 a of the first plate 81 returns to the original position by a biasing force of the biasing member 83, which is the position shown in Fig. 9. As described above, with the simple configuration and operation, the operation portion 10 may be easily retained to the workpiece 100.

[0075] The configuration according to the third embodiment allows the operator to retain the operation portion 10 at a position close to the hand holding the workpiece 100 when processing the needlework (embroidery, for example) to the workpiece 100 by retaining the workpiece 100 directly by hand without using the needlework frame 50. In this instance, when the position of the workpiece 100 is moved by hand, the operation portion 10 is moved together with the workpiece 100 being moved. In other words, the operation portion is positioned consistently close to the hand in order to sensitively control the movement of the sewing needle 2 with ease.

[0076] The sewing machine 1 according to the fourth embodiment is described as follows. Fig. 10 is a drawing describing the operation portion 10 according to a fourth embodiment to be contained internally in an upper case 91, which serves as a pedal portion. Fig. 11 is a cross-sectional view showing an internal configuration of the operation portion 10 according to the fourth embodiment.

[0077] Aside from the operation portion 10 configured to be used as a foot controller 90 for operating the sewing machine 1 with a pedal operation as the difference, the configuration of the fourth embodiment is similar to the configuration of the first embodiment. The fourth embodiment is mainly described with the differences from the first embodiment as follows.

[0078] With the fourth embodiment, the operation portion 10, as shown in Fig. 1, which detachably attaches

to the needlework 50, is detached from the needlework frame 50. The fourth embodiment is **characterized in that** the upper case 91 (the pedal portion) of a detachable state, which the operator may operate as a pedal, being disposed on the surface of the operation switch 20, so that an amount pressed by the foot of the operator becomes the amount of the operation switch 20 being pressed.

[0079] The foot controller 90 includes, the upper case 91 (the pedal portion) having a surface 92a for the operator to step on, the operation portion 10 disposed at a flip side of the surface 92a of the upper case 91 and operated according to the amount the upper case 91 being pressed by the foot, and a lower case 95 for containing the operation portion 10, as principal portions.

[0080] The upper case 91 includes a third plate 92 having the surface 92a for the operator to step on and first peripheral walls 93 extending downward from peripheral portions of the third plate 92. The upper case 91 is a box form with the lower portion being open. One end of the upper case 91 is rotationally supported by the lower case 95 so that the upper case 91 is rotational with respect to the lower case 95. The upper case 91 is configured to contain the lower case 95 internally, when the operator steps on the surface 92a. On a reverse surface 92b, which is the flip side of the surface 92a of the third plate 92, a protruded portion 92c is provided for pressing the operation switch 20 of the operation portion 10. The protruded portion 92c is provided closer to another end 92d of the upper case 91, a free end opposite to the end being rotationally supported by the lower case 95. The protruded portion 92c is provided for pressing the operation switch 20 with more ease.

[0081] The lower case 95 includes a fourth plate 96 that provides a bottom portion, second peripheral walls 97, extending upward from peripheral portions of the fourth plate 96. The lower case 95 is a box form with the upper portion being open. One end of the lower case 95 rotationally supports the upper case 91. The lower case 95 is configured to be surrounded by the upper case 91 when the operator steps on the surface 92a. Inside thereof, the lower case 95 is provided with an open space 95a where the operation portion 10 is disposed and a positioning member 95b for retaining the position of the operation portion 10 disposed in the open space 95a.

[0082] The operation portion 10 is inserted into the lower case 95 in a state in which the upper case 91 is rotated in an opening direction with respect to the lower case 95, then the upper case 91 is rotated in a closing direction to contain the operation portion 10 inside the foot controller 90. The operation portion 10 is positioned so that the protruded portion 92c contacts the operation switch 20.

[0083] As can be seen from above, when the operation portion 10, detachably attached to the needlework frame 50 being detached from the needlework frame 50, is provided with the upper case 91 (the pedal portion) in a detachable state configured to be stepped on by the operator being positioned at the surface of the operation switch 20, the operator may operate the operation switch 20 according to the amount the upper case 91 (the pedal portion) is pressed by foot. In such a case, the operator may select to use the operation portion 10 as a foot controller 90 to be controlled by foot depending on the ease of operation.

Claims

1. A sewing machine (1) for processing a needlework on a workpiece (100) by manually moving the workpiece (100) on a base portion (1b) to a desired position by an operator, comprising:

   a sewing needle (2) processing the needlework on the workpiece (100) on the base portion (1b);
   a drive source (3, 3a, 3b) actuating the sewing needle (2);
   a control portion (4) controlling the drive source (3, 3a, 3b);
   an operation portion (10) electrically connected to the control portion (4) and variably operating the sewing needle (2); and
   the operation portion (10) configured to be attached to a periphery (50a) of a frame portion (50) for providing a tensioned state of the workpiece (100).

2. The sewing machine (1) according to Claim 1, wherein an attachment portion (63) is arranged between the operation portion (10) and the frame portion (50) for the operator to change a direction of an operational surface (20a, 41 a) to and from a vertical direction and a horizontal direction relative to the frame portion (50) on the base portion (1b).

3. The sewing machine (1) according to Claim 1 or 2, wherein the operation portion (10) is equipped with an operation switch (20) of variable resistance type.

4. The sewing machine (1) according to any one of Claims 1 through 3, wherein the operation portion (10) is equipped with a retaining portion (80) in a clip form configured to retain an object for retaining, and wherein the operation portion (10) is configured to attach to and detach from an object retained by the retaining portion (80).

5. The sewing machine (1) according to any one of Claims 1 through 3, wherein the operation portion (10) is equipped with the retaining portion (80) in the clip form configured to directly retain the workpiece (100).

6. The sewing machine (1) according to any one of Claims 1 through 5, wherein the operation portion

(10) being detached from the frame portion (50) is configured to be placed within a pedal portion (91) provided for a foot operation by the operator to variably control a movement of the sewing needle (2) according to a foot operated amount by the operator.

FIG. 1

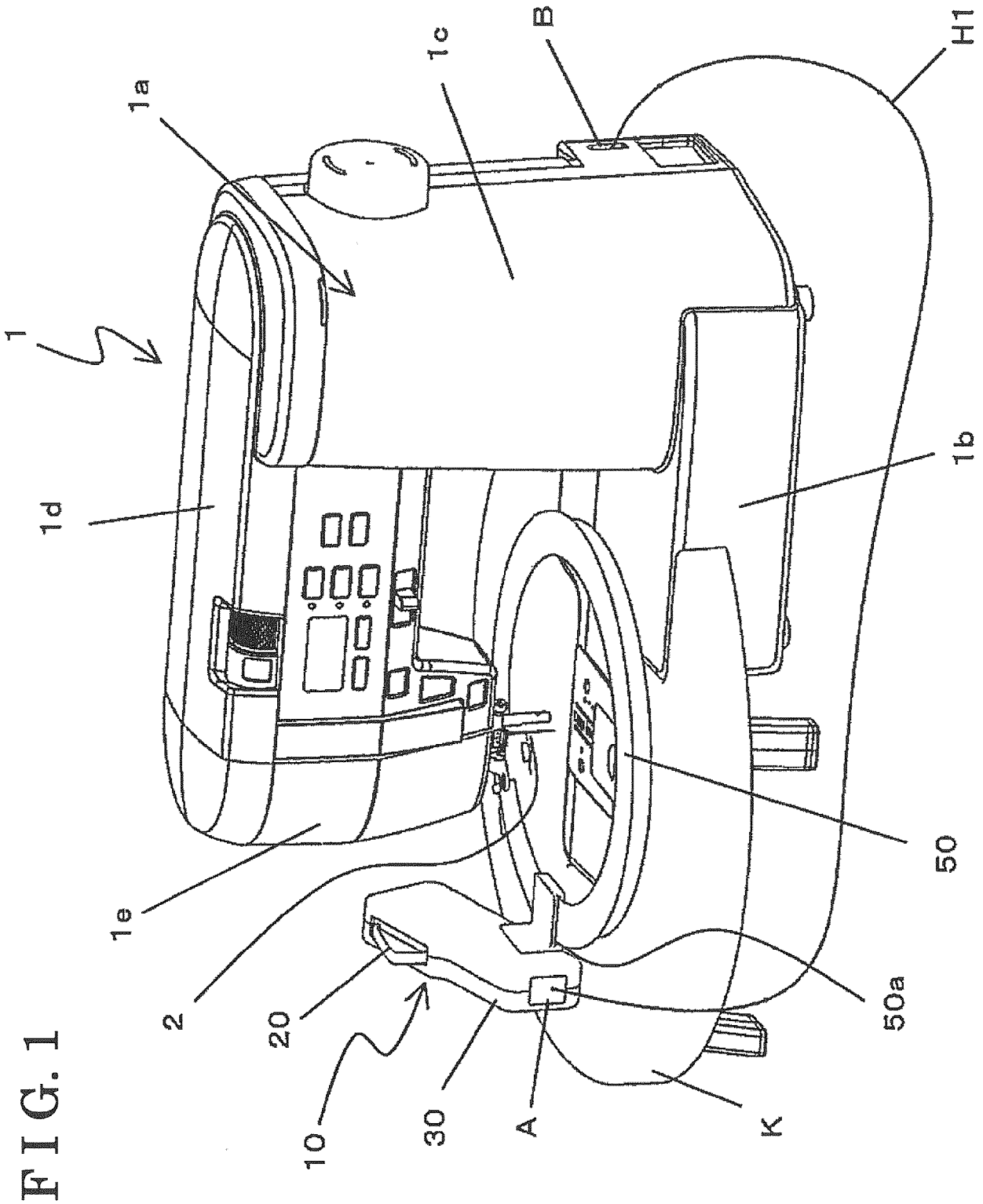


FIG. 2

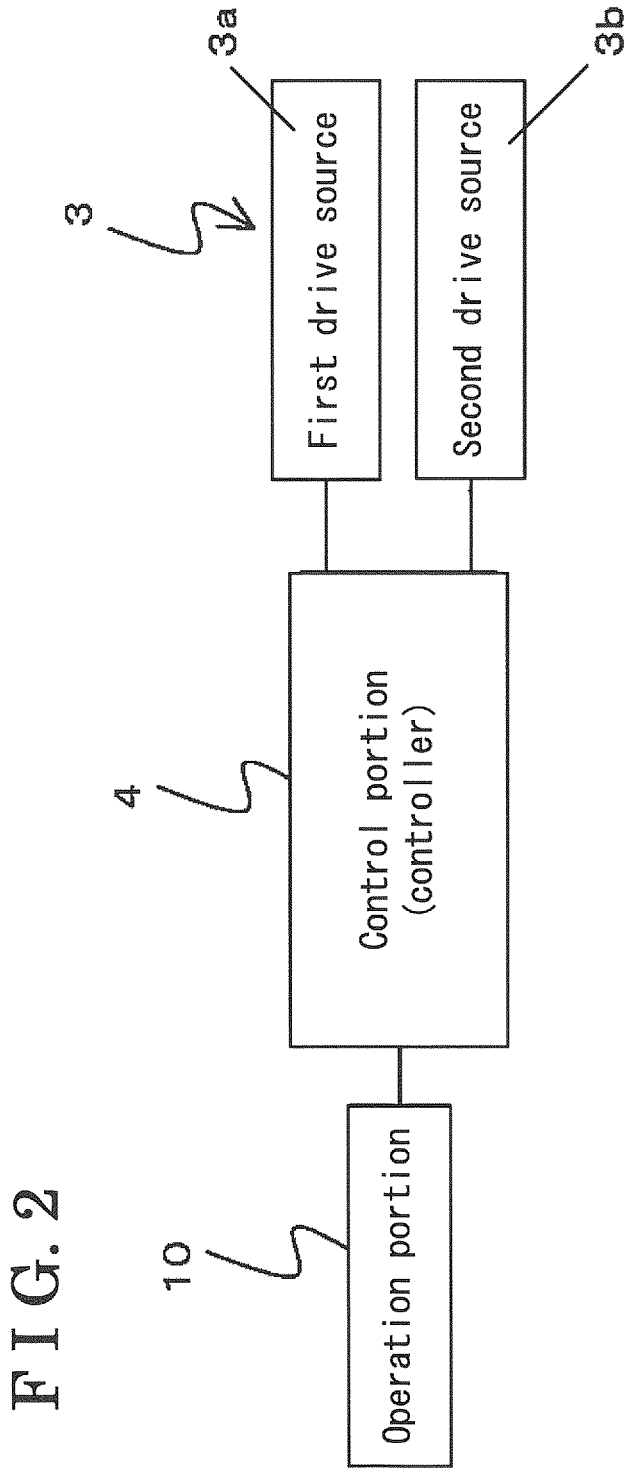

10
Operation portion
4
Control portion
(controller)
3
3a
First drive source
3b
Second drive source

FIG. 3A

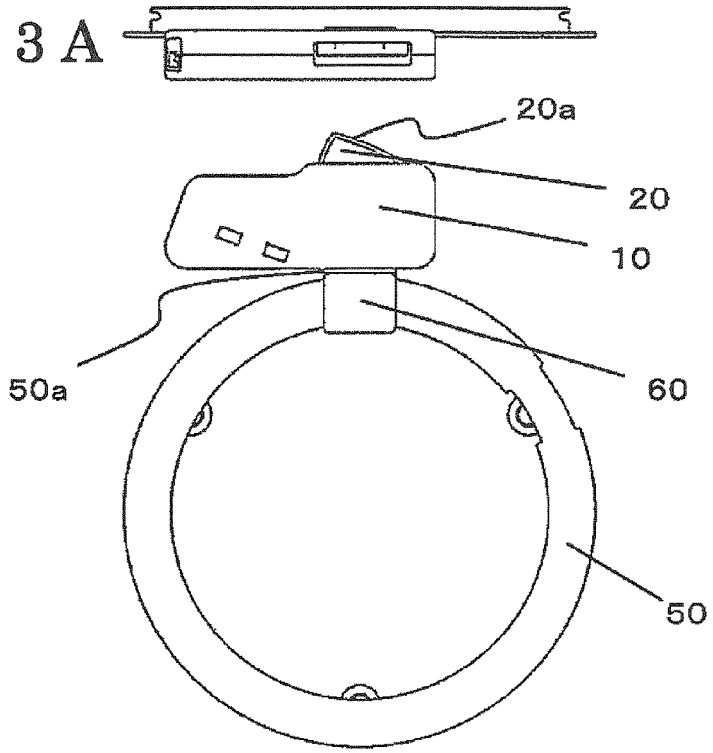


FIG. 3B

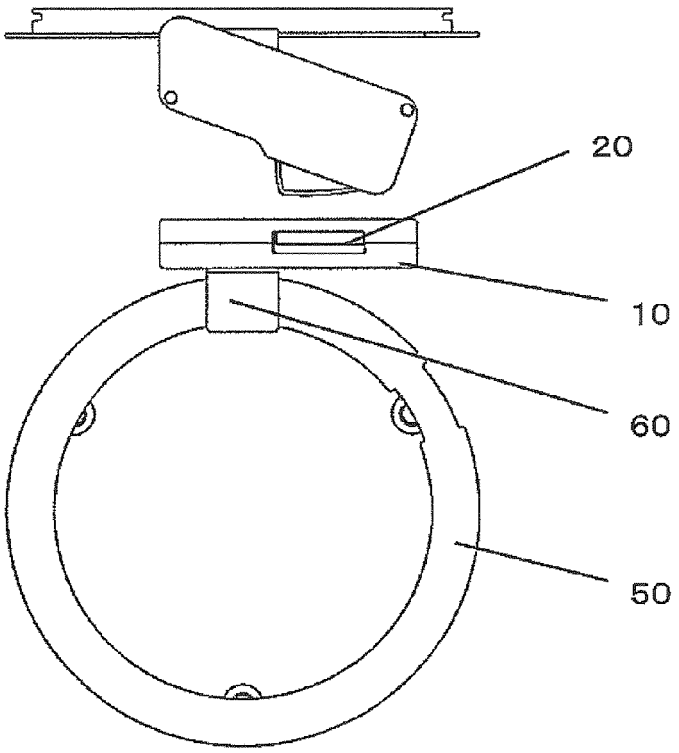
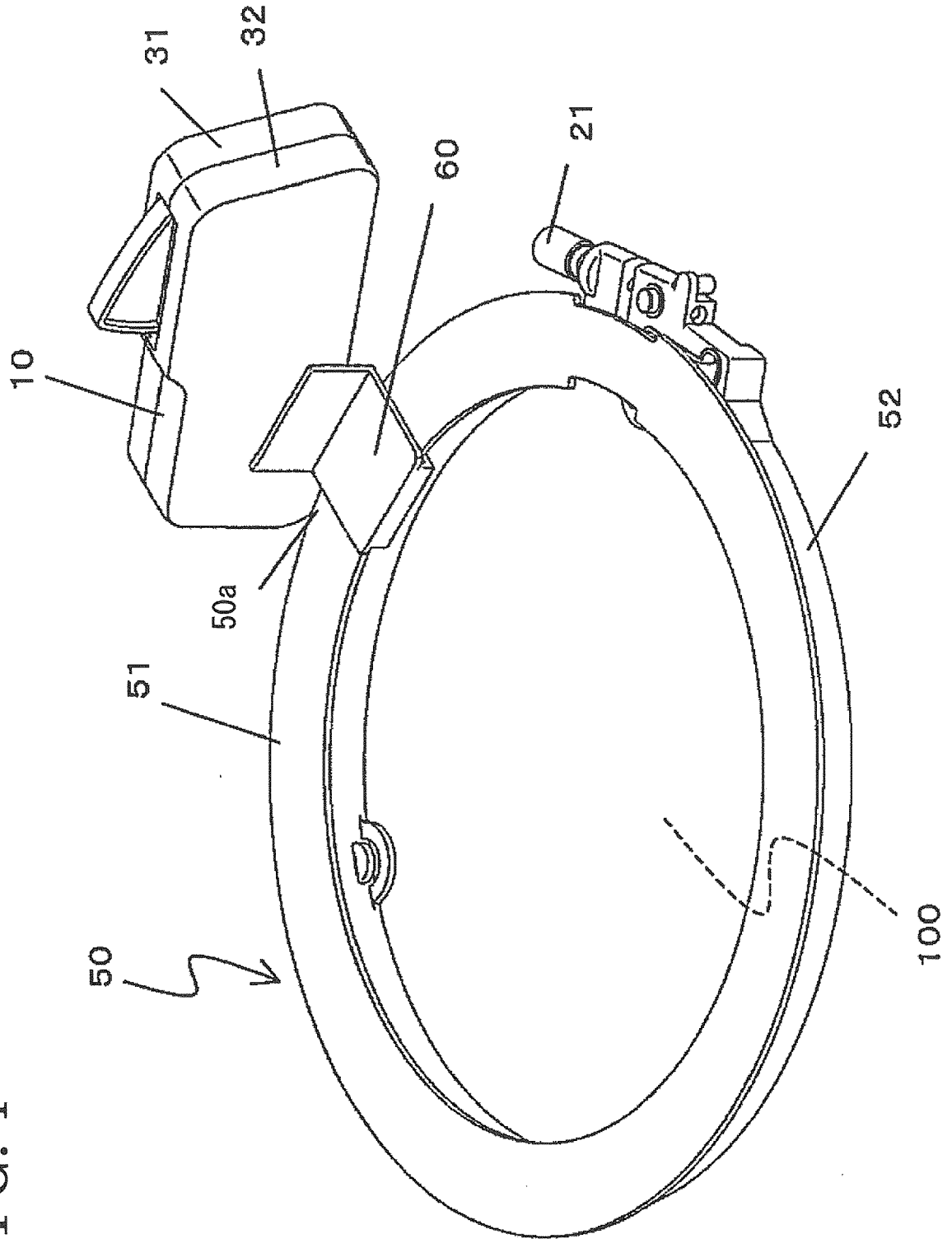


FIG. 4



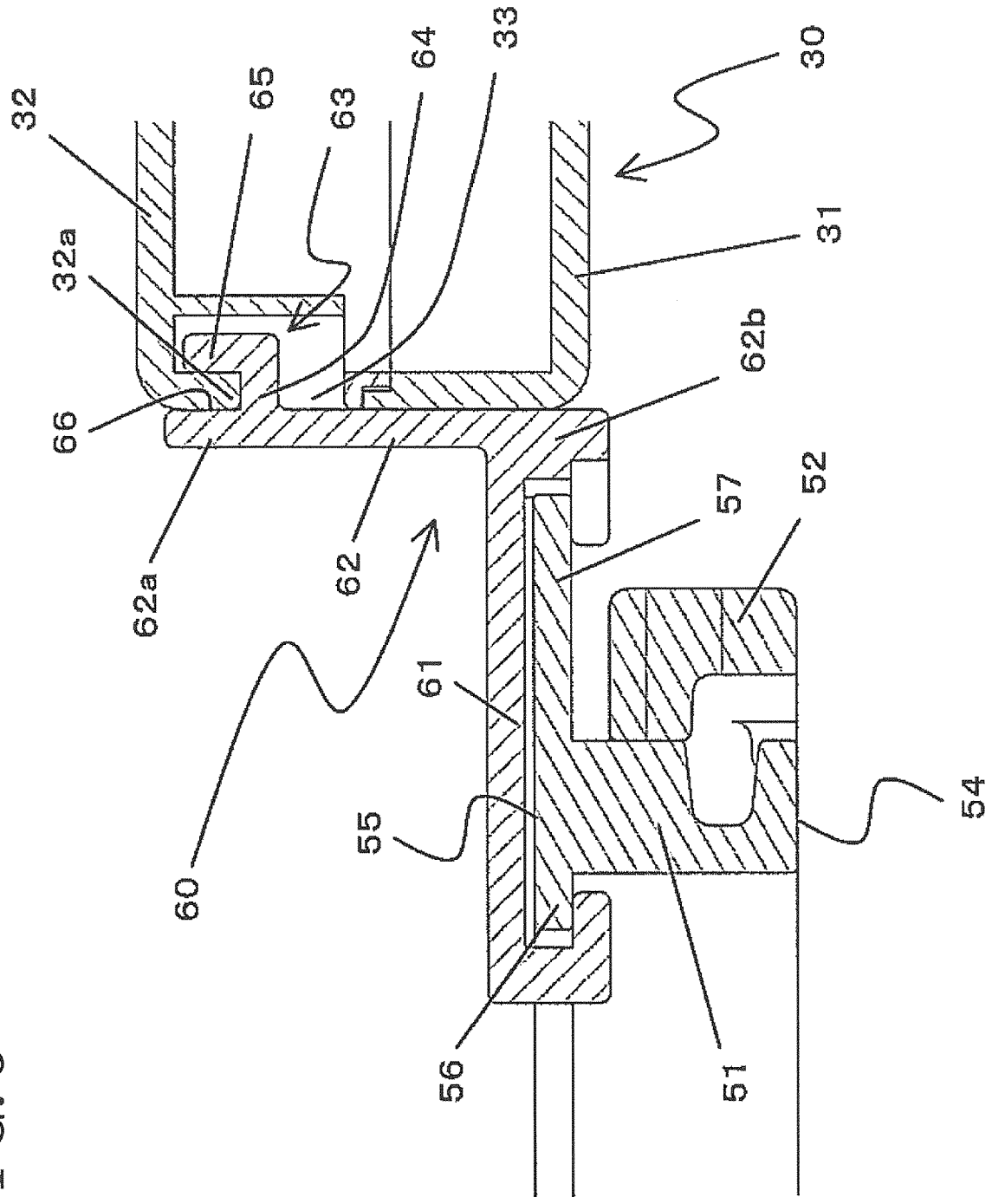
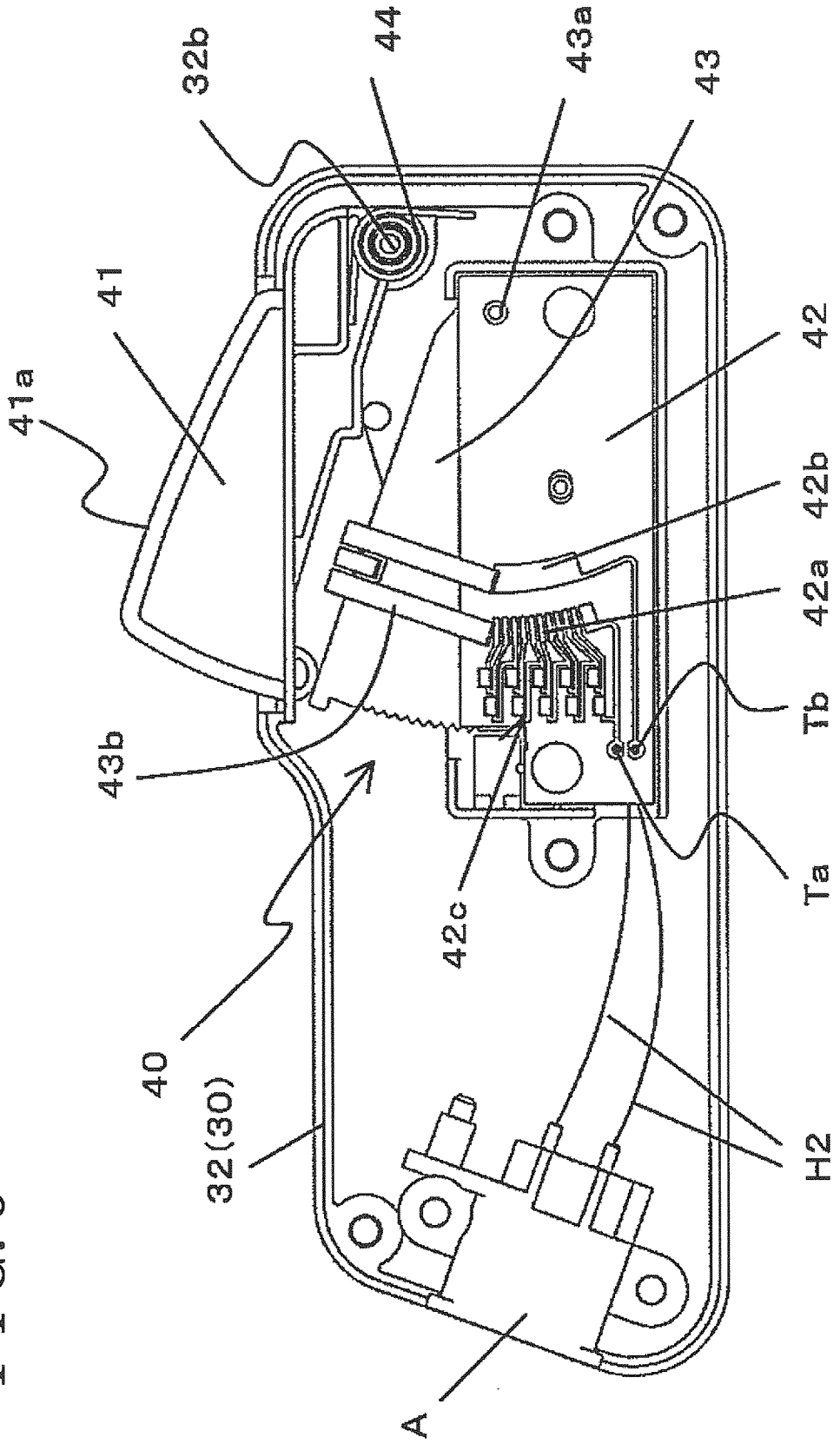


FIG. 5

FIG. 6



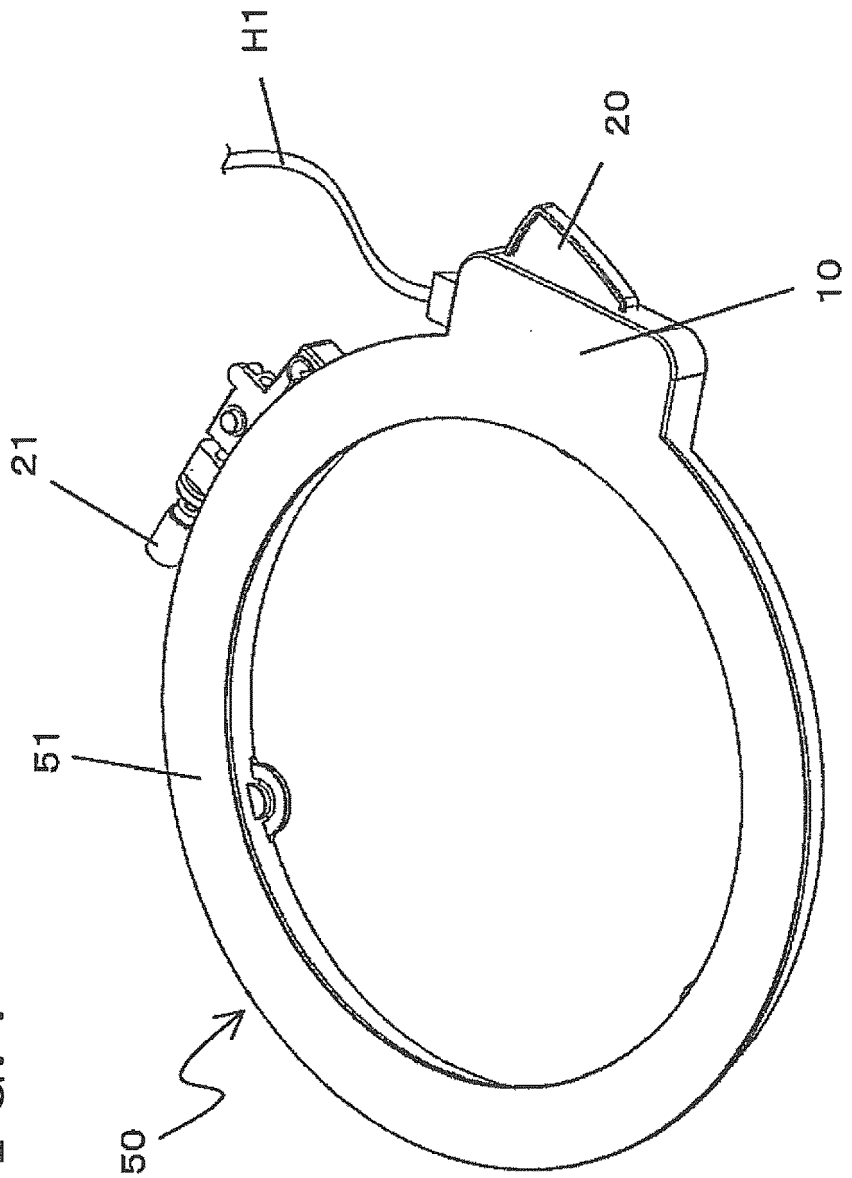


FIG. 7

FIG. 8

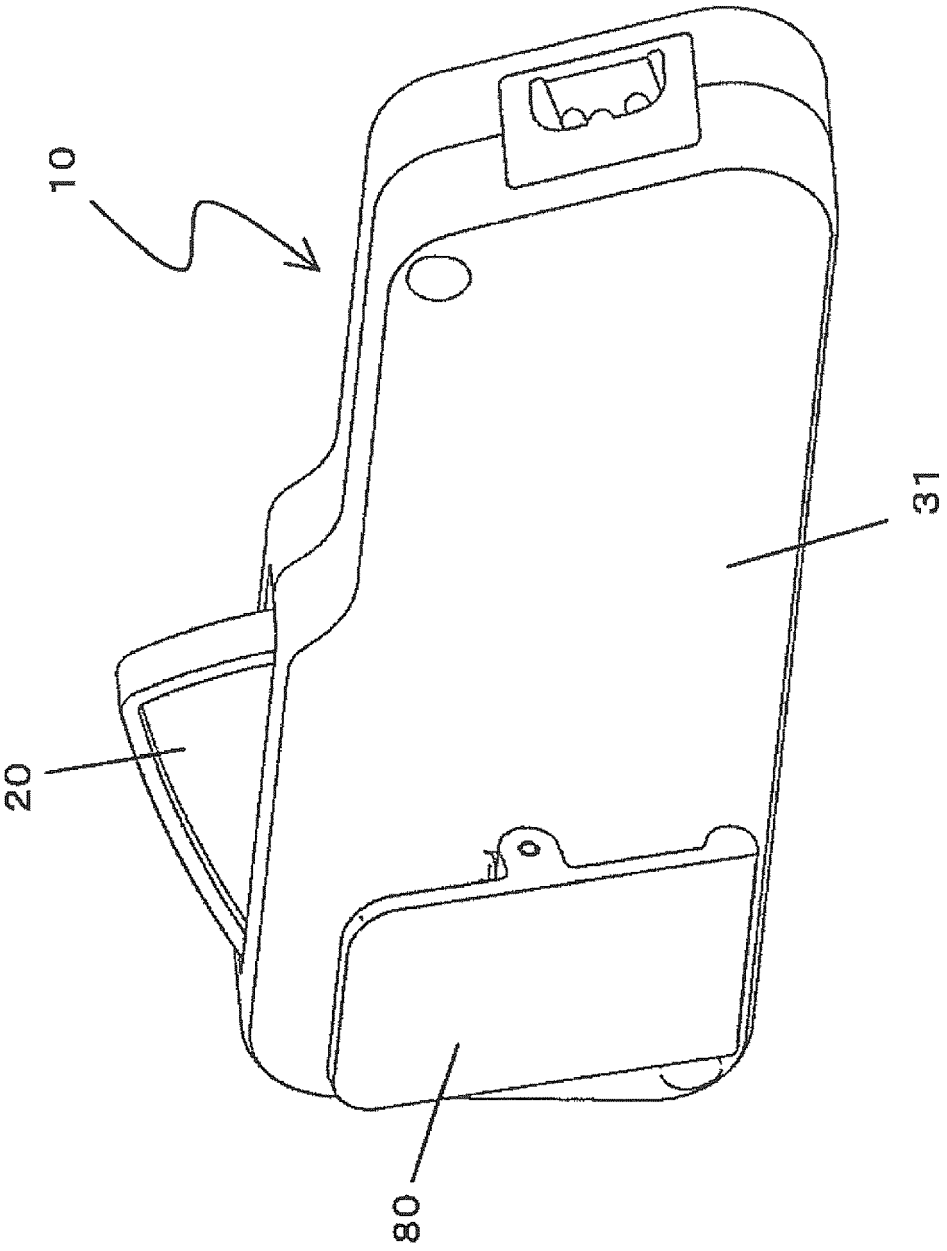


FIG. 9

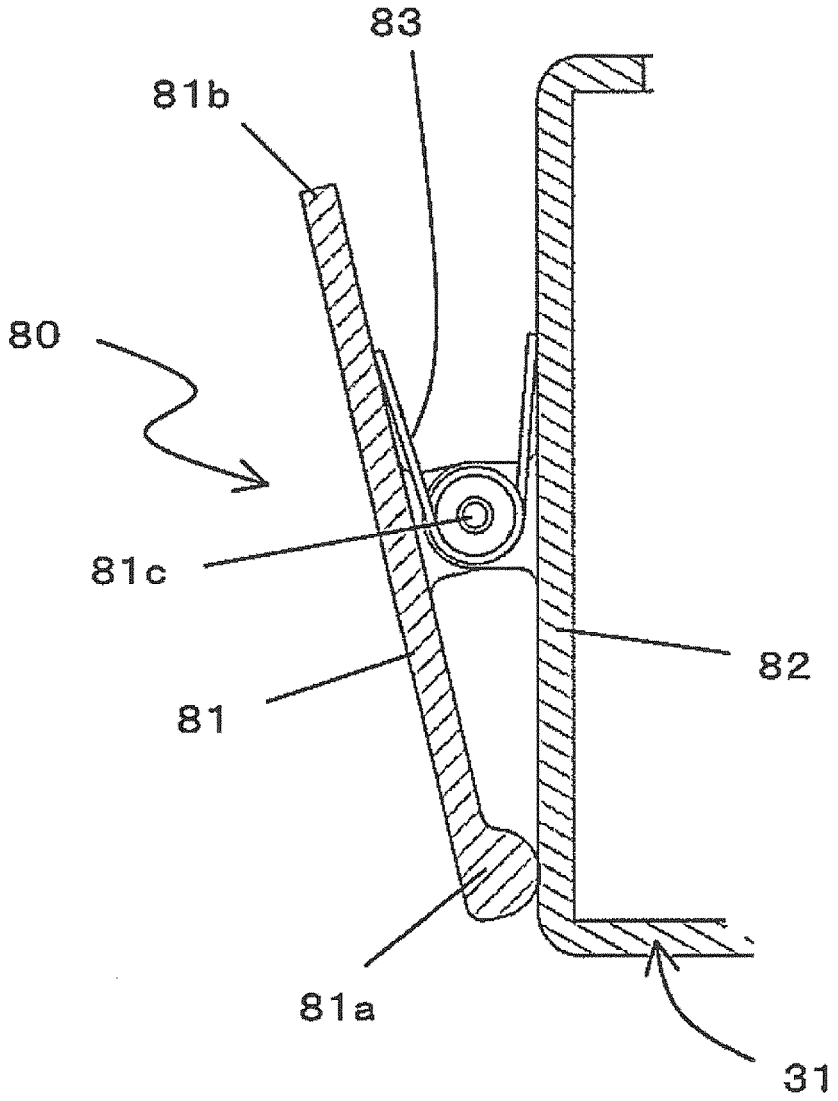


FIG. 10

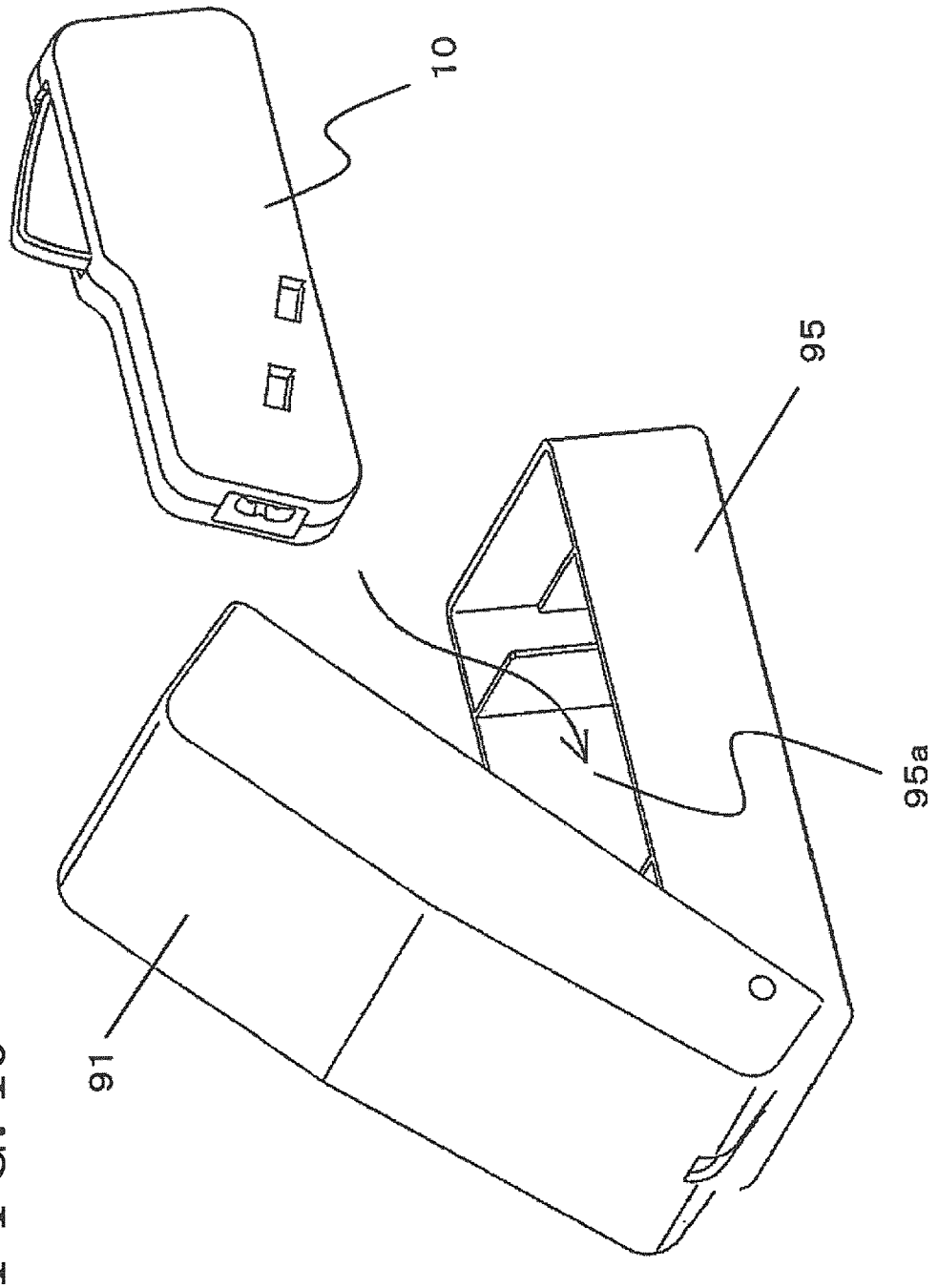
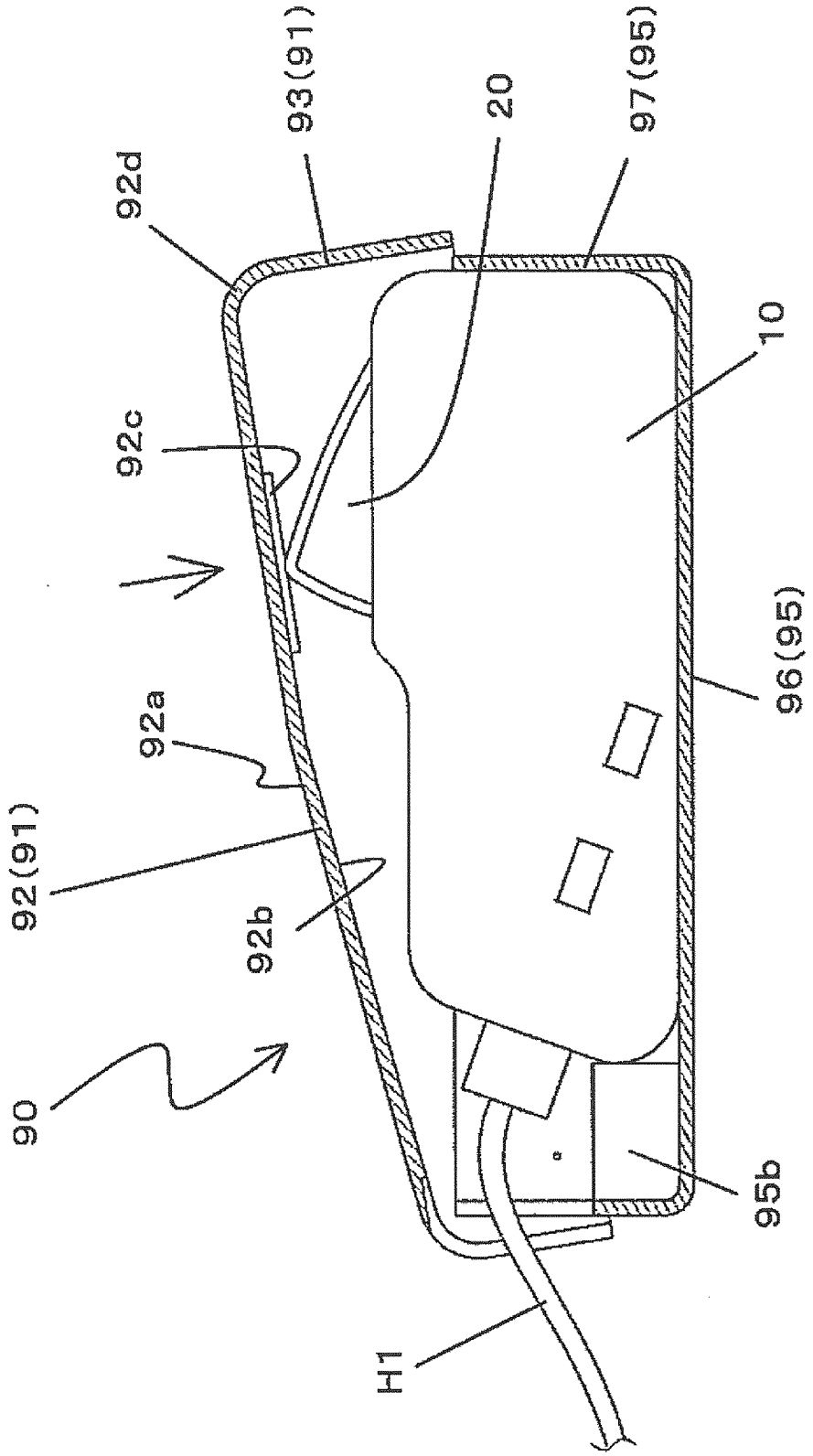


FIG. 11



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 15 5864

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP 2010 207542 A (AISIN SEIKI) 24 September 2010 (2010-09-24) * abstract; figures 1-3 *	1-6	INV. D05B19/14 D05B39/00
A	US 2007/221108 A1 (KOERNER RALPH J [US]) 27 September 2007 (2007-09-27) * paragraph [0023] - paragraph [0052]; figures 1-13 *	1-6	
A	US 2008/006191 A1 (ASABA YUTAKA [JP] ET AL) 10 January 2008 (2008-01-10) * paragraph [0036] - paragraph [0082]; figures 1-11 *	1-6	
A	US 5 291 843 A (HORI MASAYUKI [JP]) 8 March 1994 (1994-03-08) * column 3, line 50 - column 6, line 28; figures 1-8 *	1-6	

TECHNICAL FIELDS SEARCHED (IPC)

D05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 May 2012	Herry-Martin, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 15 5864

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-05-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2010207542 A	24-09-2010	NONE	
US 2007221108 A1	27-09-2007	NONE	
US 2008006191 A1	10-01-2008	JP 2008012052 A	24-01-2008
		US 2008006191 A1	10-01-2008
US 5291843 A	08-03-1994	DE 4208726 A1	24-09-1992
		JP 2522857 Y2	16-01-1997
		JP H04114586 U	08-10-1992
		US 5291843 A	08-03-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2010207542 A **[0002]**