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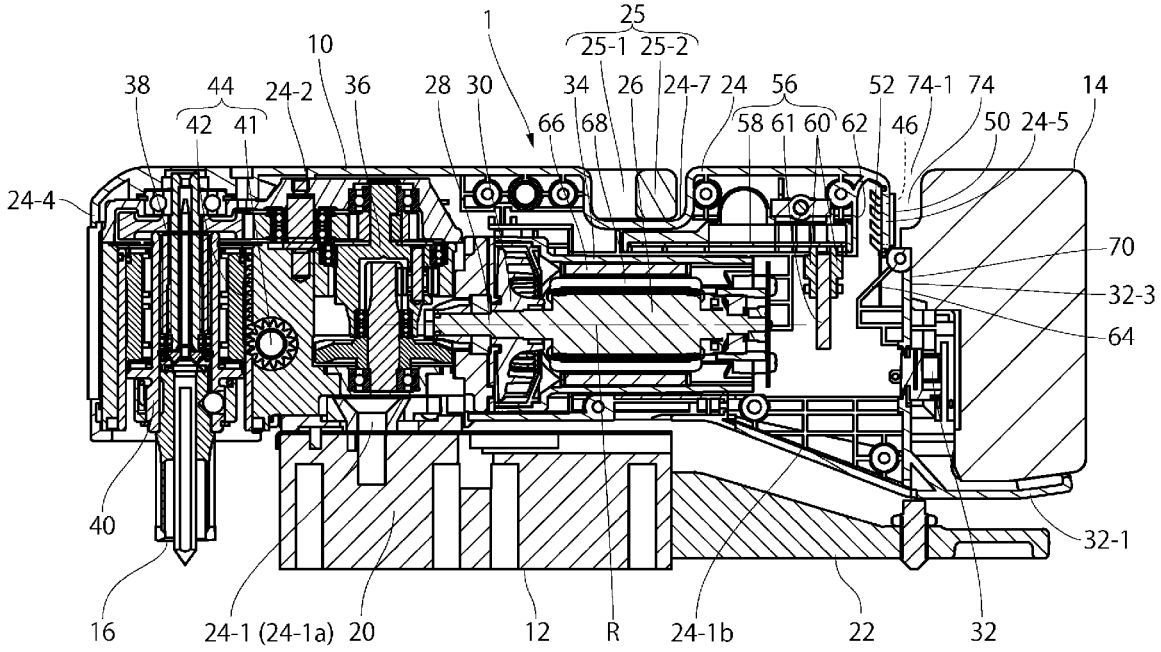
(54) **Title:** BATTERY-TYPE ELECTRIC POWER TOOL

(54) 発明の名称： バッテリ式電動工具



(57) **Abstract:** [Problem] To provide a battery-type electric power tool configured to be able to suppress suction of external dust, etc., into a tool body. [Solution] A battery-type electric power tool 1 has: a housing 24 having an intake port 46 and an exhaust port 48; a motor 26 that is mounted in the housing; a tool drive part 38 that is driven to rotate by the motor 26; a cooling fan 30 that rotates along with the motor 26; and a battery attachment part 32 that is provided to a peripheral wall 24-3 of the housing 24 and that allows the battery 14 to be detachably attached onto the outer surface of

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the peripheral wall 24-3. The battery attachment part 32 defines an air intake space 74 that has an upward opening 74-1 disposed, so as to be directed upwardly, between the attached battery 14 and a portion, of the peripheral wall 24-3, where the intake port 46 is provided.

(57) 要約：【課題】外部の塵などが工具本体内に吸引されることを抑制できるようにしたバッテリ式電動工具を提供すること 【解決手段】このバッテリ式電動工具１は、吸気口４６及び排気口４８を有するハウジング２４と、該ハウジング内に取り付けられたモータ２６と、モータ２６によって回転駆動される工具駆動部３８と、モータ２６と共に回転する冷却ファン３０と、ハウジング２４の周壁２４－３に設けられ、バッテリ１４を周壁２４－３の外側面上に着脱可能に装着するバッテリ装着部３２とを有する。バッテリ装着部３２は装着したバッテリ１４と周壁２４－３の吸気口４６が設けられている部分との間に上方に向けられた上向開口７４－１を有する空気取入空間７４を画定する。

Description

Title of Invention:

Battery-Operated Electric Tool

Technical Field:

[0001] The present invention relates to battery-operated electric tools and, more particularly, to a battery-operated electric tool having a structure configured to suck the outside air into a housing with a cooling fan disposed in the housing, thereby cooling some members disposed in the housing.

Background Art:

[0002] There have hitherto been known battery-operated electric tools such as portable jigsaws and drilling machines, which are driven by electric power supplied from a battery. One type of such battery-operated electric tools is configured to take the outside air into the tool body by rotating a cooling fan disposed in the tool body by a motor to cool heat-generating elements in the tool body, such as a motor and a control circuit. Specifically, heat-generating elements such as a motor and a control circuit are disposed between an air inlet and an air outlet which are provided in the tool body, thereby allowing the outside air sucked in from the air inlet to be applied to the heat-generating elements, and thus cooling the heat-generating elements (Patent Literature 1).

Citation List:

Patent Literature:

[0003] Patent Literature 1: Japanese Patent No. 4998846

Summary of Invention:

Technical Problem:

[0004] Electric tools are, generally, often used in dusty environments. In some cases, electric tools may be used in watery or oily environments. In the case of electric tools, particularly those which perform machining such as cutting or drilling of a workpiece, i.e., a jigsaw or a drilling machine, machining swarf is produced from the workpiece. When an electric tool having the above-described cooling structure is used in such an

environment, dust such as machining swarf, water, oil, etc, scattered around the workpiece may be undesirably sucked into the tool body from the air inlet, together with the outside air, which may cause a failure of the motor or circuit in the tool body.

[0005] An object of the present invention is to provide a battery-operated electric tool configured to be capable of suppressing suction of such dust or the like into the tool body.

Solution to Problem:

[0006] That is, the present invention provides a battery-operated electric tool including the following: a housing having a bottom wall on a side thereof facing a workpiece during machining operation, a top wall at an upper position opposing the bottom wall, and a peripheral wall between the bottom wall and the top wall, the housing having an air inlet for taking air outside the housing into the housing, and an air outlet for discharging air from the housing to outside the housing, at least the air inlet being provided in the peripheral wall; a motor mounted in the housing; a tool driving unit mounted in the housing and driven by the motor; a cooling fan mounted in the housing, the cooling fan configured to rotate in response to rotation of the motor to suck air outside the housing into the housing through the air inlet and to discharge air to outside the housing through the air outlet so that the interior of the housing is cooled by the air; and a battery loading part provided on the peripheral wall of the housing to allow a battery to be removably loaded onto an outer side surface of the peripheral wall to supply electric power to the motor, the battery loading part being configured such that when the battery is loaded, an air intake space is defined between the battery and a portion of the peripheral wall where the air inlet is provided, the air intake space having an upward opening directed upward, so that when the cooling fan rotates, air is sucked into the housing through the upward opening, the air intake space, and the air inlet.

[0007] In the battery-operated electric tool, air is sucked into the housing mainly from above. Therefore, particularly when cutting a horizontally placed workpiece from above, for example, it is possible to suppress suction into the housing of machining

swarf or other dust scattered over the workpiece, workbench, etc. around the battery-operated electric tool in operation. In addition, because the above-described air intake space is formed by using a loaded battery, it is possible to simplify the configuration of the housing in comparison to a configuration in which a similar air intake space is formed in the housing itself. It should be noted that the terms as used in the specification of this application, such as "upper", "bottom wall", and "top wall", are employed to define relative positional relationships in the housing of the battery-operated electric tool and that those terms do not specify absolute positions or directions with respect to the gravity direction. For example, when the "bottom wall" is at an upper position with respect to the vertical direction, which is the gravity direction, the "top wall" is at a position below the "bottom wall". Thus, directions discussed in the battery-operated electric tool do not always coincide with directions defined with respect to the vertical direction.

[0008] In the above-described battery-operated electric tool, the battery loading part may have a bottom plate extending from the peripheral wall of the housing so as to at least partially cover a bottom surface of the loaded battery from below. When cutting a horizontally placed workpiece from above, for example, the bottom plate is in a position for shielding the air intake space from the workpiece, workbench, etc. where machining swarf or the like is scattered. Accordingly, suction of machining swarf or the like into the housing can be suppressed even more reliably.

[0009] The battery loading part may also have a battery facing portion that contacts or comes close to the loaded battery at a position below the air inlet to suppress air from flowing into the air intake space from below.

[0010] The air intake space may also have a side opening that is open in at least one of leftward and rightward directions to allow air to flow into the air intake space. This arrangement assists in sucking air into the housing.

[0011] Further, the arrangement may be as follows. When the battery loading part is loaded with a battery, an extension lower space contiguous to the air intake space is

defined between the peripheral wall and the battery at a position below the air inlet. This arrangement takes into account relatively heavy dust and the like that may be included in air flowing into the upward opening. That is, when air is sucked into the air inlet after changing the flow direction, such relatively heavy dust is allowed to fall into the extension lower space and thus prevented from being sucked into the housing.

[0012] The battery-operated electric tool according to the present invention may be arranged as follows. The tool driving unit is disposed in a forward portion of the housing. The peripheral wall comprises a front wall portion, a rear wall portion, and left and right side wall portions. The air inlet is provided in the rear wall portion, and the battery loading part is provided in the rear wall portion. By arranging the tool driving unit and the battery loading part in the above-described positional relationship, suction of machining swarf and the like into the housing can be performed even more effectively.

[0013] Further, the housing may have a rectangular parallelepiped shape extending in a front-rear direction, and the tool driving unit, the cooling fan, and the motor may be disposed in a horizontal direction in order from front to rear in the housing and mounted on the housing. With this arrangement, it is possible to reduce the width in the up-down direction of the housing and hence possible to reduce the height of the battery-operated electric tool.

[0014] The battery-operated electric tool according to the present invention may be arranged as follows. At least a part of a control circuit for controlling the motor is disposed between the motor and the air inlet, and the housing further has a guide portion configured to direct air sucked in from the air inlet toward the at least a part of the control circuit. This arrangement is for efficiently cooling the control circuit, which generates heat.

[0015] The battery-operated electric tool according to the present invention may further include a cylindrical motor retaining member coaxially retaining the motor therein, and may be configured such that air sucked in from the air inlet passes through

the motor retaining member before traveling to the air outlet. This is for performing forced cooling of the motor.

[0016] The air outlet may be provided at a position adjacent to the cooling fan. This is for efficiently discharging air to improve the cooling effect.

[0017] The battery loading part may be configured to enable a battery to be loaded therein so as not to exceed the width of the housing in the height direction thereof. This is for reducing the height of the battery-operated electric tool.

[0018] The battery-operated electric tool according to the present invention may further include a securing device attached to a lower side of the bottom wall of the housing to secure the housing to a workpiece. This is for enabling the battery-operated electric tool to be secured to a workpiece when performing drilling on the workpiece, for example. The securing device may be a mechanical or magnetic securing device.

[0019] In this case, the arrangement may be as follows. The bottom wall has a horizontal portion extending horizontally from front to rear and an inclined portion slantingly extending rearwardly downward from a rear end of the horizontal portion to a rear end of the housing. The securing device is attached to the horizontal portion, and provided with a stabilizer extending rearward to a position underneath the battery loading part. This arrangement is for reducing the height of the battery-operated electric tool. The stabilizer is for preventing lifting of the battery-operated electric tool from the workpiece, which would otherwise be caused by reaction from the workpiece when the tool is pressed against the workpiece during operation thereof. The stabilizer also can protect the battery loading part when the worker accidentally drops the battery-operated electric tool.

[0020] In this case, the arrangement may be as follows. The tool driving unit has, at the lower end thereof, a tool mounting part configured to be removably fitted with a working tool. The tool mounting part is displaceable between a withdrawn position where the tool mounting part is withdrawn in the housing, and an extended position

where the tool mounting part is extended downward from the housing.

[0021] Further, the battery-operated electric tool according to the present invention may further include an inverted U-shaped handle comprising a pair of leg portions pivotally attached to the housing so as to be pivotable about an axis extending horizontally in a left-right direction of the housing, and a grip portion extending between the leg portions. The handle may be displaceable between a grip position where the leg portions extend upward from the axis so that a user can grip the grip portion, and an accommodation position where the grip portion is accommodated in a recess provided in the top wall of the housing. This arrangement is for facilitating carrying the battery-operated electric tool.

[0022] An embodiment of a battery-operated electric tool according to the present invention will be explained below on the basis of the accompanying drawings.

Brief Description of Drawings:

[0023] Fig. 1 is a side view of a battery-operated electric tool according to an embodiment of the present invention.

Fig. 2 is a sectional view taken along the line II-II in Fig. 1.

Fig. 3 is a sectional view taken along the line III-III in Fig. 2.

Fig. 4 is a perspective view showing the battery-operated electric tool of Fig. 1, with a battery removed therefrom.

Description of Embodiments:

[0024] A battery-operated electric tool 1 according to an embodiment of the present invention includes, as shown in Fig. 1, a tool body 10 and a securing unit 12 attached to the lower side of the tool body 10. A battery 17 is removably loaded onto a rear portion of the tool body 10. In addition, an annular cutter (working tool) 16 is removably attached to a forward position of the tool body 10. The securing unit 12 comprises an electromagnetic securing device 20 and a stabilizer 22 extending rearward from the electromagnetic securing device 20. The battery-operated electric tool 1 is a drilling machine configured to perform drilling of a metallic workpiece by lowering the

rotating annular cutter 16 through the operation of a lever 18. When drilling is to be performed, the tool body 10 is secured to a workpiece by allowing the electromagnetic securing device 20 of the securing unit 12 to magnetically adhere to a workpiece. During drilling, the battery-operated electric tool 1 is subjected to a force causing the forward portion of the tool body 10 to be lifted upward by reaction force that the annular cutter 16 receives from the workpiece when the annular cutter 16 is pressed against the workpiece. At this time, however, the stabilizer 22 contacts the workpiece, thereby preventing the tool body 10 from lifting even more reliably.

[0025] As shown in Figs. 2 and 3, the tool body 10 has a housing 24, a motor 26 disposed in the housing 24, a cooling fan 30 attached to a rotating shaft 28 of the motor 26, and a battery loading part 32 loaded with the battery 14 supplying driving electric power to the motor 26. The motor 26 is disposed so that a rotation axis R thereof extends in the front-rear direction of the tool body 10 (in the left-right direction as seen in the figures), and the motor 26 is coaxially retained inside a motor retaining member 34 cylindrically extending in the housing 24 in the front-rear direction. The rotating shaft 28 of the motor 26 is drivably connected to a tool driving unit 38 through a speed reduction gear mechanism 36. The tool driving unit 38 is formed as a cylindrical member as a whole which is configured to be rotatable about a rotation axis extending vertically and displaceable in the up-down direction. The tool driving unit 38 is provided, at the lower end thereof, with a tool mounting part 40 for removably mounting the annular cutter 16. The tool driving unit 38 is configured to move up and down in response to pivoting of the lever 18 through a feed mechanism 44 that comprises a rack 42 provided on the outer surface of the tool driving unit 38 so as to extend in the vertical direction, and a pinion 41 attached to a rotating shaft of the lever 18 and meshed with the rack 42. The tool driving unit 38 is displaceable between a withdrawn position where the tool mounting part 40 is withdrawn in the housing 24, and an extended position where the tool mounting part 40 is extended downward from the housing 24. As shown in the figures, the housing 24 contains therein the tool

driving unit 38, the feed mechanism 44, the speed reduction gear mechanism 36, the cooling fan 30, and the motor 26, which are disposed in a horizontal direction in order from front to rear of the housing 24.

[0026] The housing 24 has a rectangular parallelepiped shape elongated in the front-rear direction as a whole. The housing has a bottom wall 24-1 configured to face a workpiece when the securing unit 12 is secured to the workpiece to perform drilling, a top wall 24-2 at an upper position opposing the bottom wall 24-1, and a peripheral wall 24-3 between the bottom wall 24-1 and the top wall 24-2. The peripheral wall 24-3 comprises a front wall portion 24-4, a rear wall portion 24-5, and left and right side wall portions 24-6 extending between the front wall portion 24-4 and the rear wall portion 24-5. The housing 24 has, as shown in Figs. 3 and 4, an air inlet 46 in the rear wall portion 24-5 of the peripheral wall 24-3 to suck the outside air into the housing 24. Further, the housing 24 has, as shown in Figs. 2 and 4, air outlets 48 in the left and right side wall portions 24-6, respectively, of the peripheral wall 24-3 to discharge the air sucked in from the air inlet 46. The air inlet 46 comprises a plurality of slit-shaped holes extending laterally, and normally a wire mesh filter 50 is attached to the air inlet 46. Further, louvers 52 are formed at the inner side of the housing 24 and extend obliquely upward toward the forward direction. The louvers 52 prevent entry of water from the air inlet 46. The air outlets 48 are disposed at respective positions adjacent to the cooling fan 30 so as to face obliquely rearward. In the illustrated example, the bottom wall 24-1 has a horizontal portion 24-1a extending rearward from a forward position and an inclined portion 24-1b extending rearwardly downward from the horizontal portion 24-1a to the rear end of the housing 24. The electromagnetic securing device 20 is secured to the horizontal portion 24-1a, and the stabilizer 22 is configured to extend under the inclined portion 24-1b to a position underneath the battery 14. The described configuration enables the battery 14 to fit within the width of the housing 24 in the height direction thereof, thereby allowing the electromagnetic securing device 20 and the battery 14 to fit in a compact form in the up-down direction

of the battery-operated electric tool 1. In the illustrated example, the housing 24 is provided with a handle 25 for carrying the battery-operated electric tool 1. The handle 25 has an inverted U-shape and comprises a pair of leg portions 25-1 pivotally attached to the housing 24 so as to be pivotable about an axis extending horizontally in the left-right direction, and a grip portion 25-2 extending between the leg portions. The handle 25 is displaceable between a grip position where the leg portions 25-1 extend upward so that the user can grip the grip portion 25-2, and an accommodation position where the grip portion 25-2 is accommodated in a recess 24-7 provided in the top wall 24-2 of the housing 24.

[0027] Further in the housing 24, a control circuit 56 for controlling the motor 26 is disposed. The control circuit 56 has a circuit board 58 disposed in the front-rear direction above the motor 26, FETs (field-effect transistors) 60 disposed to extend downward from the circuit board 58, and heat dissipation fins 61 sandwiched between the FETs 60. The FETs 60 and the heat dissipation fins 61, which are parts of the control circuit 56, are located between the air inlet 46 and the motor 26. The FETs 60 are electronic components for adjusting electric power to be supplied from the battery 14 to the motor 26; therefore, a relatively large electric current flows through the FETs 60, causing the FETs 60 to heat up to a high temperature.

[0028] When the cooling fan 30 is rotated by the motor 26, the outside air is sucked into the housing 24 from the air inlet 46. The sucked air is directed upward by the louvers 52 and thereafter directed downward along a wall surface 62 in front of the louvers 52. The housing 24 has a guide portion 64 formed therein at a position underneath the air inlet 46, the guide portion 64 being inclined downward in the forward direction. Thus, the sucked air is guided by the guide portion 64 toward the FETs 60 and heat dissipation fins 61 of the control circuit 56. The air is applied to the FETs 60 and the heat dissipation fins 61 that have heated up, and thus the FETs 60 and the heat dissipation fins 61 are cooled. The air having passed along the FETs 60 and the heat dissipation fins 61 passes between a stator 66 and rotor 68 of the motor 26 in

the motor retaining member 34, thereby cooling the motor 26. The air having passed between the stator 66 and the rotor 68 passes through the cooling fan 30 before being discharged to the outside of the housing 24 from the air outlets 48. Because the air outlets 48 face obliquely rearward, the air is discharged rearward. The battery-operated electric tool 1 is configured to pass the outside air through the housing 24 as described above, thereby making it possible to effectively cool the FETs 60 and the motor 26, which heat up when driven. It should be noted that the air is configured to be discharged rearward from the air outlets 48, thereby preventing machining swarf produced during drilling with the annular cutter 16 from being blown up by the discharged air.

[0029] The battery loading part 32 has the following: a bottom plate 32-1 extending rearward from the bottom wall 24-1 of the housing 24 so as to cover the bottom surface of the battery 14 from below, support side portions 32-2 extending rearward from the left and right side wall portions 24-6, respectively, of the housing 24 to support the battery 14 from both sides; a battery facing portion 32-3 extending vertically between the support side portions 32-2 to substantially contact the loaded battery 14, a terminal section 32-4 provided on the battery facing portion 32-3 at an up-down direction intermediate position (Fig. 4) thereof and electrically connected to the connecting terminals of the loaded battery 14, and a lock section 32-6 having a surface 32-5 extending from a width direction central position of the battery facing portion 32-3 to a position equal to the height of the lower end of the air inlet 46 in flush with the battery facing portion 32-3. The lock section 32-6 is provided, in a right side surface thereof as seen in Fig. 4, with a lock groove 32-7 configured to receive a lock portion (not shown) of the battery, thereby locking the battery 14 to the battery loading part 32. The air inlet 46 is provided at an upper position of the rear wall portion 24-5 of the housing 24, which is located forward of the battery facing portion 32-3. Consequently, when the battery 14 is loaded in the battery loading part 32, an air intake space 74 is formed between the battery 14 and the upper half part of the rear wall portion 24-5,

where the air inlet 46 is provided. The air intake space 74 has an upward opening 74-1 open upward. In addition, extension lower spaces 76 are formed between the battery 14 and the rear wall portion 24-5 at respective positions below the air inlet 46. The extension lower spaces 76 are contiguous to the air intake space 74. In the illustrated example, the extension lower spaces 76 are provided at both sides, respectively, of the lock section 32-6 so as to be open sideward. The extension lower spaces 76 can accommodate dust falling from the outside air to be sucked into the air inlet 46 after changing the flow direction in the air intake space 74.

[0030] In the battery-operated electric tool 1, the upwardly open air intake space 74 is formed between the battery 14 and the air inlet 46 as described above. Accordingly, the outside air is sucked from the air inlet 46 mainly from above not from below. Therefore, it is possible to suppress suction of machining swarf or the like scattered around the battery-operated electric tool 1 during drilling operation. In addition, because the above-described air intake space 74 is formed by using the battery 14 removably loaded, it is possible to simplify the configuration of the housing 24 in comparison to a configuration in which a similar air intake space 74 is formed by using only the housing 24. It should be noted that, in this embodiment, the air intake space 74 has side openings 74-2 which are open toward the left and the right, respectively, to allow air to flow into the air intake space 74.

[0031] Although an embodiment of the present invention has been described above, the present invention is not limited to the described embodiment. For example, in the above-described embodiment, the tool driving unit is disposed in the forward portion of the tool body, and the air inlet is disposed at a rear position of the tool body. However, other arrangements may be possible. For example, the air inlet may be provided in either the left or right side wall portion. The securing device is not limited to the one using an electromagnet, but may be in other forms, such as a vacuum adhesion device or a vise. Also, it is not always necessary to provide the securing unit. The present invention may also be a drilling device using a drill as a working tool, for example, and

is also applicable to battery-operated electric tools other than drilling machines, for example, a jigsaw in which the tool mounting part is driven up and down and which uses a saw-tooth blade as a working tool.

List of Reference Signs:

[0032] 1: battery-operated electric tool
10: tool body
12: securing unit
14: battery
16: annular cutter (working tool)
18: lever
20: electromagnetic securing device
22: stabilizer
24: housing
24-1: bottom wall
24-1a: horizontal portion
24-1b: inclined portion
24-2: top wall
24-3: peripheral wall
24-4: front wall portion
24-5: rear wall portion
24-6: side wall portions
24-7: recess
25: handle
25-1: leg portions
25-2: grip portion
26: motor
28: rotating shaft
30: cooling fan

32: battery loading part

32-1: bottom plate

32-2: support side portions

32-3: battery facing portion

32-4: terminal section

32-5: surface

32-6: lock section

32-7: lock groove

34: motor retaining member

36: speed reduction gear mechanism

38: tool driving unit

40: tool mounting part

41: pinion

42: rack

44: feed mechanism

46: air inlet

48: air outlets

50: wire mesh filter

52: louvers

56: control circuit

58: circuit board

60: FETs (field-effect transistors)

61: heat dissipation fins

62: wall surface

64: guide portion

66: stator

68: rotor

74: air intake space

74-1: upward opening

74-2: side openings

76: extension lower spaces

R: rotation axis

Claims

1. A battery-operated electric tool comprising:

a housing having a bottom wall on a side thereof facing a workpiece during machining operation, a top wall at an upper position opposing the bottom wall, and a peripheral wall between the bottom wall and the top wall, the housing having an air inlet for taking air outside the housing into the housing, and an air outlet for discharging air from the housing to outside the housing, at least the air inlet being provided in the peripheral wall;

a motor mounted in the housing;

a tool driving unit mounted in the housing and driven by the motor;

a cooling fan mounted in the housing, the cooling fan configured to rotate in response to rotation of the motor to suck air outside the housing into the housing through the air inlet and to discharge air to outside the housing through the air outlet so that an interior of the housing is cooled by the air; and

a battery loading part provided on the peripheral wall of the housing to allow a battery to be removably loaded onto an outer side surface of the peripheral wall to supply electric power to the motor, the battery loading part being configured such that when the battery is loaded, an air intake space is defined between the battery and a portion of the peripheral wall where the air inlet is provided, the air intake space having an upward opening directed upward, so that when the cooling fan rotates, air is sucked into the housing through the upward opening, the air intake space, and the air inlet.

2. The battery-operated electric tool of claim 1, wherein the battery loading part has a bottom plate extending from the peripheral wall of the housing so as to at least partially cover a bottom surface of the loaded battery from below.

3. The battery-operated electric tool of claim 1 or 2, wherein the battery loading part has a battery facing portion that contacts or comes close to the loaded battery at a position below the air inlet to suppress air from flowing into the air intake space from below.

4. The battery-operated electric tool of any one of claims 1 to 3, wherein the air intake space has a side opening that is open in at least one of leftward and rightward directions to allow air to flow into the air intake space.

5. The battery-operated electric tool of any one of claims 1 to 4, wherein when the battery loading part is loaded with a battery, an extension lower space contiguous to the air intake space is defined between the battery and the peripheral wall at a position below the air inlet.

6. The battery-operated electric tool of any one of claims 1 to 5, wherein the tool driving unit is disposed in a forward portion of the housing, the peripheral wall comprises a front wall portion, a rear wall portion, and left and right side wall portions, the air inlet is provided in the rear wall portion, and the battery loading part is provided in the rear wall portion.

7. The battery-operated electric tool of any one of claims 1 to 6, wherein the housing has a rectangular parallelepiped shape extending in a front-rear direction, and the tool driving unit, the cooling fan, and the motor are disposed in a horizontal direction in order from front to rear in the housing and mounted on the housing.

8. The battery-operated electric tool of any one of claims 1 to 7, wherein

at least a part of a control circuit for controlling the motor is disposed between the motor and the air inlet; and

the housing further has a guide portion configured to direct air sucked in from the air inlet toward the at least a part of the control circuit.

9. The battery-operated electric tool of any one of claims 1 to 8, further comprising a cylindrical motor retaining member coaxially retaining the motor therein;

wherein air sucked in from the air inlet passes through the motor retaining member before traveling to the air outlet.

10. The battery-operated electric tool of any one of claims 1 to 9, wherein the air outlet is provided at a position adjacent to the cooling fan.

11. The battery-operated electric tool of any one of claims 1 to 10, wherein the

battery loading part is configured to enable a battery to be loaded therein so as not to exceed a width of the housing in a height direction thereof.

12. The battery-operated electric tool of any one of claims 1 to 11, further comprising a securing device attached to the bottom wall of the housing to secure the housing to a workpiece.

13. The battery-operated electric tool of claim 12, wherein

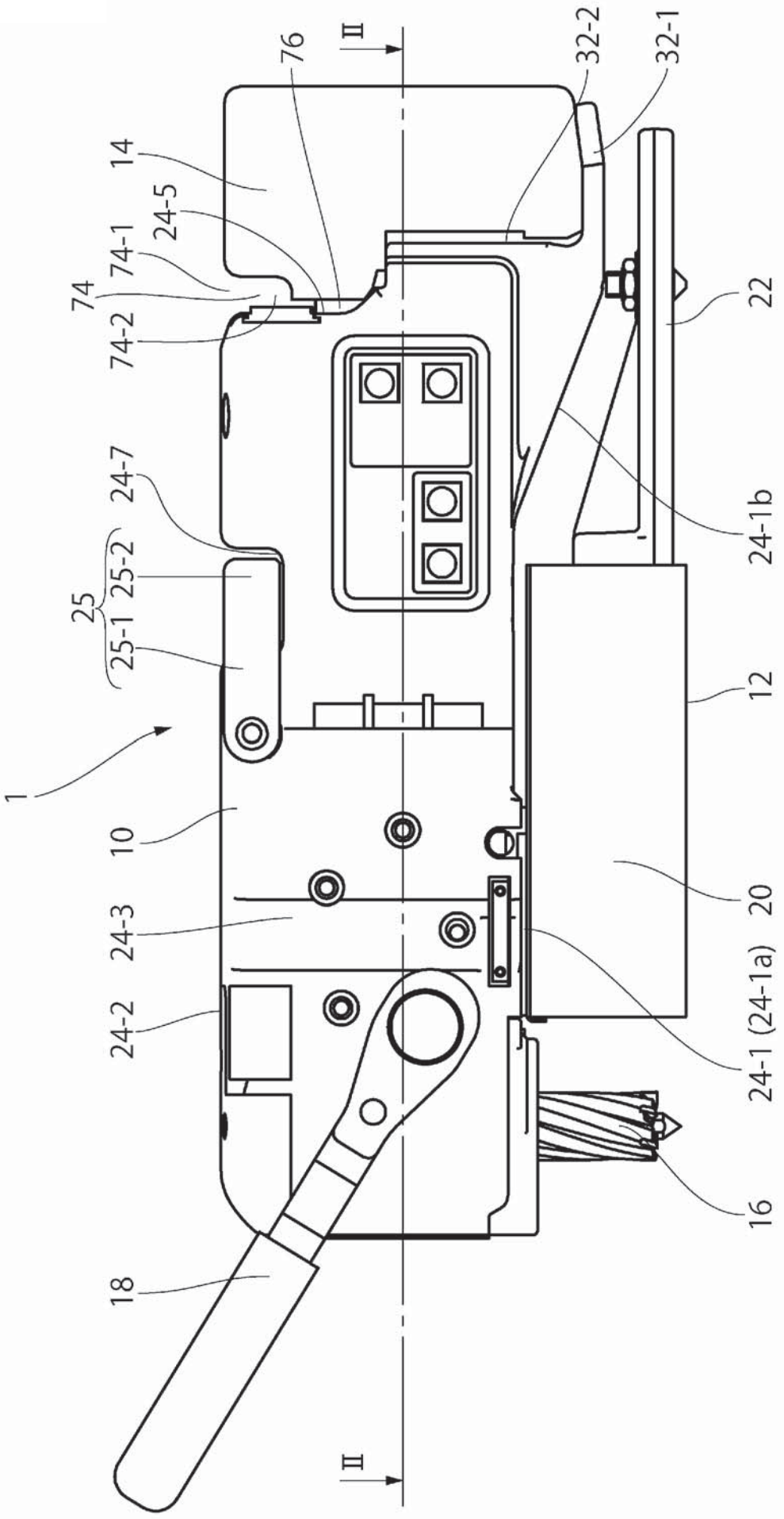
the bottom wall has a horizontal portion extending horizontally from front to rear and an inclined portion slantingly extending rearwardly downward from a rear end of the horizontal portion to a rear end of the housing;

the securing device is attached to the horizontal portion; and

the securing device is provided with a stabilizer extending rearward to a position underneath the battery loading part.

14. The battery-operated electric tool of claim 13, wherein the tool driving unit has, at a lower end thereof, a tool mounting part configured to be removably fitted with a working tool, the tool mounting part being displaceable between a withdrawn position where the tool mounting part is withdrawn in the housing, and an extended position where the tool mounting part is extended downward from the housing.

15. The battery-operated electric tool of any one of claims 1 to 14, further comprising an inverted U-shaped handle comprising a pair of leg portions pivotally attached to the housing so as to be pivotable about an axis extending horizontally in a left-right direction of the housing, and a grip portion extending between the leg portions, the handle being displaceable between a grip position where the leg portions extend upward from the axis so that a user can grip the grip portion, and an accommodation position where the grip portion is accommodated in a recess provided in the top wall of the housing.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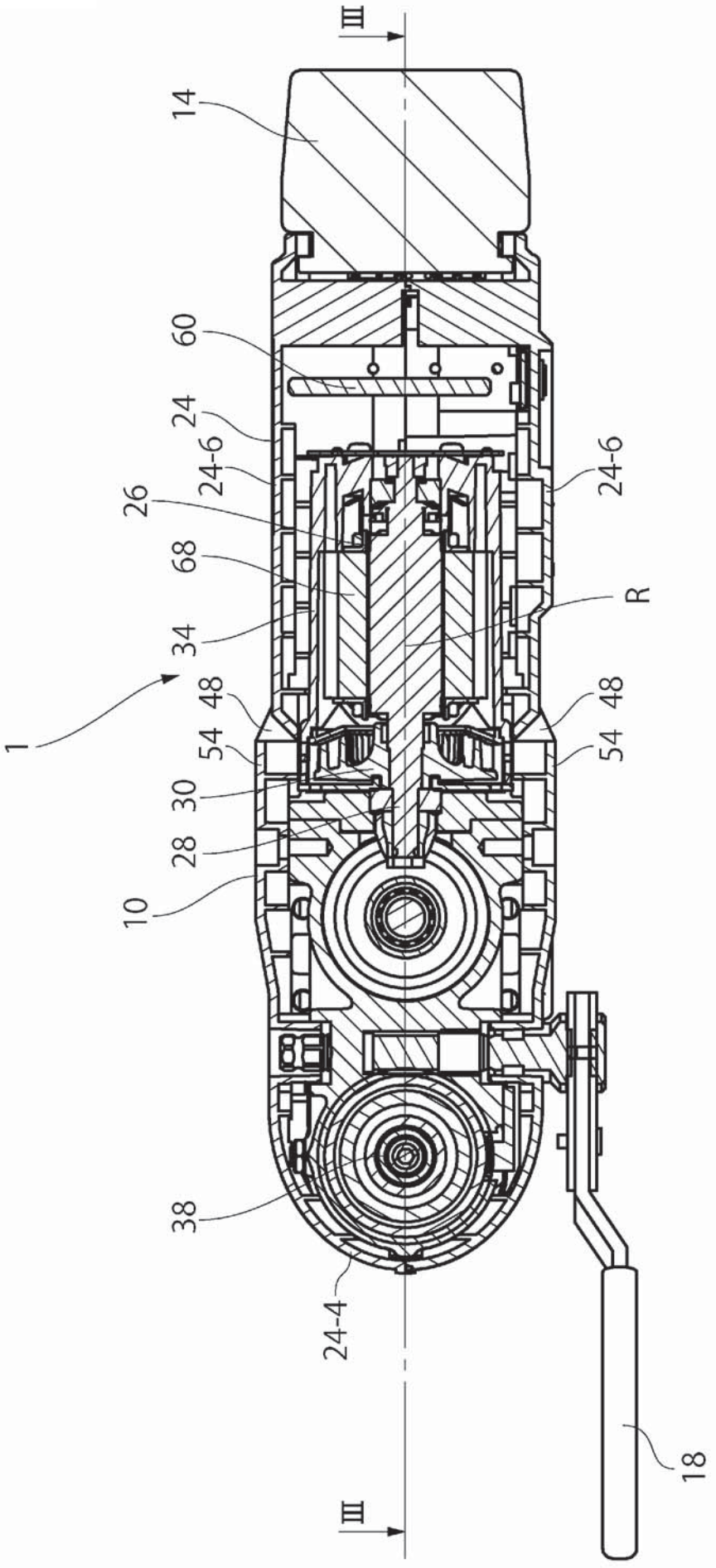
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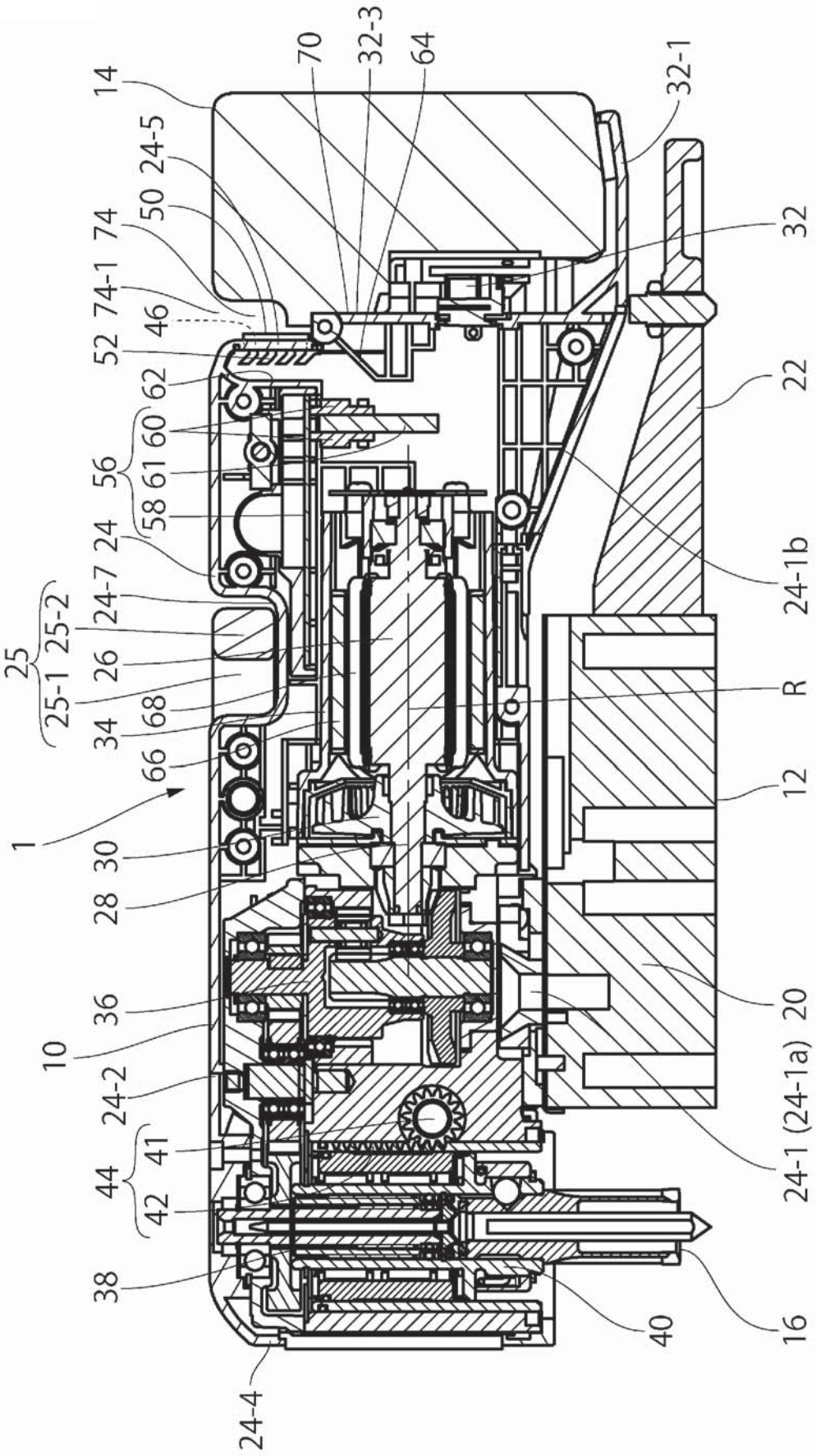
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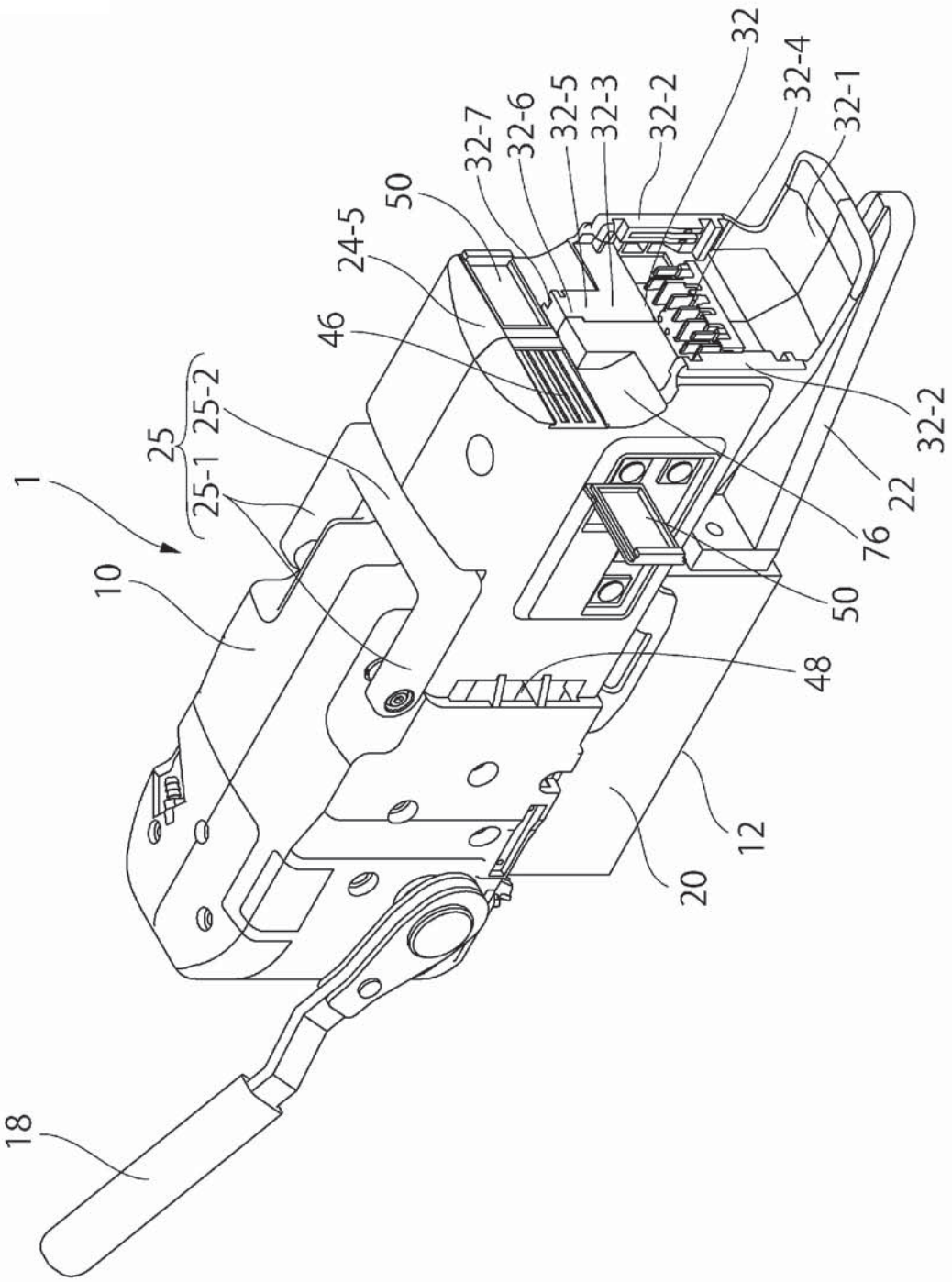
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