



US009634537B2

(12) **United States Patent**
Kinoshita

(10) **Patent No.:** **US 9,634,537 B2**
(45) **Date of Patent:** **Apr. 25, 2017**

(54) **MOTOR PROVIDED WITH TERMINAL BLOCK**

FOREIGN PATENT DOCUMENTS

(71) Applicant: **FANUC CORPORATION**, Yamanashi (JP)

JP	S63-066046	U	5/1988
JP	2002-125348	A	4/2002
JP	2005065440	A	3/2005
JP	2006006054	A	1/2006
JP	2008172932	A	7/2008
JP	2011-234523	A	11/2011

(72) Inventor: **Shinichi Kinoshita**, Yamanashi (JP)

(73) Assignee: **Fanuc Corporation**, Yamanashi (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 322 days.

OTHER PUBLICATIONS

(21) Appl. No.: **14/341,968**

English Translation of Japanese Publication No. 2008172932, published Jul. 24, 2008, 22 pages.

(22) Filed: **Jul. 28, 2014**

Concise Explanation of JP S63-066046, published May 2, 1988, 1 page.

(65) **Prior Publication Data**

US 2015/0035396 A1 Feb. 5, 2015

English Machine Translation for Japanese Publication No. 2002-125348 published Apr. 26, 2002, 17 pages.

English Machine Translation for Japanese Publication No. 2011-234523 published Nov. 17, 2011, 47 pages.

(30) **Foreign Application Priority Data**

* cited by examiner

Jul. 31, 2013 (JP) 2013-159352

Primary Examiner — Tran Nguyen

(51) **Int. Cl.**
H02K 5/22 (2006.01)

(74) *Attorney, Agent, or Firm* — Fredrikson & Byron, P.A.

(52) **U.S. Cl.**
CPC **H02K 5/225** (2013.01)

(58) **Field of Classification Search**
CPC H02K 5/225; H02K 3/50; H02K 3/522; H02K 11/225; H02K 24/00; H02K 15/00; H02K 15/04; H02K 15/10; H02K 29/12
See application file for complete search history.

(57) **ABSTRACT**

A motor which can reliably prevent varnish from ending up entering a terminal block. The motor is provided with a terminal block to which lead wires of coils are connected. The terminal block has a bottom wall, a plurality of side walls which face each other, a terminal part which is provided between adjoining side walls, and a dam wall which is arranged at a position closer to the coils than the terminal part and which is formed integrally with the bottom wall and side walls without clearance. The dam wall has a lead wire holding part for holding a lead wire.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,656,378	A *	4/1987	Atherton	H01R 4/2462
					310/68 C
6,106,324	A *	8/2000	Kwapien	H02K 3/522
					29/596
2004/0119350	A1*	6/2004	Miya	H02K 3/522
					310/71
2013/0175853	A1*	7/2013	Chamberlin	H02K 3/50
					307/9.1

9 Claims, 6 Drawing Sheets

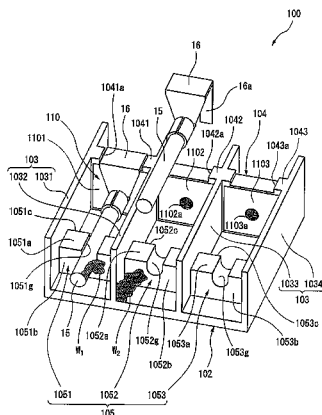


FIG. 1

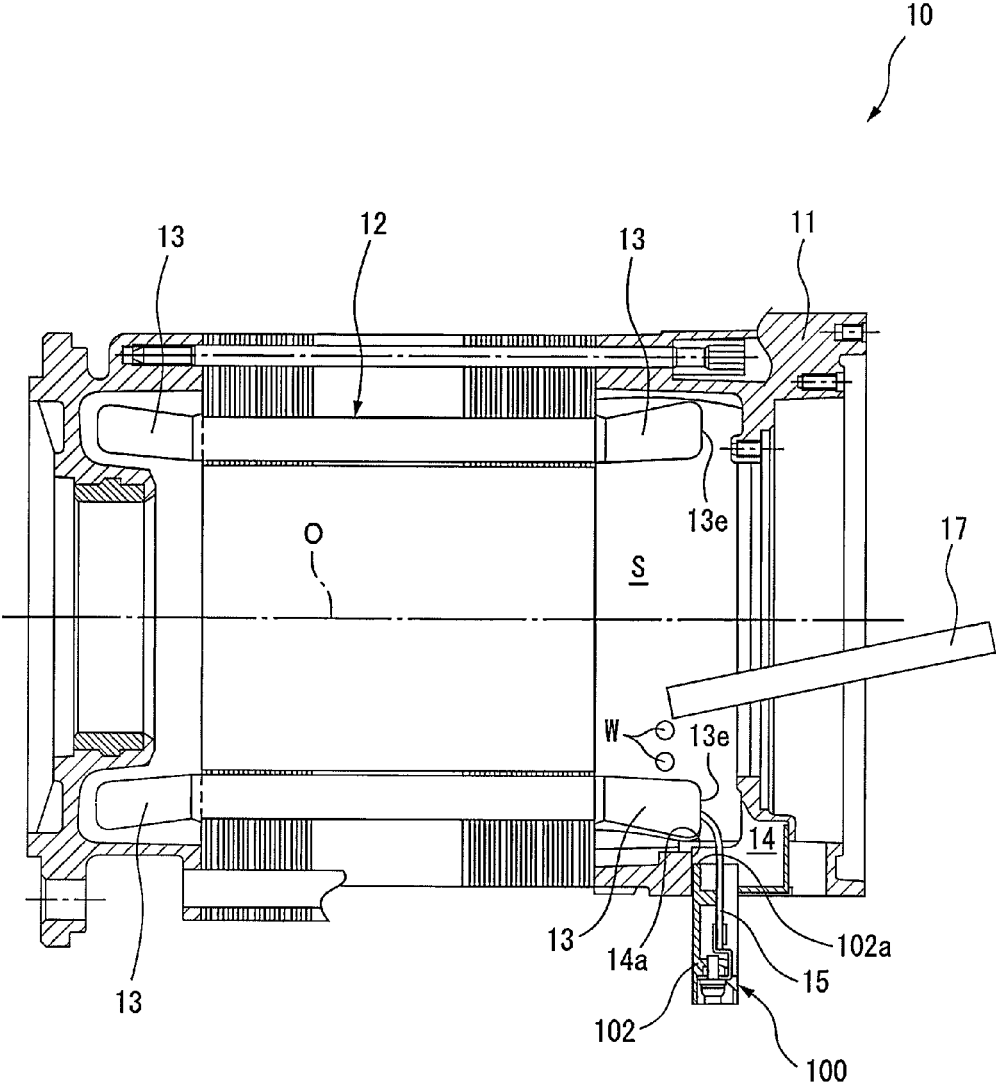


FIG. 2

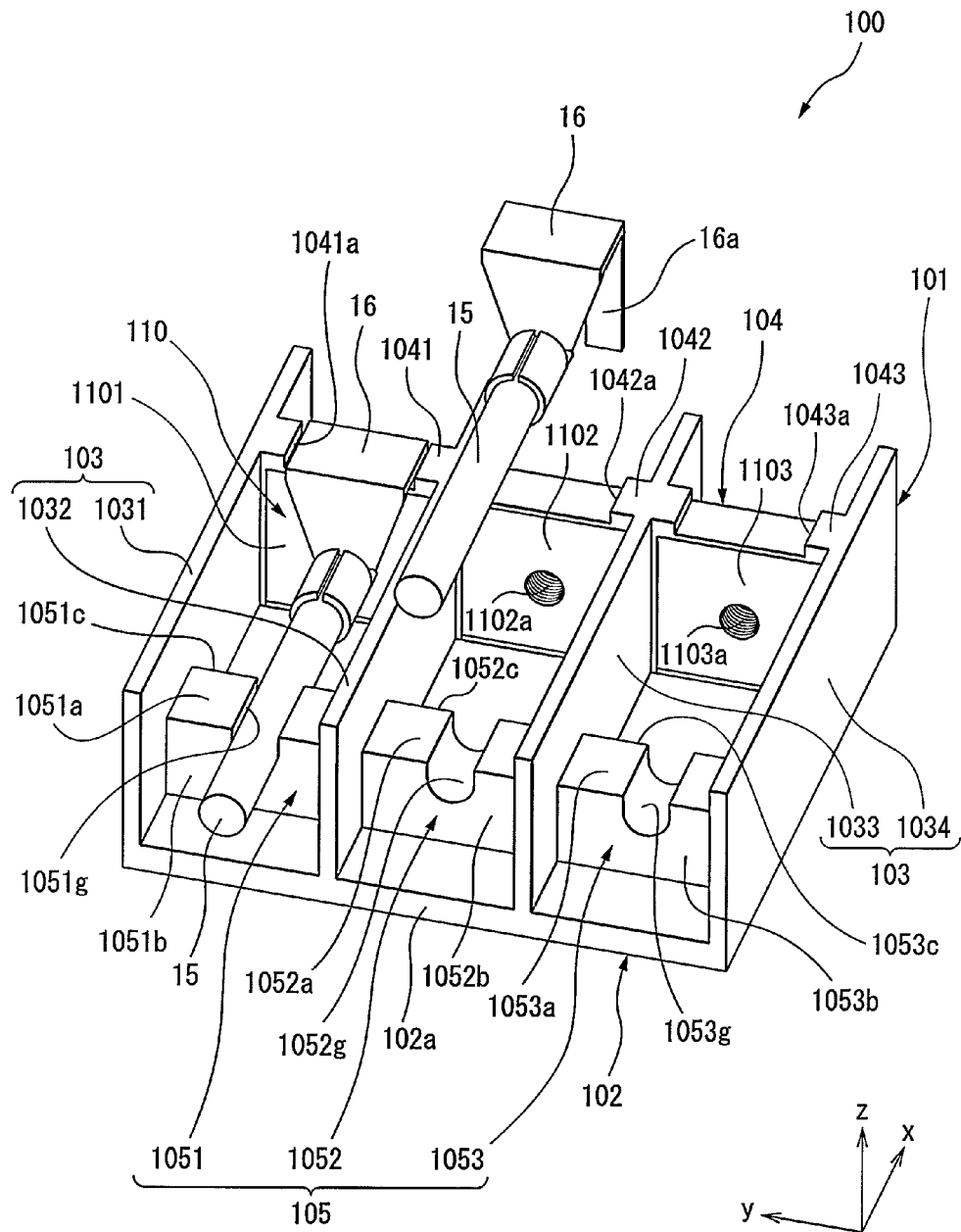


FIG. 3

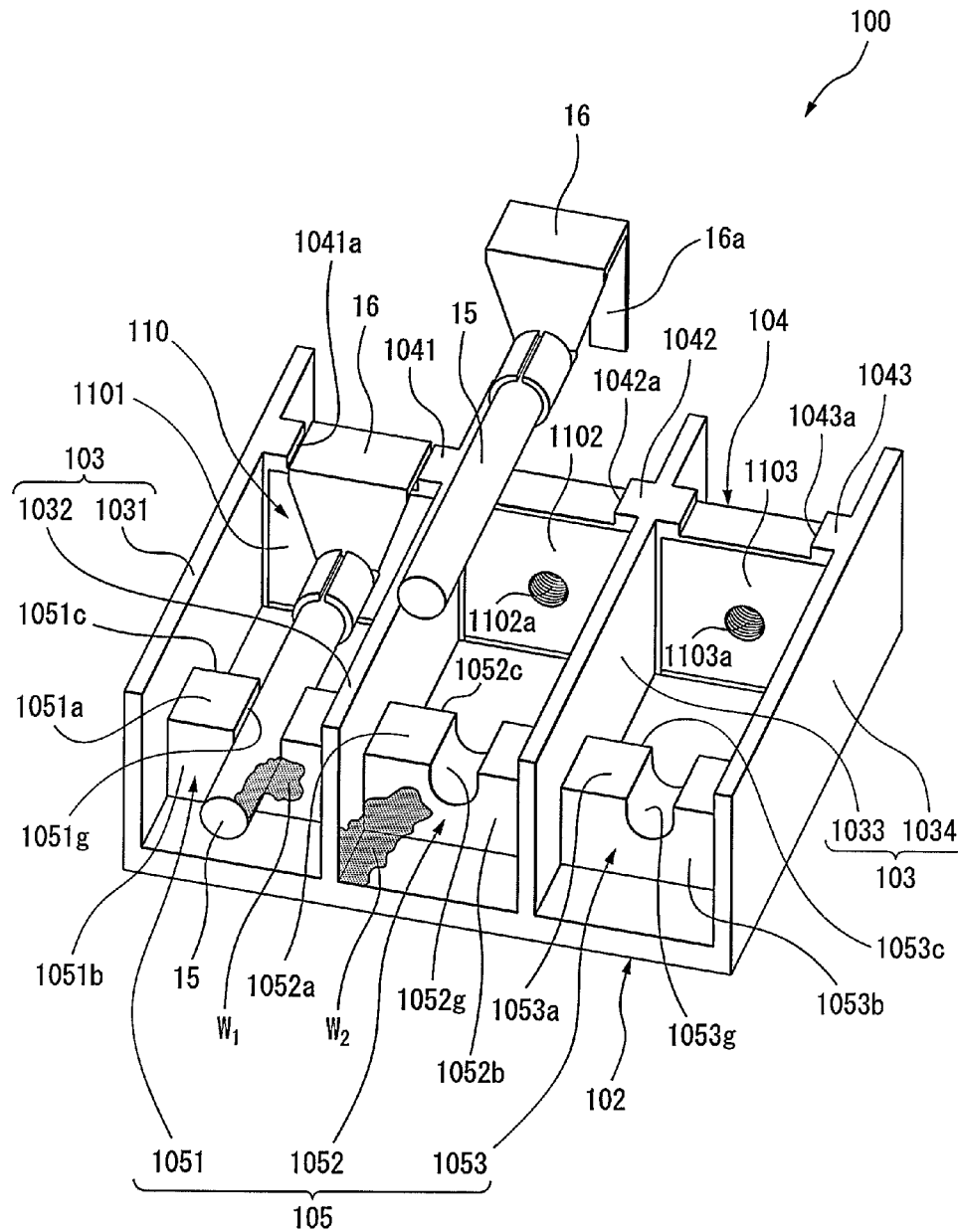


FIG. 4A

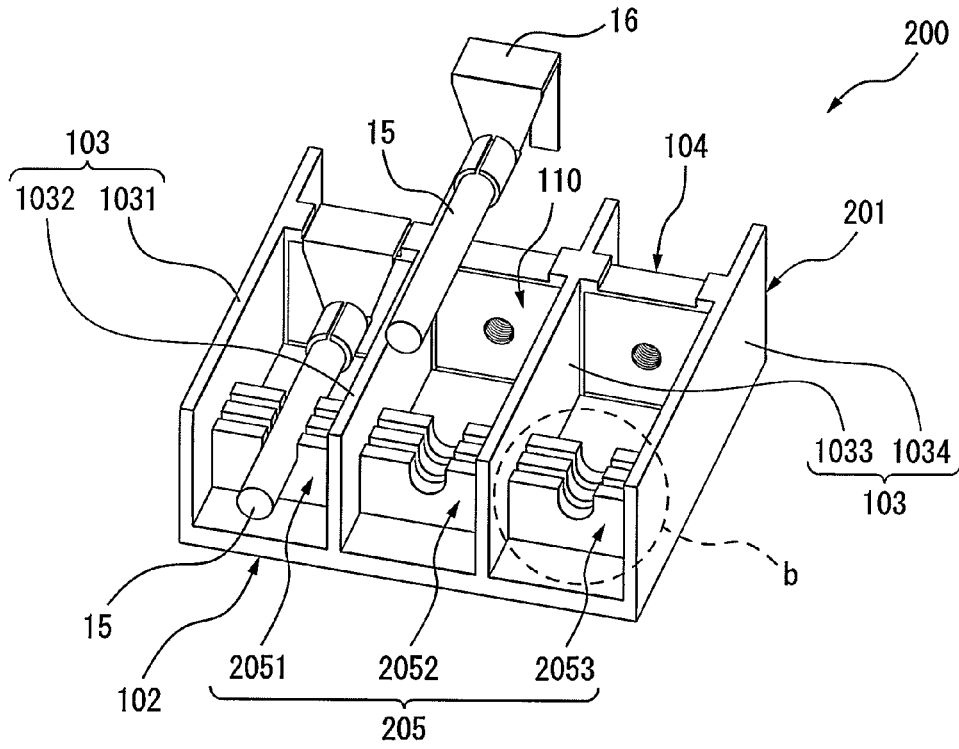


FIG. 4B

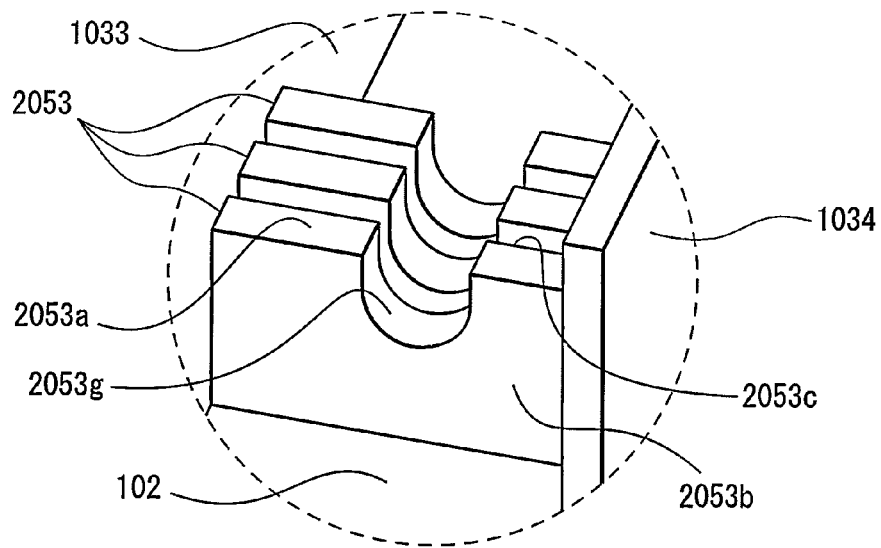


FIG. 5A

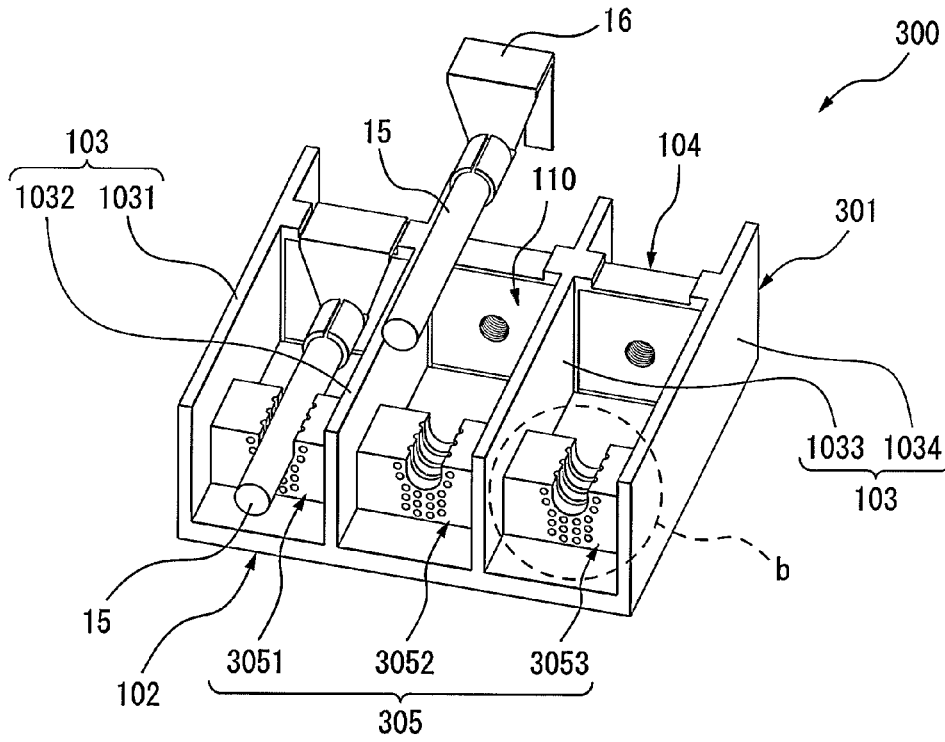


FIG. 5B

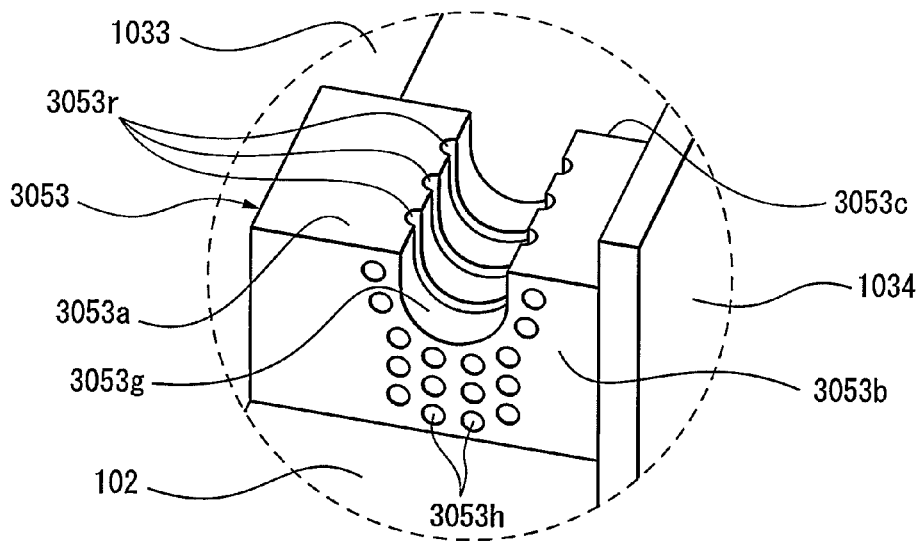
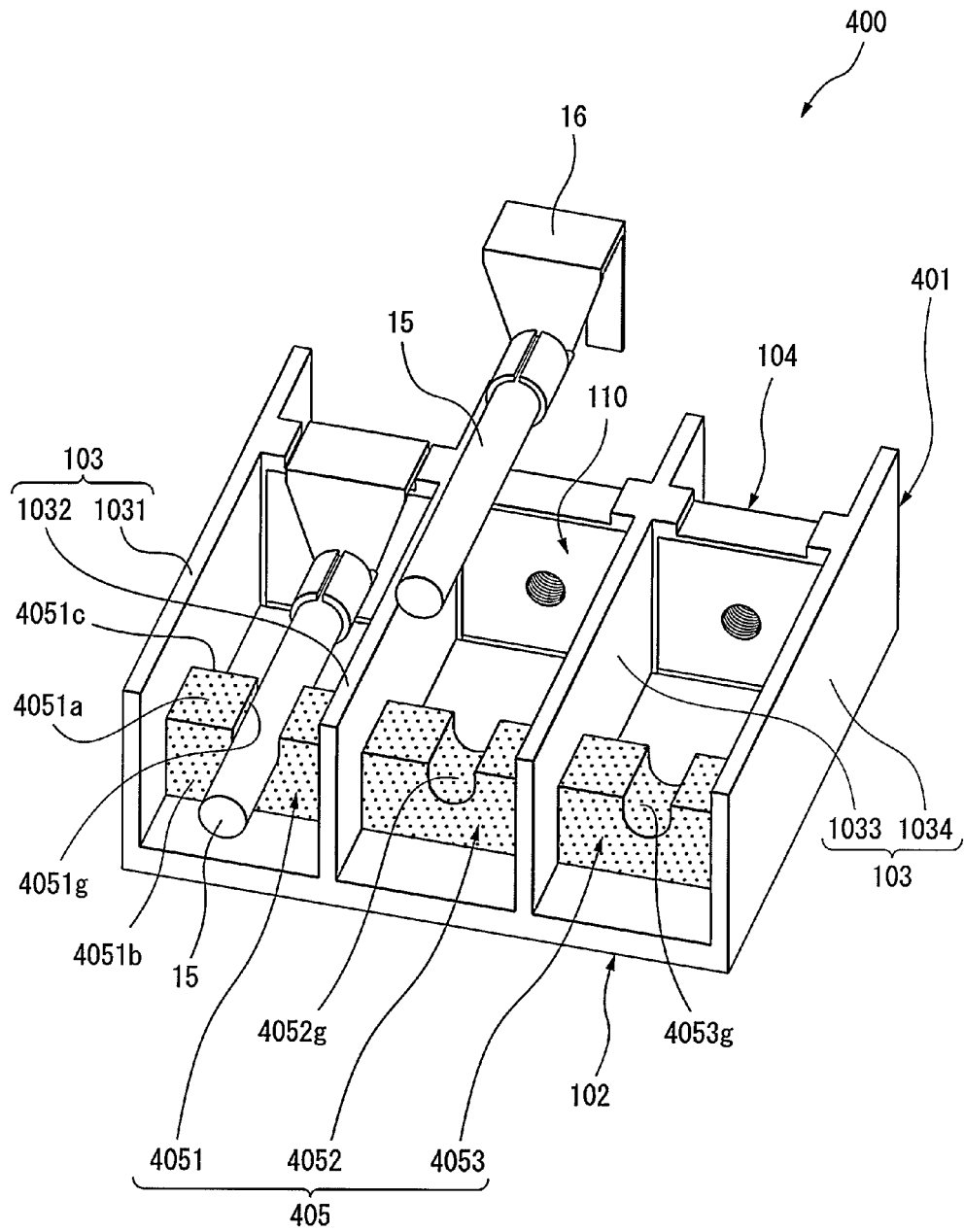


FIG. 6



1

**MOTOR PROVIDED WITH TERMINAL
BLOCK**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a motor comprising a terminal block to which lead wires of coils are connected.

2. Description of the Related Art

To improve the insulation, heat resistance, and strength of the coils which are wound about a stator of a motor, the coils are impregnated with varnish. The work of impregnating the coils with varnish is generally performed by dropping the varnish on the coil ends of the coils. In this case, the varnish sometimes ends up entering the terminal parts which are set inside of the terminal block of the motor and as a result end up obstructing the insertion and withdrawal of cables to the terminal parts. To prevent varnish from entering inside of the terminal block in this way, a configuration which attaches a member which blocks the varnish at the housing of the terminal block is known (for example, Japanese Patent Publication No. 2005-65440A or Japanese Patent Publication No. 2006-6054A).

In conventional motors, the varnish may enter the terminal block from the slight clearance formed between the member for preventing entry of varnish and the housing of the terminal block. In view of this, the object of the present invention is to provide a motor which can reliably prevent varnish from entering into the terminal block.

SUMMARY OF INVENTION

The motor according to the present invention comprises a coil which is wound around a stator and in which a varnish is impregnated; and a terminal block to which a lead wire of the coil is connected. The terminal block includes a bottom wall; a first side wall and second side wall extending from the bottom wall so as to face each other; a terminal part which is provided between the first side wall and the second side wall and to which a front end of the lead wire is connected; and a dam wall which is arranged at a position closer to the coil than the terminal part and which is formed integrally with the bottom wall, the first side wall, and the second side wall without clearance. The dam wall includes a lead wire holding part for holding the lead wire.

The terminal block may include a plurality of dam walls which are arranged separated from each other in the extension direction of the lead wire. Further, the bottom wall may be fastened at a position closer to a coil end of the coil than the stator. Further, the lead wire holding part may have a wall surface of a shape corresponding to at least part of the outer circumferential surface of the lead wire. The wall surface of the lead wire holding part may contact the outer circumferential surface of the lead wire. Further, at least part of the wall surface of the lead wire holding part may be formed with a recessed part or a projecting part.

Further, at least part of the dam wall at the end face at the opposite side to the terminal part may be formed with a recessed part or a projecting part. Further, the dam wall may include a porous material which can absorb the varnish at least at its surface. Further, the dam wall may have a length of 0.5 times or more of the diameter of the lead wire in the extension direction of the lead wire. Further, the lead wire holding part may be formed to be recessed inward from the

2

top end face of the dam wall and include a groove which extends in the extension direction of the lead wire.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, and advantages of the present invention will become clearer from the following description of preferred embodiments with reference to the attached drawings, in which:

FIG. 1 is a cross-sectional view of a motor according to an embodiment of the present invention,

FIG. 2 is a perspective view of a terminal block which is shown in FIG. 1,

FIG. 3 is a view for explaining the function of a dam wall,

FIG. 4A is a perspective view of a terminal block according to another embodiment of the present invention and corresponds to FIG. 2,

FIG. 4B is an enlarged view of a region "b" in FIG. 4A enlarged,

FIG. 5A is a perspective view of a terminal block according to still another embodiment of the present invention and corresponds to FIG. 2

FIG. 5B is an enlarged view of a region "b" in FIG. 5A enlarged,

FIG. 6 is a perspective view of a terminal block according to still another embodiment of the present invention and corresponds to FIG. 2.

DETAILED DESCRIPTION

Below, embodiments of the present invention will be explained in detail based on the drawings. First, referring to FIG. 1, the configuration of a motor 10 according to an embodiment of the present invention will be explained. The motor 10 is provided with a housing 11 which defines an internal space S, a stator 12 which is fastened in the internal space S of the housing 11, and a terminal block 100 which is fastened to the housing 11. The stator 12 has coils 13 wound around it.

At the housing 11, a terminal block mount 14 is formed. The terminal block mount 14 is an opening part for communicating the internal space S of the housing 11 and an external space and is formed in proximity to a coil end 13e of the coil 13. The terminal block 100 is fastened to the wall surface 14a which defines the terminal block mount 14 and is arranged near the coil end 13e of the coil 13. At this terminal block 100, the front ends of cylindrically shaped lead wires 15 extending from the coil 13 are connected.

Next, referring to FIG. 2, the configuration of the terminal block 100 according to an embodiment of the present invention will be explained. Note that, in the following explanation, using the directions shown by the xyz coordinates in FIG. 2 as a reference, the direction indicated by the arrow of the x-axis is defined as the front direction, the direction indicated by the arrow of the y-axis is defined as the left direction, and the direction indicated by the arrow of the z-axis is defined as the upper direction. Here, the x-axial direction substantially corresponds to the extension direction of the lead wires 15 connected to the terminal block 100.

The terminal block 100 is provided with a housing 101; and terminal parts 110 attached to the housing 101. The housing 101 is provided with a bottom wall 102; and a side wall 103 extending upward from the bottom wall 102. The bottom wall 102 is a plate-shaped member of a square shape when viewed from the top. The bottom wall 102, as shown in FIG. 1, is fastened at a position closer to the coil end 13e of the coil 13 than the stator 12. More specifically, the

bottom wall **102** is fastened to the wall surface **14a** of the terminal block mount **14** so that the rear end part **102a** of the bottom wall **102** adjoins the coil end **13e** of the coil **13** at the outside in the radial direction.

The side wall **103** extends from the bottom wall **102** so as to be orthogonal to the bottom wall **102**. The side wall **103** includes a first side wall **1031**, second side wall **1032**, third side wall **1033**, and fourth side wall **1034**. The first side wall **1031** rises up from the left end edge of the bottom wall **102** and extends from the rear end to the front end of the bottom wall **102**.

On the other hand, the fourth side wall **1034** rises up from the right end edge of the bottom wall **102** and extends from the rear end to the front end of the bottom wall **102**. The second side wall **1032** is arranged at a position separated from the first side wall **1031** in the right direction and extends from the rear end to the front end of the bottom wall **102** so as to face the first side wall **1031**.

Further, the third side wall **1033** is arranged at a position between the second side wall **1032** and the fourth side wall **1034** and extends from the rear end to the front end of the bottom wall **102** so as to face both of the second side wall **1031** and fourth side wall **1034**.

The housing **101** includes a terminal holding wall **104** provided at the front region of the housing **101** and extending between the first side wall **1031** and the fourth side wall **1034**. The terminal holding wall **104** extends from the first side wall **1031** to the right direction, intersects the second side wall **1032** and third side wall **1033**, and is connected to the fourth side wall **1034**. Further, the terminal holding wall **104** is formed to be orthogonal to the bottom wall **102** and the side wall **103**, and extends from the bottom wall **102** to the top end faces of the side wall **103**.

The terminal holding wall **104** has a first terminal holding wall **1041** extending between the first side wall **1031** and the second side wall **1032**; a second terminal holding wall **1042** extending between the second side wall **1032** and the third side wall **1033**; and a third terminal holding wall **1043** extending between the third side wall **1033** and the fourth side wall **1034**. The first terminal holding wall **1041**, the second terminal holding wall **1042**, and the third terminal holding wall **1043** have the same shapes.

The first terminal holding wall **1041** includes a recessed part **1041a** which is formed so as to be recessed downward from its top end face. Further, the first terminal holding wall **1041** includes a through hole (not shown) which runs from its rear end face to front end face. This through hole is arranged at the approximate center of the first terminal holding wall **1041**.

Similarly, the second terminal holding wall **1042** includes a recessed part **1042a** which is formed so as to be recessed downward from its top end face and a through hole (not shown) which runs from the rear end face to front end face of the second terminal holding wall **1042**. Similarly, the third terminal holding wall **1043** includes a recessed part **1043a** which is formed so as to be recessed downward from its top end face and a through hole (not shown) which runs from the rear end face to front end face of the third terminal holding wall **1043**.

The housing **101** includes a dam wall **105** disposed at the rear region thereof and extending between the first side wall **1031** and the fourth side wall **1034**. The dam wall **105** is arranged at a position rearwardly separated from the terminal holding wall **104** and somewhat frontwardly separated from the rear end part **102a** of the bottom wall **102**. The dam wall **105** is formed to be orthogonal to the bottom wall **102** and the side wall **103**, and extends from the bottom wall **102**

to a predetermined height lower than the top end face of the side wall **103**. This dam wall **105** is formed integrally with the bottom wall **102**, first side wall **1031**, second side wall **1032**, third side wall **1033**, and fourth side wall **1034** without clearance.

More specifically, the dam wall **105** has a first dam wall **1051** extending between the first side wall **1031** and the second side wall **1032**; a second dam wall **1052** extending between the second side wall **1032** and the third side wall **1033**; and a third dam wall **1053** extending between the third side wall **1033** and the fourth side wall **1034**. Note that the first dam wall **1051**, second dam wall **1052**, and third dam wall **1053** have the same shapes.

The first dam wall **1051** has a groove **1051g** which is formed so as to be recessed inward from its top end face **1051a**. The groove **1051g** extends from the rear end face **1051b** to the front end face **1051c** of the first dam wall **1051** along the x-axis. This groove **1051g** has a wall surface which corresponds to the outer circumferential surface of a cylindrically shaped lead wire **15**.

More specifically, the wall surface of the groove **1051g** includes a circumferential surface which has a radius the same or slightly smaller than the radius of the outer circumferential surface of the lead wire **15**. The first dam wall **1051** has a predetermined x-axial direction length. For example, the first dam wall **1051** has an x-axial direction length of 0.5 times or more of the diameter of the lead wire **15**.

Similarly, the second dam wall **1052** has a groove **1052g** which is formed so as to be recessed inward from its top end face **1052a**. The third dam wall **1053** has a groove **1053g** which is formed so as to be recessed inward from its top end face **1053a**. The wall surfaces of these groove **1052g** and groove **1053g** also have radii the same or slightly smaller than the radius of the outer circumferential surface of the lead wire **15**.

The terminal part **110** includes a first terminal part **1101**; second terminal part **1102**; and third terminal part **1103**. At the center part of the first terminal part **1101**, a screw part (not shown) which extends from the body part of the first terminal part **1101** to the front direction is formed. The first terminal part **1101** is attached to the rear end face of the first terminal holding wall **1041** so that the screw part of the first terminal part **1101** is inserted into a through hole which is provided in the first terminal holding wall **1041**. In this way, the first terminal part **1101** is attached to the housing **101** between the first side wall **1031** and the second side wall **1032**.

Similarly, at the center part of the second terminal part **1102**, a screw part **1102a** which extends from the body part of the second terminal part **1102** to the front direction is formed. The second terminal part **1102** is attached to the rear end face of the second terminal holding wall **1042** so that this screw part **1102a** is inserted into a through hole which is provided in the second terminal holding wall **1042**.

Similarly, at the center part of the third terminal part **1103**, a screw part **1103a** which extends from the body part of the third terminal part **1103** to the front direction is formed. The third terminal part **1103** is attached to the rear end face of the third terminal holding wall **1043** so that this screw part **1103a** is inserted into a through hole which is provided in the third terminal holding wall **1043**.

According to the present embodiment, a total of three lead wires **15** are connected to the terminal block **100**. Fastener **16** is attached to the front end of each of the lead wires **15**. The fastener **16** is made of a metal member having a bifurcated clamping part **16a**, and electrically contacts the conductive wire of the lead wire **15**. The first lead wire **15**

5

is connected to the first terminal part **1101** which is attached to the first terminal holding wall **1041**.

Specifically, the fastener **16** provided at the front end of the first lead wire **15** is fit into the recessed part **1041a** formed at the first terminal holding wall **1041** so as to be put from the upper side of the first terminal holding wall **1041**. At this time, the clamping part **16a** of the fastener **16** clamps the first terminal holding wall **1041** from the front and rear, and then electrically contacts the first terminal part **1101** attached to the first terminal holding wall **1041**. In this way, the first lead wire **15** is electrically connected to the first terminal part **1101**.

On the other hand, at the screw part formed at the first terminal part **1101**, an external cable connected to a voltage source for driving the motor **10** or other external device is inserted. In this way, the first lead wire **15** is electrically connected to the external cable, and thus, is electrically connected to the external device via the external cable.

The front end of the first lead wire **15** is connected to the first terminal part **1101**, while a part of the first lead wire **15** positioned slightly rearward of the front end thereof is fit inside of a groove **1051g** provided at the first dam wall **1051** and held by the groove **1051g**. In this state, the wall surface of the groove **1051g** tightly contacts the outer circumferential surface of the lead wire **15** over half of the radius in the lower side of that outer circumferential surface. In this way, the groove **1051g** functions as a lead wire holding part for holding the lead wire **15**. As shown in FIG. 2, the first lead wire **15** is connected to the terminal part **1101** so as to extend along the x-axis.

Similarly, the second lead wire **15** is connected to the second terminal part **1102**. Note that, in order to facilitate understanding, a state before the second lead wire **15** is attached to the second terminal holding wall **1042** is shown in FIG. 2. The fastener **16** which is provided at the front end of the second lead wire **15** is fit into the recessed part **1042a** of the second terminal holding wall **1042**. Due to this, it electrically contacts the second terminal part **1102** which is attached to the second terminal holding wall **1042**. In this way, the second lead wire **15** is electrically connected to an external device via an external cable connected to the second terminal part **1102**.

Further, a part of the second lead wire **15** positioned slightly rearward of the front end of the second lead wire **15** is fit into the groove **1052g** formed on the second dam wall **1052**, and held by the groove **1052g**. At this time, the wall surface of the groove **1052g** tightly contacts the outer circumferential surface of the lead wire **15** over half of the circumference in the bottom side of the outer circumferential surface.

Similarly, the third lead wire **15** is connected to a third terminal part **1103**. Note that, in order to facilitate understanding, the third lead wire **15** is omitted in FIG. 2. The fastener **16** provided at the front end of the third lead wire **15** is also fit in the recessed part **1043a** of the third terminal holding wall **1043**. Due to this, it electrically contacts the third terminal part **1103** which is attached to the third terminal holding wall **1043**. In this way, the third lead wire **15** is electrically connected to an external device via an external cable connected to the second terminal part **1102**.

Further, a part of the third lead wire **15** positioned slightly rearward of the front end of the third lead wire **15** is fit into the groove **1053g** formed on the third dam wall **1053**, and held by the groove **1053g**. At this time, the wall surface of the groove **1053g** tightly contacts the outer circumferential surface of the lead wire **15** over half of the circumference in the bottom side of the outer circumferential surface.

6

Next, referring to FIG. 1 to FIG. 3, the function of the terminal block **100** according to the present embodiment will be explained. As shown in FIG. 1, the work of impregnating the coils **13** with varnish is performed while making the motor **10** rotate about the center axis of the motor **10** and dropping varnish **W** on the coil end **13e** of the coil **13** with a varnish coating nozzle **17**.

If dropping varnish **W** on the coil **13** in this way, part of the varnish which was dropped may travel from the coil end **13e** along the wall surface **14a** of the terminal block mount **14**, reach the end part **102a** of the bottom wall **102**, and flow into the inside of the terminal block **100**. Alternatively, part of the varnish which was dropped may travel from the coil end **13e** along the lead wires **15**, and flow into the inside of the terminal block **100**.

The state where the varnish **W** flows into the inside of the terminal block **100** is shown in FIG. 3. In FIG. 3, varnish W_1 travels along the first lead wire **15** which is connected to the first terminal part **1101**, and flows into the inside of the terminal block **100**. On the other hand, varnish W_2 travels along the edge where the bottom wall **102** and the second side wall **1032** are connected to each other, and flows into the inside of the terminal block **100**.

The terminal block **100** according to the present embodiment is provided with a dam wall **105** which is arranged at a position closer to the coil end **13e** than the terminal part **110** and which is formed integrally with the bottom wall **102** and the side wall **103** without clearance. Due to this dam wall **105**, the varnish **W** which flows from the coil end **13e** to the inside of the terminal block **100** can be stopped before reaching the terminal part **110**.

Specifically, the varnish W_1 which flows in by traveling along the first lead wire **15** is stopped by the first dam wall **1051**. As explained above, the wall surface of the groove **1051g** provided at the first dam wall **1051** includes a circumferential surface which has a radius same as or somewhat smaller than the radius of the outer circumferential surface of the lead wire **15**, and as a result, tightly contacts the outer circumferential surface of the lead wire **15**. Therefore, the varnish W_1 which flows in by traveling along the first lead wire **15** cannot enter into the groove **1051g** and, due to this, is stopped at the position of the rear end face **1051b** of the first dam wall **1051**.

On the other hand, the varnish W_2 which flows in by traveling along the bottom wall **102** is stopped by the second dam wall **1052**. As explained above, the dam wall **105** is formed integrally with the bottom wall **102** and side wall **103** without clearance, so the varnish W_2 can be reliably stopped by the second dam wall **1052**.

In this way, according to the present embodiment, before the varnish **W** which flows from the coil end **13e** into the inside of the terminal block **100** reaches the terminal part **110**, it can be reliably dammed by the dam wall **105**. Due to this, the varnish **W** can be prevented from entering the screw parts **1102a** and **1103a** of the terminal part **110**, and therefore it is possible to reliably connect the lead wires **15** and the external cables, and prevent the obstruction of work of inserting the external cables into the screw parts of the terminal part **110** due to the varnish **W** flow in.

Further, according to the present embodiment, when connecting lead wires **15** to the terminal block **100**, it is possible to easily and stably set the lead wires **15** on the terminal block **100** only by fitting lead wires **15** into the grooves **1051g**, **1052g**, and **1053g**. Note that, even if only half circumference of the lead wires **15** in the bottom side are held by the upward opening grooves **1051g**, **1052g**, and **1053g**, it is possible to sufficiently dam the varnish **W**.

This will be explained below. As explained above, in the state where the terminal block **100** is fastened to the terminal block mount **14**, the bottom wall **102** is arranged near the coil end **13e**. Therefore, many of the varnish **W** flowing from the coil end **13e** into the terminal block **100**, as with the varnish W_2 shown in FIG. 3, travels along the bottom wall **102**.

Further, regarding the varnish W_1 which flows into the terminal block **100** by traveling along the lead wires **15** as well, this tends to travel over the sides closer to the bottom wall **102**. For this reason, as in the present embodiment, even if holding only the bottom sides of the lead wires **15** by the upward opening grooves **1051g**, **1052g**, and **1053g**, it is possible to prevent the varnish **W** from reaching the terminal part **110** with a high certainty, since the dam wall **105** can reliably stop the varnish **W** between the bottom wall **102** and the lead wires **15**.

Further, according to the present embodiment, the dam wall **105** has an x-axial direction length of 0.5 times or more of the diameter of the lead wires **15**. Due to this, the varnish W_1 which flows in by traveling along the lead wires **15** can be more reliably stopped by the dam wall **105**. Specifically, even if part of the varnish W_1 enters into the groove **1051g**, the path by which the varnish **W** moves forward inside the groove **1051g** and reaches the front end face **1051c** of the first dam wall **1051** becomes substantially longer. For this reason, it becomes hard for the varnish W_1 to reach the front end face **1051c**, and therefore the varnish W_1 can be reliably stopped inside the groove **1051g**.

Next, referring to FIGS. 4A and 4B, a terminal block **200** according to another embodiment of the present invention will be explained. Note that, elements similar to the above embodiment will be assigned the same reference numerals and detailed descriptions thereof will be omitted. The terminal block **200** according to the present embodiment is provided with a housing **201**; and a terminal part **110** attached to the housing **201**. The housing **201** has a bottom wall **102**; a side wall **103** which include a first side wall **1031**, second side wall **1032**, third side wall **1033**, and fourth side wall **1034**; a terminal holding wall **104**; and a dam wall **205** according to the present embodiment.

The dam wall **205** is formed integrally with the bottom wall **102** and side wall **103** without clearance. Specifically, the dam wall **205** includes a plurality of first dam walls **2051** which extend between the first side wall **1031** and the second side wall **1032**; a plurality of second dam walls **2052** which extend between the second side wall **1032** and the third side wall **1033**; and a plurality of third dam walls **2053** which extend between the third side wall **1033** and the fourth side wall **1034**.

Below, referring to FIG. 4B, the configuration of the third dam walls **2053** will be explained. In the present embodiment, a total of three third dam walls **2053** are formed aligned in the x-axial direction separated from each other at substantially equal intervals. Each of the third dam walls **2053** has a groove **2053g** which is formed to be recessed inward from the top end face **2053a**.

Similar to the above embodiment, the groove **2053g** extends along the x-axis from the rear end face **2053b** to the front end face **2053c** of the third dam wall **2053**, and has a wall surface corresponding to the outer circumferential surface of the lead wire **15**. Each of the third dam walls **2053** has an x-axial direction length which is shorter than the dam walls **1051**, **1052**, and **1053** according to the above embodiments. Note that, each of the first dam wall **2051** and second dam wall **2052** has a shape similar to the third dam wall **2053**, so detailed descriptions will be omitted.

According to the present embodiment, varnish which flows inside of the terminal block **200** can be more effectively stopped by the dam wall **205**. Specifically, assuming that varnish **W** which has flowed inside of the terminal block **200** by traveling along the lead wires **15** or bottom wall **102** enters into the groove **2053g** of the third dam wall **2053** positioned at the rear-most side (that is, the front side of FIG. 4B), reaches the front end face **2053c** of this third dam wall **2053**, and flows out from the groove **2053g** to forward.

Here, a gap having a predetermined x-axial direction distance is formed between the adjacent third dam walls **2053** in the x-axial direction. Accordingly, even if varnish **W** passes over one third dam wall **2053**, this varnish **W** will be caught in the gap formed between the adjacent third dam walls **2053** in the x-axial direction.

In this way, according to the present embodiment, due to the presence of the gap between the adjacent dam walls **205** in the x-axial direction, the path over which the varnish **W** flows from the rear-most dam wall **205** to the front-most dam wall **205** can be much longer, and this gap functions as a "catch basin" for preventing the flow of the varnish **W**. Due to this, the varnish **W** can be more reliably stopped by the dam wall **205**.

Next, referring to FIGS. 5A and 5B, a terminal block **300** according to still another embodiment of the present invention will be explained. Note that, elements similar to the above embodiments will be assigned the same reference numerals and detailed descriptions thereof will be omitted. The terminal block **300** according to the present embodiment is provided with a housing **301**; and a terminal part **110** attached to the housing **301**. The housing **301** has a bottom wall **102**; a side wall **103** which include a first side wall **1031**, second side wall **1032**, third side wall **1033**, and fourth side wall **1034**; a terminal holding wall **104**; and a dam wall **305** according to the present embodiment.

The dam wall **305** is integrally formed with the bottom wall **102** and side wall **103** without clearance. Specifically, the dam wall **305** includes a first dam wall **3051** which extends between the first side wall **1031** and the second side wall **1032**; a second dam wall **3052** which extends between the second side wall **1032** and the third side wall **1033**; and a third dam wall **3053** which extends between the third side wall **1033** and the fourth side wall **1034**.

Below, referring to FIG. 5B, the configuration of the third dam wall **3053** will be explained. In the present embodiment, the third dam wall **3053** has a groove **3053g** which is formed to be recessed inward from the top end face **3053a**. Similar to the above embodiments, the groove **3053g** extends along the x-axis from the rear end face **3053b** to the front end face **3053c** of the third dam wall **3053**, and has a wall surface corresponding to the outer circumferential surface of a lead wire **15**.

Here, in the present embodiment, a plurality of recessed parts **3053r**, which are formed to be recessed inward from the wall surface of the groove **3053g**, are formed aligned separated from each other in the x-axial direction. Each of the recessed parts **3053r** extends over the circumference of the wall surface of the groove **3053g**. In the present embodiment, a total of three recessed parts **3053r** are formed aligned in the x-axial direction at equal intervals.

Further, at the rear end face **3053b** of the third dam wall **3053**, a plurality of holes **3053h** which are recessed inward from the rear end face **3053b** (do not pass through to the front end face **3053c**) are formed. Note that, each of the first dam wall **3051** and the second dam wall **3052** has a similar shape as the third dam wall **3053**, so detailed descriptions will be omitted.

According to the present embodiment, varnish which flows inside of the terminal block **300** can be more effectively stopped by the dam wall **305**. Specifically, assuming that part of the varnish **W** flowing into the terminal block **300** enters the groove **3053g** of the third dam wall **3053**.

In this case, the varnish **W** entered must move inside the groove **3053g** to forward so as to pass over a total of three recessed parts **3053r**, before it reaches the front end face **3053c** of the third dam wall **3053**. Due to the presence of the recessed parts **3053r**, the path over which the varnish **W** passes inside the groove **3053g** becomes substantially longer, and each of the recessed parts **3053r** acts as a "catch basin" for preventing the flow of the varnish **W**. For this reason, it becomes hard for the varnish **W** to reach the front end face **3053c**, and therefore the varnish **W** can be reliably stopped inside the groove **3053g**.

Furthermore, the holes **3053h** formed on the rear end face **3053b** of the third dam wall **3053** also make the path of the varnish **W** over the rear end face **3053b** substantially longer, and each of the holes **3053h** functions as a "catch basin" for preventing the flow of the varnish **W**. Due to this, it becomes further harder for the varnish **W** to reach the front end face **3053c**, and therefore the varnish **W** can be stopped more reliably.

Next, referring to FIG. 6, a terminal block **400** according to still another embodiment of the present invention will be explained. Note that, elements similar to the above embodiments will be assigned the same reference numerals and detailed descriptions thereof will be omitted. The terminal block **400** according to the present embodiment is provided with a housing **401**; and a terminal part **110** attached to the housing **401**. The housing **401** has a bottom wall **102**; side wall **103** which include a first side wall **1031**, second side wall **1032**, third side wall **1033**, and fourth side wall **1034**; a terminal holding wall **104**; and a dam wall **405** according to the present embodiment.

The dam wall **405** is formed integrally with the bottom wall **102** and side wall **103** without clearance. Specifically, the dam wall **405** includes a first dam wall **4051** extending between the first side wall **1031** and the second side wall **1032**, a second dam wall **4052** extending between the second side wall **1032** and the third side wall **1033**, and a third dam wall **4053** extending between the third side wall **1033** and the fourth side wall **1034**. The first dam wall **4051**, second dam wall **4052**, and third dam wall **4053** respectively include a groove **4051g**, groove **4052g**, and groove **4053g**, in the same way as the embodiment shown in FIG. 2.

Here, the dam wall **405** according to the present embodiment is made of a porous material capable of absorbing the varnish **W**. For example, the dam wall **405** is made of urethane foam. Thus, the housing **401** according to the present embodiment is made of two different materials. Such a housing **401** can be fabricated, for example, by two-color molding including a resin material which forms the bottom wall **102**, side wall **103**, and terminal holding wall **104**; and urethane foam which forms the dam wall **405**.

According to the present embodiment, it is possible to absorb the varnish **W** flowing along the dam wall **405** by the porous material, and therefore, more effectively stop the varnish flowing inside of the terminal block **400** by the dam wall **405**.

Note that, in the above-mentioned embodiments, the case where as the lead wire holding part, a groove part which contacts the outer circumferential surface over half the circumference at the bottom side of the outer circumferential surface of the lead wire was explained. However, the invention is not limited to this. The lead wire holding part may

include a through hole which is formed in the dam wall and which contacts the outer circumferential surface of the lead wire so as to surround the entire circumference of the outer circumferential surface.

Further, the case of forming recessed parts which extend across the circumference of the wall surface of the groove in the embodiment which is shown in FIG. 5 was explained. However, the invention is not limited to this. For example, it is also possible to form a plurality of holes which are recessed inward from the wall surface of the groove. Further, by forming not only the recessed parts, but also projecting parts which project outward from the wall surface of the groove, it is possible to de facto lengthen the path over which the varnish passes in the groove.

Further, in the embodiment which is shown in FIG. 6, the case of forming the dam wall by a porous material which can absorb varnish was explained. However, the invention is not limited to this. For example, it is also possible to cover the surface of the dam wall with a porous material. In this way, from the viewpoint of de facto lengthening the path over which the varnish passes, the dam wall should include a porous material which can absorb varnish at least at its surface.

According to the present invention, when impregnating varnish in the coils, the varnish which flows in from the coil ends of the coils to the inside of the terminal block can be reliably stopped by the dam wall before reaching the terminal part. Due to this, it is possible to prevent varnish from ending up entering into the terminal part, so the lead wires and the external cables can be made to reliably connect and the varnish can be prevented from causing the work of inserting the external cables into the screw parts of the terminal parts to be obstructed.

Above, the present invention was explained through embodiments of the present invention, but the above embodiments do not limit the invention relating to the claims. Further, all combinations of features which were explained in the embodiment are not necessarily essential for the invention. Further, the above embodiments can be changed or improved in various ways as clear to a person skilled in the art. Such changed or improved embodiments are also included in the technical scope of the present invention as clear from the claim language.

The invention claimed is:

1. A motor, comprising:

a coil that is wound around a stator and a varnish impregnated in the coil; and
a terminal block to which a lead wire of the coil is connected, wherein

the terminal block includes:

a bottom wall;

a first side wall and second side wall extending from the bottom wall so as to face each other;

a terminal part that is provided between the first side wall and the second side wall and a front end of the lead wire is connected to the terminal part; and

a dam wall that is arranged at a position closer to the coil than the terminal part and the dam wall is formed integrally with the bottom wall, the first side wall, and the second side wall without clearance, the dam wall being spaced apart from a rear end part of the terminal block so as to define a reservoir bound by the rear end part, the first side wall, the second side wall and the dam wall, the reservoir is configured to collect varnish flowing toward the terminal block, wherein

the dam wall includes a lead wire holding part for holding the lead wire.

2. The motor according to claim 1, wherein the terminal block includes a plurality of dam walls which are arranged separated from each other in the extension direction of the lead wire.

3. The motor according to claim 1, wherein the bottom wall is fastened to a position closer to a coil end of the coil than the stator. 5

4. The motor according to claim 1, wherein the lead wire holding part has a wall surface of a shape corresponding to at least part of the outer circumferential surface of the lead wire, the wall surface contacting the outer circumferential surface of the lead wire. 10

5. The motor according to claim 4, wherein a recessed part is formed on at least part of the wall surface of the lead wire holding part. 15

6. The motor according to claim 1, wherein a recessed part is formed on at least part of the end face of the dam wall opposite to the terminal part.

7. The motor according to claim 1, wherein the dam wall includes a porous material which can absorb the varnish at least at its surface. 20

8. The motor according to claim 1, wherein the dam wall has a length of 0.5 times or more of the diameter of the lead wire in the extension direction of the lead wire. 25

9. The motor according to claim 1, wherein the lead wire holding part is formed to be recessed inward from the top end face of the dam wall and includes a groove extending in the extension direction of the lead wire. 30

* * * * *

30