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Lead block and rotary connector device

Abstract

A lead block includes a lead block body and a plurality of busbars. The plurality of busbars is each partially embedded in the lead block body. The plurality of busbars includes a plurality of exposed portions. The plurality of exposed portions each extends in a longitudinal direction and disposed spaced apart from one another in an arrangement direction orthogonal to the longitudinal direction. The plurality of exposed portions includes at least one first exposed portion. The at least one first exposed portion includes a first surface and a first additional surface disposed on a reverse side of the first surface in the arrangement direction. The first surface includes a first cut surface having an area smaller than an area of the first surface. The first additional surface includes a first additional cut surface having an area smaller than an area of the first additional surface.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application is a continuation application of International Application No. PCT/JP2021/005772, filed Feb. 16, 2021, which claims priority to Japanese Patent Application No. 2020-063104 filed Mar. 31, 2020. The contents of these applications are incorporated herein by reference in their entirety.

BACKGROUND
Technical Field
(1) The technology disclosed in the present application relates to a lead block and a rotary connector device.
Background Art
(2) Japanese Unexamined Patent Publications JP 10-144371 A, JP 2003-022879 A and JP 2003-045598 A and International Publication WO 2018/047581 describe a rotary connector device including a lead block.
SUMMARY
(3) According to one aspect, a lead block includes a lead block body and a plurality of busbars. The lead block body includes an electrical insulating material. The plurality of busbars is each partially embedded in the lead block body and includes an electrically conductive material. The plurality of busbars includes a plurality of exposed portions exposed from the lead block body. The plurality of exposed portions respectively corresponds to the plurality of busbars. The plurality of exposed

portions each extends in a longitudinal direction and disposed spaced apart from one another in an arrangement direction orthogonal to the longitudinal direction. The plurality of exposed portions includes at least one first exposed portion. The at least one first exposed portion includes a first surface and a first additional surface disposed on a reverse side of the first surface in the arrangement direction. The first surface includes a first cut surface having an area smaller than an area of the first surface. The first additional surface includes a first additional cut surface having an area smaller than an area of the first additional surface.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings.
(2) FIG. **1** is a plan view of a rotary connector device according to the present embodiment.
(3) FIG. **2** is a cross-sectional view of the rotary connector device illustrated in FIG. **1**.
(4) FIG. **3** is a side view of a lead block of the rotary connector device illustrated in FIG. **1**.
(5) FIG. **4** is a partial side view of the lead block illustrated in FIG. **3**.
(6) FIG. **5** is a partial perspective view of the lead block illustrated in FIG. **3**.
(7) FIG. **6** is a partial perspective view of the lead block illustrated in FIG. **3**.
(8) FIG. **7** is a cross-sectional view of the lead block taken along a line VII-VII of FIG. **4**.
(9) FIG. **8** is a flowchart illustrating a method of manufacturing the lead block illustrated in FIG. **3**.
(10) FIG. **9** is a plan view illustrating the press machining step for the lead block illustrated in FIG. **3**.
(11) FIG. **10** is a plan view illustrating the molding step for the lead block illustrated in FIG. **3**.
(12) FIG. **11** is a plan view illustrating the cutting step and the carrier cutting step for the lead block illustrated in FIG. **3**.
(13) FIG. **12** is a view illustrating a surface state of a first surface of the lead block illustrated in FIG. **3**.
(14) FIG. **13** is a diagram illustrating a surface state of a first additional surface of the lead block illustrated in FIG. **3**.
(15) FIG. **14** is a diagram illustrating a surface state of a second surface of the lead block illustrated in FIG. **3**.
(16) FIG. **15** is a diagram illustrating a surface state of a third surface of the lead block illustrated in FIG. **3**.
(17) FIG. **16** is a diagram illustrating a surface state of a first surface of a lead block according to a modified example.
(18) FIG. **17** is a diagram illustrating a surface state of a first surface of a lead block according to a modified example.
(19) FIG. **18** illustrates a positional relationship between a first cut surface and a first adjacent surface and a positional relationship between a first additional cut surface and a first additional adjacent surface, in a lead block according to a modified example.
(20) FIG. **19** illustrates a positional relationship between a first cut surface and a first adjacent surface and a positional relationship between a first additional cut surface and a first additional adjacent surface, in a lead block according to a modified example.
DESCRIPTION OF THE EMBODIMENTS
(21) Hereinafter, embodiments will be described with reference to the drawings. In the drawings, the same reference signs denote corresponding or identical components.
(22) As illustrated in FIG. **1**, a rotary connector device **1** according to the present embodiment

includes a stator **10** and a rotator **20**. The stator **10** is configured to be mounted in a vehicle body. The rotator **20** is provided rotatably about a rotation axis A**1** relative to the stator **10**. The rotator **20** is configured to be fixed to a steering wheel. The rotary connector device **1** includes a first connector **30** and a second connector **40**. The first connector **30** is provided on the stator **10**. The second connector **40** is provided on the rotator **20**.

(23) The first connector **30** is configured with a vehicle body side connector detachably installed on the first connector **30**. The first connector **30** includes a first connector housing portion **31** into which the vehicle body side connector is inserted. The vehicle body side connector is electrically connected to an electric circuit such as a control device. The second connector **40** is configured with a steering side connector detachably installed on the second connector **40**. The second connector **40** includes a second connector housing portion **41** into which the steering side connector is inserted. The steering side connector is electrically connected to electric circuits such as switches for the steering wheel and an airbag device.

(24) As illustrated in FIG. **2**, the stator **10** and the rotator **20** define a cable housing space **50** between the stator **10** and the rotator **20**, the cable housing space **50** provided surrounding the rotation axis A**1**. For example, the cable housing space **50** is annular and extends in a circumferential direction D**2** relative to the rotation axis A**1**. The rotary connector device **1** includes an electrical cable **60**. The electrical cable **60** electrically connects the first connector **30** to the second connector **40**. The electrical cable **60** is housed in the cable housing space **50**. The electrical cable **60** is flexible and has a flat shape. The electrical cable **60** may also be referred to as a flexible flat cable.

(25) As illustrated in FIG. **1**, the rotary connector device **1** includes a lead block **70**. In the present embodiment, the rotary connector device **1** includes a plurality of the lead blocks **70**. Lead blocks **70**A and **70**B of the plurality of lead blocks **70** are attached to the stator **10**. The lead blocks **70**A and **70**B are disposed in the first connector housing portion **31**. The lead blocks **70**C and **70**D of the plurality of lead blocks **70** are attached to the rotator **20**. The lead blocks **70**C and **70**D are disposed in the second connector housing portion **41**. The first connector **30** includes lead blocks **70**A and **70**B. The second connector **40** includes lead blocks **70**C and **70**D. However, the total number of the lead blocks **70** is not limited to the present embodiment.

(26) As illustrated in FIG. **3**, the lead block **70** includes a lead block body **71** and a plurality of busbars **72**. The lead block body **71** includes an electrical insulating material. The plurality of busbars **72** are each partially embedded in the lead block body **71** and include an electrically conductive material. The electrical insulating material includes, for example, a resin material. The electrically conductive material includes a metal material such as copper, for example. The plurality of busbars **72** are electrically isolated from one another by the lead block body **71**. The plurality of busbars **72** are respectively electrically connected to a plurality of wires included in the electrical cable **60** (see FIG. **2**).

(27) The plurality of busbars **72** include a plurality of exposed portions **73** exposed from the lead block body **71** and corresponding to the respective plurality of busbars **72**. The busbar **72** includes the exposed portion **73**. The plurality of exposed portions **73** each extend in a longitudinal direction D**4** and are spaced apart from one another in an arrangement direction D**5** orthogonal to the longitudinal direction D**4**.

(28) The plurality of exposed portions **73** include at least one first exposed portion **74**. In the present embodiment, the plurality of exposed portions **73** include a plurality of the first exposed portions **74**. However, the total number of the first exposed portions **74** is not limited to the present embodiment.

(29) The plurality of exposed portions **73** include a second exposed portion **75**. The plurality of exposed portions **73** include a third exposed portion **76**. At least one of the first exposed portions **74** is disposed between the second exposed portion **75** and third exposed portion **76** in the arrangement direction D**5**. The plurality of first exposed portions **74** are disposed between the

second exposed portion **75** and the third exposed portion **76** in the arrangement direction D**5**. The plurality of first exposed portions **74**, the second exposed portion **75**, and the third exposed portion **76** are spaced apart from one another in the arrangement direction D**5**.

(30) The plurality of busbars **72** include at least one first busbar **77** that includes the at least one first exposed portion **74**. The at least one first busbar **77** includes a first end portion **77**A and a first additional end portion **77**B. In the present embodiment, the plurality of busbars **72** includes a plurality of the first busbars **77** including the plurality of first exposed portions **74**. The plurality of busbars **72** each include the first end portion **77**A and the first additional end portion **77**B. However, the total number of the first busbars **77** is not limited to the present embodiment.

(31) The plurality of busbars **72** include a second busbar **78** that includes the second exposed portion **75**. The plurality of busbars **72** include a third busbar **79** that includes the third exposed portion **76**. The second busbar **78** includes a second end portion **78**A and a second additional end portion **78**B. The third busbar **79** includes a third end portion **79**A and a third additional end portion **79**B. At least one of the second busbar **78**A and the third busbar **79** may be omitted from the plurality of busbars **72**.

(32) The first end portion **77**A is exposed from the lead block body **71**. The first busbar **77** includes a first pin terminal **77**C that is exposed from the lead block body **71**. The first pin terminal **77**C protrudes from the lead block body **71** in the longitudinal direction D**4**. The first pin terminal **77**C includes the first end portion **77**A. As viewed in an orthogonal direction D**6** orthogonal to the longitudinal direction D**4** and the arrangement direction D**5**, the first end portion **77**A is disposed outside a contour **71**A of the lead block body **71**.

(33) On the other hand, as viewed in the orthogonal direction D**6** orthogonal to the longitudinal direction D**4** and the arrangement direction D**5**, the first additional end portion **77**B is disposed inside the contour of the lead block body **71**. The first additional end portion **77**B is at least partially embedded in the lead block body **71**. In the present embodiment, the first additional end portion **77**B is partially embedded in the lead block body **71**, but a portion of the surface of the first additional end portion **77**B is exposed from the lead block body **71**. However, the entirety of first additional end portion **77**B may be embedded in the lead block body **71**.

(34) As illustrated in FIG. **4**, the at least one first exposed portion **74** includes a first surface **80** and a first additional surface **81**. The first additional surface **81** is disposed on the reverse side of the first surface **80** in the arrangement direction D**5**. Each of the plurality of first exposed portions **74** includes the first surface **80** and the first additional surface **81**.

(35) The second exposed portion **75** includes a second surface **83** and a second additional surface **84**. The second surface **83** faces toward the at least one first exposed portions **74** in the arrangement direction D**5**. The second additional surface **84** is disposed on the reverse side of the second surface **83** in the arrangement direction D**5**.

(36) The third exposed portion **76** includes a third surface **85** and a third additional surface **86**. The third surface **85** faces toward the at least one first exposed portion **74** in the arrangement direction D**5**. The third additional surface **86** is disposed on the reverse side of the third surface **85** in the arrangement direction D**5**.

(37) One of the plurality of busbars **72** includes a first protruding portion **87** protruding from the second additional surface **84** of the second exposed portion **75** in the arrangement direction D**5**. The second busbar **78** includes the first protruding portion **87**. The first protruding portion **87** is at least partially embedded in the lead block body **71**. In the present embodiment, the first protruding portion **87** is partially embedded in the lead block body **71**. However, the entirety of first protruding portion **87** may be embedded in the lead block body **71**. Additionally, the first protruding portion **87** may be omitted from the plurality of busbars **72**.

(38) One of the plurality of busbars **72** includes a second protruding portion **88** protruding from the third additional surface **86** of the third exposed portion **76** in the arrangement direction D**5**. The third busbar **79** includes the second protruding portion **88**. The second protruding portion **88** is at

least partially embedded in the lead block body **71**. In the present embodiment, the second protruding portion **88** is partially embedded in the lead block body **71**. However, the entirety of second protruding portion **88** may be embedded in the lead block body **71**. Additionally, the second protruding portion **88** may be omitted from the plurality of busbars **72**.

(39) The lead block body **71** includes an opening **71**B. The plurality of exposed portions **73** are at least partially disposed within the opening **71**B as viewed in the orthogonal direction D**6**. The plurality of first exposed portions **74**, the second exposed portion **75**, and the third exposed portion **76** are disposed at least partially within the opening **71**B as viewed in the orthogonal direction D**6**.

(40) As illustrated in FIG. **5**, the first surface **80** includes a first cut surface **90** having an area smaller than an area of the first surface **80**. The first cut surface **90** is disposed within the opening **71**B. A length L**11** of the first cut surface **90** in the longitudinal direction D**4** is shorter than a length L**12** of the first surface **80** in the longitudinal direction D**4**. The first surface **80** includes a first adjacent surface **80**A adjacent to the first cut surface **90**. The first surface **80** includes a first adjacent surface **80**B adjacent to the first cut surface **90**. The appearance of the first cut surface **90** differs from the appearance of the first adjacent surface **80**A. The appearance of the first cut surface **90** differs from the appearance of the first adjacent surface **80**B. The appearance of the first adjacent surface **80**A is the same as the appearance of the first adjacent surface **80**B.

(41) As described below, the first cut surface **90** is a surface formed when a connector bar **104** (see FIGS. **9** to **11**) is cut off from the plurality of first exposed portions **74** during manufacture of the lead block **70**. The first adjacent surfaces **80**A and **80**B are surfaces formed by, for example, press machining (e.g., shearing), while the first cut surface **90** is a surface formed in a step different from and later than a step for forming the first adjacent surfaces **80**A and **80**B. The first cut surface **90** is, for example, a surface formed by press machining (e.g., shearing) similarly to the first adjacent surfaces **80**A and **80**B.

(42) As illustrated in FIG. **12**, the first adjacent surface **80**A includes a shear surface **80**C and a fracture surface **80**D. The fracture surface **80**D is adjacent to the shear surface **80**C in the orthogonal direction D**6**. The shear surface **80**C is a surface formed during shearing by shearing a material using a punch and a die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The fracture surface **80**D is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **80**C differs from the appearance of the fracture surface **80**D.

(43) Similarly, the first adjacent surface **80**B includes a shear surface **80**E and a fracture surface **80**F. The fracture surface **80**F is adjacent to the shear surface **80**E in the orthogonal direction D**6**. The shear surface **80**E is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The fracture surface **80**F is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **80**E differs from the appearance of the fracture surface **80**F.

(44) The first cut surface **90** includes a first shear surface **90**A and a first fracture surface **90**B. The first fracture surface **90**B is adjacent to the first shear surface **90**A in the orthogonal direction D**6**. The first shear surface **90**A is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The first fracture surface **90**B is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the first shear surface **90**A differs from the appearance of the first fracture surface **90**B.

(45) As illustrated in FIG. **12**, the length of the first shear surface **90**A in the orthogonal direction D**6** differs from the length of the shear surfaces **80**C and **80**E in the orthogonal direction D**6**. The

length of the first fracture surface **90**B in the orthogonal direction D**6** differs from the length of the fracture surfaces **80**D and **80**F in the orthogonal direction D**6**. Accordingly, the appearance of the first cut surface **90** differs from the appearance of the first adjacent surfaces **80**A and **80**B. Note that the first cut surface **90** may be a surface subjected to surface finish after the connector bar **104** is cut off from the plurality of first exposed portions **74**. Similarly, the first adjacent surfaces **80**A and **80**B may be a surface subjected to surface finish. In a case where the first cut surface **90** is subjected to surface finish, the first shear surface **90**A and the first fracture surface **90**B are at least partially replaced with finished surfaces. In a case where the first adjacent surface **80**A is subjected to surface finish, the shear surface **80**C and the fracture surface **80**D are at least partially replaced with finished surfaces. In a case where the first adjacent surface **80**B is subjected to surface finish, the shear surface **80**E and the fracture surface **80**F are at least partially replaced with finished surfaces. Accordingly, the appearance of the first cut surface **90** may be the same as the appearance of the first adjacent surfaces **80**A and **80**B.

(46) As illustrated in FIG. **6**, the first additional surface **81** includes a first additional cut surface **91** having an area smaller than an area of the first additional surface **81**. The first additional cut surface **91** is disposed within the opening **71**B. A length L**13** of the first additional cut surface **91** in the longitudinal direction D**4** is shorter than a length L**14** of the first additional surface **81** in the longitudinal direction D**4**. The first additional surface **81** includes a first additional adjacent surface **81**A adjacent to the first additional cut surface **91**. The first additional surface **81** includes a first additional adjacent surface **81**B adjacent to the first additional cut surface **91**. The appearance of the first additional cut surface **91** differs from the appearance of the first additional adjacent surface **81**A. The appearance of the first additional cut surface **91** differs from the appearance of the first additional adjacent surface **81**B. The appearance of the first additional adjacent surface **81**A is the same as the appearance of the first additional adjacent surface **81**B.

(47) The first additional cut surface **91** is disposed on the reverse side of the first cut surface **90** (see FIG. **5**) in the arrangement direction D**5**. The first additional cut surface **91** is disposed at the same position as that of the first cut surface **90** in the longitudinal direction D**4** (see FIG. **5**). However, the first additional cut surface **91** need not be located on the reverse side of the first cut surface **90** (see FIG. **5**) in the arrangement direction D**5**. The first additional cut surface **91** may be offset from the first cut surface **90** (see FIG. **5**) in the longitudinal direction D**4**.

(48) As described below, the first additional cut surface **91** is a surface formed when the connector bar **104** (see FIGS. **9** to **11**) is cut off from the plurality of first exposed portions **74** during manufacture of the lead block **70**. The first additional adjacent surfaces **81**A and **81**B are surfaces formed by, for example, press machining (e.g., shearing), whereas the first additional cut surface **91** is a surface formed in a step different from and later than a step for forming the first additional adjacent surfaces **81**A and **81**B. The first additional cut surface **91** is, for example, a surface formed by press machining (e.g., shearing) similarly to the first additional adjacent surfaces **81**A and **81**B.

(49) As illustrated in FIG. **13**, the first additional adjacent surface **81**A includes an additional shear surface **81**C and an additional fracture surface **81**D. The additional fracture surface **81**D is adjacent to the additional shear surface **81**C in the orthogonal direction D**6**. The additional shear surface **81**C is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The additional fracture surface **81**D is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the additional shear surface **81**C differs from the appearance of the additional fracture surface **81**D.

(50) Similarly, the first additional adjacent surface **81**B includes an additional shear surface **81**E and an additional fracture surface **81**F. The additional fracture surface **81**F is adjacent to the additional shear surface **81**E in the orthogonal direction D**6**. The additional shear surface **81**E is a surface formed during shearing by shearing of the material using the punch and die, and includes a

plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The additional fracture surface **81**F is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the additional shear surface **81**E differs from the appearance of the additional fracture surface **81**F.

(51) The first additional cut surface **91** includes a first additional shear surface **91**A and a first additional fracture surface **91**B. The first additional fracture surface **91**B is adjacent to the first additional shear surface **91**A in the orthogonal direction D**6**. The first additional shear surface **91**A is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The first additional fracture surface **91**B is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the first additional shear surface **91**A differs from the appearance of the first additional fracture surface **91**B.

(52) As illustrated in FIG. **13**, the length of the first additional shear surface **91**A in the orthogonal direction D**6** differs from the length of the additional shear surfaces **81**C and **81**E in the orthogonal direction D**6**. The length of the first additional fracture surface **91**B in the orthogonal direction D**6** differs from the length of the additional fracture surfaces **81**D and **81**F in the orthogonal direction D**6**. Accordingly, the appearance of the first additional cut surface **91** differs from the appearance of the first additional adjacent surfaces **81**A and **81**B. Note that the first additional cut surface **91** may be a surface subjected to surface finish after the connector bar **104** is cut off from the plurality of first exposed portions **74**. Similarly, the first additional adjacent surfaces **81**A and **81**B may be surfaces subjected to surface finish. In a case where the first additional cut surface **91** is subjected to surface finish, the first additional shear surface **91**A and the first additional fracture surface **91**B are at least partially replaced with finished surfaces. In a case where the first additional adjacent surface **81**A is subjected to surface finish, the additional shear surface **81**C and the additional fracture surface **81**D are at least partially replaced with finished surfaces. In a case where the first additional adjacent surface **81**B is subjected to surface finish, the additional shear surface **81**E and the additional fracture surface **81**F are at least partially replaced with finished surfaces. Accordingly, the appearance of the first additional cut surface **91** may be the same as the appearance of the first additional adjacent surfaces **81**A and **81**B.

(53) As illustrated in FIG. **5**, the second surface **83** includes a second cut surface **93** having an area smaller than an area of the second surface **83**. The second cut surface **93** is disposed within the opening **71**B. A length L**21** of the second cut surface **93** in the longitudinal direction D**4** is shorter than a length L**22** of the second surface **83** in the longitudinal direction D**4**. The second surface **83** includes second adjacent surfaces **83**A and **83**B adjacent to the second cut surface **93**. The appearance of the second cut surface **93** differs from the appearance of each of the second adjacent surfaces **83**A and **83**B. The appearance of the second adjacent surface **83**A is the same as the appearance of the second adjacent surface **83**B.

(54) As described below, the second cut surface **93** is a surface formed when the connector bar **104** (see FIGS. **9** to **11**) is cut off from the plurality of first exposed portions **74** during manufacture of the lead block **70**. The second adjacent surfaces **83**A and **83**B are surfaces formed by, for example, press machining (e.g., shearing), while the second cut surface **93** is a surface formed in a step different from and later than a step for forming the second adjacent surfaces **83**A and **83**B. The second cut surface **93** is, for example, a surface formed by press machining (e.g., shearing) similarly to the second adjacent surfaces **83**A and **83**B.

(55) As illustrated in FIG. **14**, the second adjacent surface **83**A includes a shear surface **83**C and a fracture surface **83**D. The fracture surface **83**D is adjacent to the shear surface **83**C in the orthogonal direction D**6**. The shear surface **83**C is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction

(e.g., the orthogonal direction D**6**). The fracture surface **83**D is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **83**C differs from the appearance of the fracture surface **83**D.

(56) Similarly, the second adjacent surface **83**B includes a shear surface **83**E and a fracture surface **83**F. The fracture surface **83**F is adjacent to the shear surface **83**E in the orthogonal direction D**6**. The shear surface **83**E is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The fracture surface **83**F is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **83**E differs from the appearance of the fracture surface **83**F.

(57) The second cut surface **93** includes a second shear surface **93**A and a second fracture surface **93**B. The second fracture surface **93**B is adjacent to the second shear surface **93**A in the orthogonal direction D**6**. The second shear surface **93**A is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The second fracture surface **93**B is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the second shear surface **93**A differs from the appearance of the second fracture surface **93**B.

(58) As illustrated in FIG. **14**, the length of the second shear surface **93**A in the orthogonal direction D**6** differs from the length of the shear surfaces **83**C and **83**E in the orthogonal direction D**6**. The length of the second fracture surface **93**B in the orthogonal direction D**6** differs from the length of the fracture surfaces **83**D and **83**F in the orthogonal direction D**6**. Thus, the appearance of the second cut surface **93** differs from the appearance of the second adjacent surfaces **83**A and **83**B. Note that the second cut surface **93** may be a surface subjected to surface finish after the connector bar **104** is cut off from the plurality of first exposed portions **74**. Similarly, the second adjacent surfaces **83**A and **83**B may be surfaces subjected to surface finish. In a case where the second cut surface **93** is subjected to surface finish, the second shear surface **93**A and the second fracture surface **93**B are at least partially replaced with finished surfaces. In a case where the second adjacent surface **83**A is subjected to surface finish, the shear surface **83**C and the fracture surface **83**D are at least partially replaced with finished surfaces. In a case where the second adjacent surface **83**B is subjected to surface finish, the shear surface **83**E and the fracture surface **83**F are at least partially replaced with finished surfaces. Accordingly, the appearance of the second cut surface **93** may be the same as the appearance of the second adjacent surfaces **83**A and **83**B.

(59) As illustrated in FIG. **6**, the third surface **85** includes a third cut surface **95** having an area smaller than an area of the third surface **85**. The third cut surface **95** is disposed within the opening **71**B. A length L**31** of the third cut surface **95** in the longitudinal direction D**4** is shorter than a length L**32** of the third surface **85** in the longitudinal direction D**4**. The third surface **85** includes third adjacent surfaces **85**A and **85**B adjacent to the third cut surface **95**. The appearance of the third cut surface **95** differs from the appearance of each of the third adjacent surfaces **85**A and **85**B. The appearance of the third adjacent surface **85**A is the same as the appearance of the third adjacent surface **85**B.

(60) As described below, the third cut surface **95** is a surface formed when the connector bar **104** (see FIGS. **9** to **11**) is cut off from the plurality of first exposed portions **74** during manufacture of the lead block **70**. The third adjacent surfaces **85**A and **85**B are surfaces formed by, for example, press machining (e.g., shearing), while the third cut surface **95** is a surface formed in a step different from and later than a step for forming the third adjacent surfaces **85**A and **85**B. The third cut surface **95** is, for example, a surface formed by press machining (e.g., shearing) similarly to the third adjacent surfaces **85**A and **85**B.

(61) As illustrated in FIG. **15**, the third adjacent surface **85**A includes a shear surface **85**C and a fracture surface **85**D. The fracture surface **85**D is adjacent to the shear surface **85**C in the orthogonal direction D**6**. The shear surface **85**C is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The fracture surface **85**D is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **85**C differs from the appearance of the fracture surface **85**D.
(62) Similarly, the third adjacent surface **85**B includes a shear surface **85**E and a fracture surface **85**F. The fracture surface **85**F is adjacent to the shear surface **85**E in the orthogonal direction D**6**. The shear surface **85**E is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The fracture surface **85**F is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the shear surface **85**E differs from the appearance of the fracture surface **85**F.
(63) The third cut surface **95** includes a third shear surface **95**A and a third fracture surface **95**B. The third fracture surface **95**B is adjacent to the third shear surface **95**A in the orthogonal direction D**6**. The third shear surface **95**A is a surface formed during shearing by shearing of the material using the punch and die, and includes a plurality of streaks extending in one direction (e.g., the orthogonal direction D**6**). The third fracture surface **95**B is a surface formed during shearing by fracturing of the material after shearing of a portion of the material using the punch and die, and includes fine recesses and protruding portions. Thus, the appearance of the third shear surface **95**A differs from the appearance of the third fracture surface **95**B.
(64) As illustrated in FIG. **15**, the length of the third shear surface **95**A in the orthogonal direction D**6** differs from the length of the shear surfaces **85**C and **85**E in the orthogonal direction D**6**. The length of the third fracture surface **95**B in the orthogonal direction D**6** differs from the length of the fracture surfaces **85**D and **85**F in the orthogonal direction D**6**. Accordingly, the appearance of the third cut surface **95** differs from the appearance of the third adjacent surfaces **85**A and **85**B. Note that the third cut surface **95** may be a surface subjected to surface finish after the connector bar **104** is cut off from the plurality of first exposed portions **74**. Similarly, the third adjacent surfaces **85**A and **85**B may be surfaces subjected to surface finish. In a case where the third cut surface **95** is subjected to surface finish, the third shear surface **95**A and the third fracture surface **95**B are at least partially replaced with finished surfaces. In a case where the third adjacent surface **85**A is subjected to surface finish, the shear surface **85**C and the fracture surface **85**D are at least partially replaced with finished surfaces. In a case where the third adjacent surface **85**B is subjected to surface finish, the shear surface **85**E and the fracture surface **85**F are at least partially replaced with finished surfaces. Accordingly, the appearance of the third cut surface **95** may be the same as the appearance of the third adjacent surfaces **85**A and **85**B.
(65) As illustrated in FIG. **3**, in the at least one first busbar **77**, the first exposed portion **74** is disposed between the first end portion **77**A and the first additional end portion **77**B. In the at least one first busbar **77**, the first cut surface **90** and the first additional cut surface **91** are disposed between the first end portion **77**A and the first additional end portion **77**B. In the second busbar **78**, the second cut surface **93** is disposed between the second end portion **78**A and the second additional end portion **78**B. In the third busbar **79**, the third cut surface **95** is disposed between the third end portion **79**A and the third additional end portion **79**B.
(66) As illustrated in FIG. **6**, the first protruding portion **87** includes a second additional cut surface **97**. The second additional cut surface **97** is an end portion surface of the first protruding portion **87** and is exposed from the lead block body **71**. As described below, the second additional cut surface **97** is a surface formed when the connector bar **104** (see FIGS. **9** to **11**) is cut off from the first

protruding portion **87** during manufacture of the lead block **70**.
(67) As illustrated in FIG. **5**, the second protruding portion **88** includes a third additional cut surface **98**. The third additional cut surface **98** is an end portion surface of the second protruding portion **88** and is exposed from the lead block body **71**. As described below, the third additional cut surface **98** is a surface formed when the connector bar **104** (see FIGS. **9** to **11**) is cut off from the second protruding portion **88** during manufacture of the lead block **70**.
(68) The plurality of exposed portions **73** respectively include a plurality of cable mounting surfaces **73**A. The cable mounting surface **73**A is disposed facing in the orthogonal direction D**6**. The plurality of cable mounting surfaces **73**A lie opposite to the electrical cable **60** (see FIG. **2**) connected to the plurality of busbars **72**.
(69) As illustrated in FIG. **6**, the plurality of exposed portions **73** respectively include a plurality of back surfaces **73**B. The back surface **73**B is disposed on the reverse side of the cable mounting surface **73**A in the orthogonal direction D**6**. The back surface **73**B is disposed facing in the orthogonal direction D**6**.
(70) As illustrated in FIG. **7**, the plurality of exposed portions **73** respectively include a plurality of projections **73**C. The projection **73**C protrudes from the cable mounting surface **73**A in the orthogonal direction D**6**. The plurality of projections **73**C are respectively electrically connected to a plurality of wires included in the electrical cable **60** (see FIG. **2**). For example, the plurality of projections **73**C are connected by a connection method such as ultrasonic bonding or resistance welding with the plurality of wires included in the electrical cable **60** (see FIG. **2**).
(71) The plurality of exposed portions **73** respectively include a plurality of recesses **73**D. The recess **73**D is disposed in the back surface **73**B of each of the plurality of exposed portions **73**. The recess **73**D is disposed on the reverse side of the projection **73**C in the orthogonal direction D**6**. The projection **73**C and the recess **73**D are formed by, for example, press machining. At least one of the projection **73**C and the recess **73**D may be omitted from the exposed portion **73**.
(72) A method of manufacturing the lead block **70** will be described with reference to FIGS. **8** to **11**.
(73) As illustrated in FIGS. **8** and **9**, the method of manufacturing the lead block **70** includes the press machining step S**1** of forming, by press machining, a busbar plate **102** from a plate **100** including an electrically conductive material. As illustrated in FIG. **9**, the busbar plate **102** includes the plurality of busbars **72**, the connector bar **104** connecting the plurality of exposed portions **73** of the plurality of busbars **72** together, and a carrier **106** connecting the plurality of busbars **72** together. The plurality of first end portions **77**A, the second end portion **78**A, and the third end portion **79**A are connected to the carrier **106**.
(74) As illustrated in FIGS. **8** and **10**, the method of manufacturing the lead block **70** includes the molding step S**2** of embedding, in the lead block body **71** by insertion molding, the busbar plate **102** including the plurality of busbars **72** and the connector bar **104** connecting the plurality of exposed portions **73** of the plurality of busbars **72** together so that the plurality of exposed portions **73** is exposed from the lead block body **71**.
(75) The molding step S**2** includes the step S**21** of embedding the busbar plate **102** in the lead block body **71** by the insertion molding so that the plurality of exposed portions **73** and at least a portion of the connector bar **104** are disposed within the opening **71**B of the lead block body **71**. The molding step S**2** includes the step S**22** of embedding the busbar plate **102** in the lead block body **71** by the insertion molding so that a portion of the connector bar **104** is embedded in the lead block body **71**. The steps S**21** and S**22** are typically performed by a single insertion molding operation, but may be performed by separate insertion molding operations. Additionally, one of the steps S**21** and S**22** may be omitted from the molding step S**2**.
(76) As illustrated in FIGS. **8** and **11**, the method of manufacturing the lead block **70** includes the cutting step S**3** of cutting the connector bar **104** off from the plurality of exposed portions **73**. The cutting step S**3** includes the step S**31** of cutting the connector bar **104** off from the plurality of

exposed portions **73** via the opening **71**B in the lead block body **71**. For example, in the cutting step S**3**, the connector bar **104** is cut off from the plurality of exposed portions **73** by press machining.

(77) As illustrated in FIG. **11**, the connector bar **104** includes a plurality of first connecting portions **104**A, a second connecting portion **104**B, and a third connecting portion **104**C. When the plurality of first connecting portions **104**A are cut off from the plurality of exposed portions **73**, the plurality of first cut surfaces **90** (see FIG. **5**), the plurality of first additional cut surfaces **91** (see FIG. **6**), the second cut surface **93** (see FIG. **5**), and the third cut surface **95** (see FIG. **6**) are formed. When the second connecting portion **104**B is cut off from the first protruding portion **87**, the second additional cut surface **97** (see FIG. **6**) is formed. When the third connecting portion **104**C is cut off from the second protruding portion **88**, the third additional cut surface **98** (see FIG. **5**) is formed.

(78) As illustrated in FIGS. **8** and **11**, the method of manufacturing the lead block **70** includes the carrier cutting step S**4** including cutting the carrier **106** off from the plurality of busbars **72**. For example, by press machining, the carrier **106** is cut off from the plurality of busbars **72**. Thus, the lead block **70** is manufactured. Note that in a case where the busbar plate **102** does not include the carrier **106**, the carrier cutting step S**4** may be omitted. Also, the cutting step S**3** and the carrier cutting step S**4** may be performed simultaneously as a single step or may be performed at different timings as separate steps.

(79) The aspects of the lead block **70** according to the present embodiment are as follows.

(80) (1) The lead block **70** includes the lead block body **71** including an electrical insulating material and the plurality of busbars **72** each partially embedded in the lead block body **71** and including an electrically conductive material. The plurality of busbars **72** include the plurality of exposed portions **73** exposed from the lead block body **71** and respectively corresponding to the plurality of busbars **72**. The plurality of exposed portions **73** each extend in the longitudinal direction D**4** and are disposed spaced apart from one another in the arrangement direction D**5** orthogonal to the longitudinal direction D**4**. The plurality of exposed portions **73** include at least one first exposed portion **74**. The at least one first exposed portion **74** includes the first surface **80** and the first additional surface **81** disposed on the reverse side of the first surface **80** in the arrangement direction D**5**. The first surface **80** includes a first cut surface **90** having an area smaller than an area of the first surface **80**. The first additional surface **81** includes a first additional cut surface **91** having an area smaller than an area of the first additional surface **81**.

(81) In the lead block **70**, the first cut surface **90** having the area smaller than the area of the first surface **80** is disposed on the first surface **80**, and the first additional cut surface **91** having the area smaller than the area of the first additional surface **81** is disposed on the first additional surface **81**. Thus, discarded materials cut off from the plurality of busbars **72** can be reduced. This enables a reduction in the manufacturing costs of the lead block **70**.

(82) (2) The first surface **80** includes the first adjacent surface **80**A adjacent to the first cut surface **90**. The first additional surface **81** includes the first additional adjacent surface **81**A adjacent to the first additional cut surface **91**. The appearance of the first cut surface **90** differs from the appearance of the first adjacent surface **80**A. The appearance of the first additional cut surface **91** differs from the appearance of the first additional adjacent surface **81**A. Thus, the steps of surface finishing for the first cut surface **90** and the first additional cut surface **91** can be omitted. This enables a further reduction in the manufacturing costs of the lead block **70** compared to a configuration in which the first cut surface **90** and the first additional cut surface **91** are subjected to surface finish.

(83) (3) The first additional cut surface **91** is disposed on the reverse side of the first cut surface **90** in the arrangement direction D**5**. Thus, for example, during manufacture, when the connector bar connecting the plurality of exposed portions **73** is cut off from the plurality of exposed portions **73**, possible deformation of the plurality of exposed portions **73** can be suppressed.

(84) (4) The length of the first cut surface **90** in the longitudinal direction D**4** is shorter than the

length of the first surface **80** in the longitudinal direction D**4**. The length of the first additional cut surface **91** in the longitudinal direction D**4** is shorter than the length of the first additional surface **81** in the longitudinal direction D**4**. This enables a reduction in discarded materials cut off from the plurality of busbars **72** compared to a configuration in which the length of the first cut surface **90** is equal to the length of the first surface **80** and/or the length of the first additional cut surface **91** is equal to the length of the first additional surface **81**. This enables a further reduction in the manufacturing costs of the lead block **70**.

(85) (5) The plurality of exposed portions **73** include the second exposed portion **75**. The second exposed portion **75** includes the second surface **83** facing toward the at least one first exposed portion **74** in the arrangement direction D**5**, and the second additional surface **84** disposed on the reverse side of the second surface **83** in the arrangement direction D**5**. The second surface **83** includes the second cut surface **93** having an area smaller than an area of the second surface **83**. The second cut surface **93** having the area smaller than the area of the second surface **83** is disposed on the second surface **83**, and thus, during manufacture, the discarded materials cut off from the plurality of busbars **72** can be reduced. This enables a further reduction in the manufacturing costs of the lead block **70**.

(86) (6) One of the plurality of busbars **72** includes the first protruding portion **87** protruding from the second additional surface **84** of the second exposed portion **75** in the arrangement direction D**5**. The first protruding portion **87** is at least partially embedded in the lead block body **71**. This enables an increase in the connection strength between the second exposed portion **75** and the lead block body **71**, with the manufacturing costs of the lead block **70** reduced. During manufacture, in a case where the connector bar connecting the plurality of exposed portions **73** includes the first protruding portion **87**, a portion of the connector bar can be utilized to increase the connection strength, allowing facilitation of effective utilization of the material of the lead block **70**, with the connection strength between the second exposed portion **75** and the lead block body **71** increased.

(87) (7) The plurality of exposed portions **73** include the third exposed portion **76**. The third exposed portion **76** includes the third surface **85** facing toward the at least one first exposed portion **74** in the arrangement direction D**5**, and the third additional surface **86** disposed on the reverse side of the third surface **85** in the arrangement direction D**5**. The third surface **85** includes the third cut surface **95** having an area smaller than an area of the third surface **85**. The third cut surface **95** having the area smaller than the area of the third surface **85** is disposed on the third surface **85**, and thus, during manufacture, the discarded materials cut off from the plurality of busbars **72** can be reduced. This enables a further reduction in the manufacturing costs of the lead block **70**.

(88) (8) The second protruding portion **88** is included that protrudes from the third additional surface **86** of the third exposed portion **76** in the arrangement direction D**5**. The second protruding portion **88** is at least partially embedded in the lead block body **71**. This enables an increase in the connection strength between the third exposed portion **76** and the lead block body **71**, with the manufacturing costs of the lead block **70** reduced. In a case where the connector bar connecting the plurality of exposed portions **73** at the time of manufacture includes the second protruding portion **88**, a portion of the connector bar can be utilized to increase the connection strength, allowing facilitation effective utilization of the material of the lead block **70**, with the connection strength between the third exposed portion **76** and the lead block body **71** increased.

(89) (9) The plurality of busbars **72** include the at least one first busbar **77** that includes the at least one first exposed portion **74**. The at least one first busbar **77** includes the first end portion **77**A and the first additional end portion **77**B. In the at least one first busbar **77**, the first cut surface **90** and the first additional cut surface **91** are disposed between the first end portion **77**A and the first additional end portion **77**B. By providing the first cut surface **90** and the first additional cut surface **91** on portions other than the first end portion **77**A and the first additional end portion **77**B, integral holding of the plurality of busbars **72** can be facilitated with less materials during manufacture.

(90) (10) The first end portion **77**A is exposed from the lead block body **71**. As viewed in the

orthogonal direction D**6** orthogonal to the longitudinal direction D**4** and the arrangement direction D**5**, the first additional end portion **77**B is disposed inside the contour of the lead block body **71**. This allows suppression of contact of the first additional end portion **77**B with another member such as a cable compared to a configuration in which the first additional end portion **77**B is disposed on or outside the contour of the lead block body **71**.

(91) (11) The first additional end portion **77**B is at least partially embedded in the lead block body **71**. This allows reliable suppression of contact of the first additional end portion **77**B with another member such as a cable.

(92) (12) The lead block body **71** includes the opening. The first cut surface **90** and the first additional cut surface **91** are disposed within the opening. Thus, during manufacture, the connector bar connecting the plurality of exposed portions **73** together can be cut off from the plurality of connecting portions via the opening.

(93) (13) The rotary connector device **1** includes the stator **10**, the rotator **20** provided rotatably about the rotation axis A**1** with respect to the stator **10**, and the lead block **70**. The manufacturing costs of the lead block **70** can be reduced, and thus, the manufacturing costs of the rotary connector device **1** can be reduced.

(94) (14) The method of manufacturing the lead block **70** includes: the molding step S**2** including embedding, in the lead block body **71** by the insertion molding, the busbar plate **102** including the plurality of busbars **72** and the connector bar **104** connecting the plurality of exposed portions **73** of the plurality of busbars **72** together so that the plurality of exposed portions **73** is exposed from the lead block body **71**; and the cutting step S**3** including cutting the connector bar **104** off from the plurality of exposed portions **73**. In this manufacturing method, the discarded material cut off from the plurality of busbars **72** can be reduced. This enables a reduction in the manufacturing costs of the lead block **70**.

(95) (15) The molding step S**2** includes the step S**21** of embedding the busbar plate **102** in the lead block body **71** by the insertion molding so that the plurality of exposed portions **73** and at least a portion of the connector bar are disposed within the opening in the lead block body **71**. This allows the peripheral portion of the plurality of exposed portions **73** to be held by the lead block body **71**.

(96) (16) The cutting step S**3** includes the step S**31** of cutting the connector bar **104** off from the plurality of exposed portions **73** via the opening **71**B in the lead block body **71**. This allows the connector bar to be cut off from the plurality of exposed portions **73**, with the peripheral portion of the plurality of exposed portions **73** held by the lead block body **71**. This stabilizes the cutting operation.

(97) (17) The molding step S**2** includes the step of embedding the busbar plate **102** in the lead block body **71** by the insertion molding so that a portion of the connector bar **104** embedded in the lead block body **71**. This enables an increase in the connection strength between the plurality of exposed portions **73** and the lead block body **71**.

(98) (18) The method of manufacturing the lead block **70** further includes the press machining step S**1** including forming, by press machining, the busbar plate **102** from the plate **100** including the electrically conductive material. The press machining enables a reduction in remaining portions cut off from the busbar plate **102** by press machining.

(99) As illustrated in FIG. **12**, in the present embodiment, the length of the first shear surface **90**A in the orthogonal direction D**6** is longer than the length of the shear surfaces **80**C and **80**E in the orthogonal direction D**6**. However, as illustrated in FIG. **16**, the length of the first shear surface **90**A in the orthogonal direction D**6** may be shorter than the length of the shear surfaces **80**C and **80**E in the orthogonal direction D**6**. Additionally, the length of the first shear surface **90**A in the orthogonal direction D**6** may be equal to the length of the shear surfaces **80**C and **80**E in the orthogonal direction D**6**. The dimensional relationship described above can be applied to the dimensional relationship between the first additional shear surface **91**A and the additional shear surfaces **81**C and **81**E, and to the dimensional relationship between the second shear surface **93**A

and the shear surfaces **83**C and **83**E, and to the dimensional relationship between the third shear surface **95**A and the shear surfaces **85**C and **85**E.

(100) As illustrated in FIG. **12**, in the present embodiment, the first shear surface **90**A and the shear surfaces **80**C and **80**E are disposed closer to the cable mounting surface **73**A than the first fracture surface **90**B and the fracture surfaces **80**D and **80**F. However, as illustrated in FIG. **17**, the first fracture surface **90**B may be disposed near the cable mounting surface **73**A.

(101) As illustrated in FIGS. **4** to **6**, in the present embodiment, the first cut surface **90** is disposed flush with the first adjacent surfaces **80**A and **80**B in the arrangement direction D**5**. However, as illustrated in FIGS. **18** and **19**, the first cut surface **90** need not be disposed flush with the first adjacent surfaces **80**A and **80**B. The first additional cut surface **91** need not be disposed flush with the first additional adjacent surfaces **81**A and **81**B. The first cut surface **90** may be offset from the first adjacent surfaces **80**A and **80**B in the arrangement direction D**5**. The first additional cut surface **91** may be offset from the first additional adjacent surfaces **81**A and **81**B in the arrangement direction D**5**. This also applies to the positional relationship between the second cut surface **93** and the second adjacent surfaces **83**A and **83**B in the arrangement direction D**5**. The above-described relationship also applies to the positional relationship between the third cut surface **95** and the third adjacent surfaces **85**A and **85**B in the arrangement direction D**5**.

(102) In the present embodiment and the above-described modified examples, the material is cut by press machining (specifically, shearing), but any other cutting method can be applied.

(103) It should be noted that, in the present application, “comprise” and its derivatives are open-ended terms describing the presence of a component and do not exclude the presence of other components not described. This also applies to “have”, “include”, and their derivatives.

(104) In the present application, a number such as “first” or “second” is merely a term for identifying a configuration, and does not have any other meaning (e.g., a particular order, or the like). For example, the presence of a “first element” does not imply that a “second element” exists, and the presence of a “second element” does not imply that a “first element” exists.

(105) Additionally, expressions such as “parallel”, “orthogonal”, and “identical” in the present disclosure should not be interpreted strictly and include respectively the meanings of “substantially parallel”, “substantially orthogonal”, and “substantially identical”. Further, representations of other arrangements are not to be strictly interpreted.

(106) Furthermore, the expression “at least one of A and B” in the present disclosure encompasses, for example, all of (1) only A, (2) only B, and (3) both A and B. The expression “at least one of A, B, and C” encompasses, for example, all of (1) only A, (2) only B, (3) only C, (4) A and B, (5) B and C, (6) A and C, and (7) all of A, B, and C. In the present disclosure, the expression “at least one of A and B” is not interpreted as “at least one of A and at least one of B”.

(107) Various alterations and modifications of the disclosure are apparent from the foregoing disclosure. Accordingly, the disclosure may be implemented in a manner different from the specific disclosure of the present application without departing from the spirit of the disclosure.

Claims

1. A lead block comprising: a lead block body including an electrical insulating material; a plurality of busbars each partially embedded in the lead block body and comprising an electrically conductive material; the plurality of busbars comprising a plurality of exposed portions exposed from the lead block body and respectively corresponding to the plurality of busbars; the plurality of exposed portions each extending in a longitudinal direction and disposed spaced apart from one another in an arrangement direction orthogonal to the longitudinal direction; the plurality of exposed portions comprising at least one first exposed portion; the at least one first exposed portion comprising a first surface and a first additional surface disposed on a reverse side of the first surface in the arrangement direction; the first surface comprising a first cut surface having an area

smaller than an area of the first surface; and the first additional surface comprising a first additional cut surface having an area smaller than an area of the first additional surface.
2. The lead block according to claim 1, wherein the first additional cut surface is disposed on a reverse side of the first cut surface in the arrangement direction.
3. The lead block according to claim 1, wherein a length of the first cut surface in the longitudinal direction is shorter than a length of the first surface in the longitudinal direction, and a length of the first additional cut surface in the longitudinal direction is shorter than a length of the first additional surface in the longitudinal direction.
4. The lead block according to claim 1, wherein the lead block body comprises an opening, and the first cut surface and the first additional cut surface are disposed in the opening.
5. The lead block according to claim 1, wherein the first surface comprises a first adjacent surface adjacent to the first cut surface, the first additional surface comprises a first additional adjacent surface adjacent to the first additional cut surface, appearance of the first cut surface differs from appearance of the first adjacent surface, and appearance of the first additional cut surface differs from appearance of the first additional adjacent surface.
6. The lead block according to claim 5, wherein the first cut surface is offset from the first adjacent surface in the arrangement direction.
7. The lead block according to claim 5, wherein the first additional cut surface is offset from the first additional adjacent surface in the arrangement direction.
8. The lead block according to claim 1, wherein the plurality of busbars comprise at least one first busbar comprising the at least one first exposed portion, the at least one first busbar comprises a first end portion and a first additional end portion, and the first cut surface and the first additional cut surface are disposed between the first end portion and the first additional end portion in the at least one first busbar.
9. The lead block according to claim 8, wherein the first end portion is exposed from the lead block body, and the first additional end portion is disposed inside a contour of the lead block body as viewed in an orthogonal direction orthogonal to the longitudinal direction and the arrangement direction.
10. The lead block according to claim 8, wherein the first additional end portion is at least partially embedded in the lead block body.
11. The lead block according to claim 1, wherein the plurality of exposed portions comprises a second exposed portion, the second exposed portion comprises a second surface facing toward the at least one first exposed portion in the arrangement direction, and a second additional surface disposed on a reverse side of the second surface in the arrangement direction, and the second surface comprises a second cut surface having an area smaller than an area of the second surface.
12. The lead block according to claim 11, wherein one of the plurality of busbars comprises a first protruding portion protruding from the second additional surface of the second exposed portion in the arrangement direction, and the first protruding portion is at least partially embedded in the lead block body.
13. The lead block according to claim 11, wherein the plurality of exposed portions comprises a third exposed portion, the third exposed portion comprises a third surface facing toward the at least one first exposed portion in the arrangement direction, and a third additional surface disposed on a reverse side of the third surface in the arrangement direction, and the third surface comprises a third cut surface having an area smaller than an area of the third surface.
14. The lead block according to claim 13, wherein one of the plurality of busbars comprises a second protruding portion protruding from the third additional surface of the third exposed portion in the arrangement direction, and the second protruding portion is at least partially embedded in the lead block body.
15. A rotary connector device comprising: a stator; a rotator provided rotatably about a rotation axis with respect to the stator; and a lead block comprising: a lead block body including an electrical

insulating material; a plurality of busbars each partially embedded in the lead block body and comprising an electrically conductive material; the plurality of busbars comprising a plurality of exposed portions exposed from the lead block body and respectively corresponding to the plurality of busbars; the plurality of exposed portions each extending in a longitudinal direction and disposed spaced apart from one another in an arrangement direction orthogonal to the longitudinal direction; the plurality of exposed portions comprising at least one first exposed portion; the at least one first exposed portion comprising a first surface and a first additional surface disposed on a reverse side of the first surface in the arrangement direction; the first surface comprising a first cut surface having an area smaller than an area of the first surface; and the first additional surface comprising a first additional cut surface having an area smaller than an area of the first additional surface.

16. A method of manufacturing a lead block, the method comprising: embedding, in a lead block body by insertion molding, a busbar plate including a plurality of busbars and a connector bar connecting a plurality of exposed portions of the plurality of busbars together so that the plurality of exposed portions is exposed from the lead block body; and cutting the connector bar off from the plurality of exposed portions.

17. The method of manufacturing a lead block according to claim 16, wherein the embedding comprises embedding the busbar plate in the lead block body by the insertion molding so that a portion of the connector bar is embedded in the lead block body.

18. The method of manufacturing a lead block according to claim 16, the method further comprising: forming, by press machining, the busbar plate from a plate comprising an electrically conductive material.

19. The method of manufacturing a lead block according to claim 16, wherein the embedding comprises embedding the busbar plate in the lead block body by the insertion molding so that the plurality of exposed portions and at least a portion of the connector bar are disposed in an opening of the lead block body.

20. The method of manufacturing a lead block according to claim 19, wherein the cutting comprises cutting the connector bar off from the plurality of exposed portions via the opening in the lead block body.