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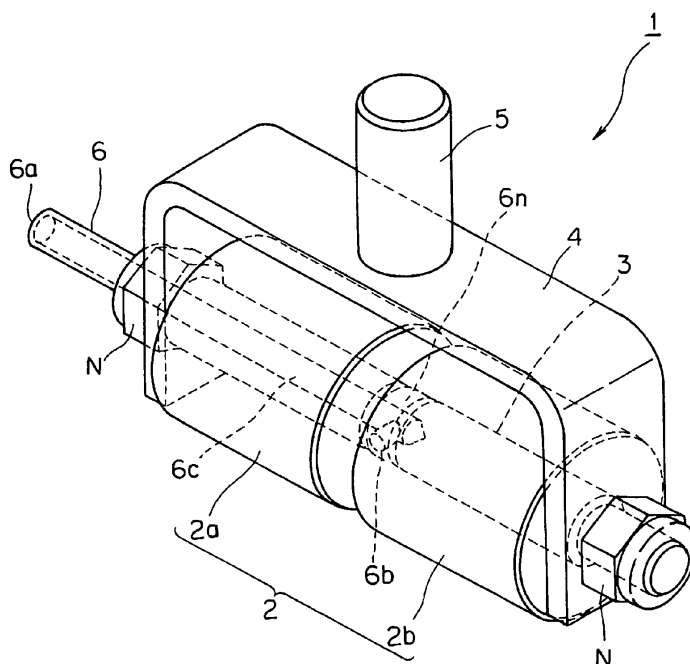
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(54) **Sheet metal repair jig**

(57) A sheet metal repair jig for smoothening a sheet metal by heating and cooling a part of the sheet metal to be repaired includes at least one roller (2) having a cylindrical shape, the roller (2) being made of an electrically-conductive material and serving as a heating means; a roller support shaft (3) supporting the roller pivotably about an axis of rotation of the cylindrical shape; a support (4) supporting the roller support shaft (3) and having

an electrode (5) electrically connected to the roller (2); and a cooling channel (6) serving as an air channel for discharging cooling air to a contact surface between the part of the sheet metal to be repaired and the roller (2). The cooling channel (6) is formed inside the roller support shaft (3) and has a discharge port (6b) that discharges the cooling air to the contact surface between the part of the sheet metal to be repaired and the roller (2).

[FIG. 1]



Description

BACKGROUND OF INVENTION

Field of the Invention

[0001] The present invention relates to a sheet metal repair jig for repairing dents or distortions generated in a curved surface or in a peripheral surface of a sheet metal used for vehicles or the like.

Background of the Invention

[0002] In repairing dents or distortions in a sheet metal of, for example, an automotive body which were caused by contact, crash, etc., first, the location of a dent or distortion is identified, accessories of a panel requiring repairs are detached, and coating applied to the identified location of the dent or distortion is removed. Next, with a puller or the like, the sheet metal having the dent or distortion is roughly flattened out by pulling, hammering, welding, etc. Then, the dent or distortion is heated and cooled repeatedly so as to utilize expansion due to heating and contraction due to cooling.

[0003] As a sheet metal repair jig for repairing dents or distortions in a sheet metal, the following art has been proposed (see JP Utility Model Appl. Publ. No. 3,154,968). This sheet metal repair jig includes: a roller serving as a heating means; a roller shaft for pivotably supporting the roller; and a U-shaped holding frame serving as a bearing for the roller shaft. By using this roller as a heat source and moving the roller at constant speed and in contact with a part to be repaired, an uneven heat distribution in the sheet metal is suppressed and repair works can be carried out without producing scratches.

[0004] As mentioned above, works for repairing dents or distortions in a sheet metal require heating and cooling to be repeated. In this respect, in the aforementioned conventional art, the use of a roller has facilitated the heating operation itself. However, to cool a part of a sheet metal to be repaired, the operator had to put a heating roller down and then pick up a separately-prepared cooling device to perform a cooling operation. Therefore, the operator needed to use the heating device and the cooling device alternately in carrying out the repair work, which was troublesome to the operator.

[0005] Further, high tensile strength steel sheets or the like used for recent automotive bodies are weak against heat, and thus needs to be expanded by being heated at a low temperature. It is important that the steel plate is cooled immediately after heating in order to avoid an excessive temperature rise. However, in the conventional sheet metal repair jig, since the operator each time had to alternate between the heating means and the cooling means, it was difficult to cool the sheet metal immediately after heating. Further, when there was a time lag from heating to cooling, the temperature of the heated part may become higher than the control temperature of

the heating means, depending on the degree of contact between the heated part of the sheet metal and the roller.

[0006] The present invention proposes to solve the aforementioned problem of the conventional art, and it is an object of the present invention to provide a sheet metal repair jig that can smoothly heat and cool a part of a sheet metal to be repaired to enhance precision of repair and to reduce the operator's workload.

10 SUMMARY OF INVENTION

[0007] In order to solve the aforementioned problem, according an aspect of the invention, a sheet metal repair jig for smoothening a sheet metal by heating and cooling a part of the sheet metal to be repaired, includes:

at least one roller having a cylindrical shape, the roller being made of an electrically-conductive material and serving as a heating means;

a roller support shaft supporting the roller pivotably about an axis of rotation of the cylindrical shape; a support supporting the roller support shaft and having an electrode electrically connected to the roller; and

a cooling channel serving as an air channel for discharging cooling air to a contact surface between the part of the sheet metal to be repaired and the roller,

wherein the cooling channel is formed inside the roller support shaft and has a discharge port that discharges the cooling air to the contact area between the part of the sheet metal to be repaired and the roller.

[0008] According to the above aspect, cooling air is discharged to an area in the vicinity of the roller of the sheet metal repair jig that is in contact with a part to be repaired. Therefore, it is possible to cool the sheet metal immediately after heating with the roller. Also, using this roller for heating allows not only a drawing process but also smoothening of a surface to be repaired with the roller, enabling a more precise repair.

[0009] Since a sheet metal used for automotive bodies or the like is formed into a curved surface or the like, a residual internal stress exists. In this case, after the heating, if the heated sheet metal is subject to natural heat radiation or is left to let cool, the shape etc. of the curved surface of the sheet metal is distorted. Therefore, the sheet metal needs to be cooled immediately after heating. In this respect, in the present aspect, the sheet metal can be cooled immediately after heating, since cooling air is discharged from a discharge port through a cooling channel simultaneously with the heating by the roller.

[0010] According to this aspect of the invention, particularly, it is possible to repair heat-sensitive materials, e.g., high tensile strength steel sheets, at a low temperature, since the steel plate can be prevented from reaching an unnecessarily high temperature even when heated by the roller.

[0011] Conventionally, since the heating means and the cooling means were separately provided, after a part of a sheet metal to be repaired has been heated, the operator puts down a heating device used for heating and then holds a cooling device to carry out cooling. In this respect, according to the present aspect, both heating and cooling can be performed with a single device, thereby significantly eliminating the burden on the operator.

[0012] As a device for discharging gases in the vicinity of the point of operation, such devices as those used for CO₂ welding or MAG welding are typically known. However, the discharge gas of these devices serves as a shielding gas for preventing a metal melted by arc welding from being exposed to air. Accordingly, this discharge gas totally differs from the cooling air of the present invention in terms of technical idea.

[0013] The temperature of the roller may increase above the control temperature due to an increase and decrease in the resistance depending on the extent of contact area or due to contact over a long period of time. In this respect, in the present aspect, since the sheet metal can be cooled by the cooling means immediately after the roller has contacted the sheet metal, the temperature is less influenced by both the contact area or the contact time. Thus, in sheet metal repair works in which expert skills are ultimately of importance, it is possible to provide a jig that eliminates the difference in skill between the inexperienced operator and the expert.

[0014] Preferably, the sheet metal repair jig includes a plurality of rollers arranged along the axis of rotation, and the discharge port is formed in a gap between the plurality of rollers.

[0015] With the sheet metal repair jig of the above configuration, the sheet metal repair jig includes the plurality of rollers, and the discharge port for discharging cooling air is formed in a gap therebetween. Therefore, the cooling air can be supplied uniformly in the width direction of the contact surface between a part of the sheet metal to be repaired and the roller (in a direction of the roller shaft).

[0016] Preferably, the sheet metal repair jig includes two rollers of the same size and shape, and the discharge port is formed in a gap between the two rollers.

[0017] With the sheet metal repair jig of the above configuration, the sheet metal repair jig includes two rollers, and a port for discharging cooling air is formed in a gap situated centrally between the rollers. By discharging the cooling air from the discharge port toward a contact surface between the roller and the sheet metal, the cooling air can be supplied uniformly across the entire contact surface between the roller and a part of the sheet metal to be repaired.

[0018] According to the aforementioned present invention, it is possible to provide a sheet metal repair jig that can smoothly heat and cool a part of a sheet metal to be repaired to enhance precision of repair and to reduce the operator's workload.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

Fig. 1 is a perspective view illustrating an overall constitution of a sheet metal repair jig according to an embodiment of the present invention.

Fig. 2 is a plan view illustrating an overall constitution of a sheet metal repair jig according to an embodiment of the present invention.

Fig. 3 is a schematic side view illustrating an operation of a sheet metal repair jig according to an embodiment of the present invention.

Fig. 4 is a plan view illustrating an overall constitution of a sheet metal repair jig according to another embodiment of the present invention.

Fig. 5 is a perspective view illustrating an overall constitution of a sheet metal repair jig according to another embodiment of the present invention.

DETAILED DESCRIPTION

[0020] Hereinafter, the present invention will be described with reference to the drawings illustrating embodiments thereof.

1. Present Embodiment

[0021] A sheet metal repair jig 1 according to an embodiment (hereinafter the present embodiment) is a jig configured to repair a sheet metal made of, for example, a general steel plate, an aluminum sheet metal, a stainless-steel sheet metal or a high tensile strength steel sheet by smoothening a part of the sheet metal to be repaired by heating and cooling. As shown in Figs. 1 and 2, the sheet metal repair jig 1 includes: a roller 2 having a cylindrical shape and made of an electrically-conductive material; a roller support shaft 3 supporting the roller 2 pivotably about an axis of rotation of the cylinder; a support 4 supporting the roller support shaft 3; an electrode 5 disposed at one end of the support 4 and electrically connected to the roller 2; and a cooling channel 6 serving as a channel for discharging cooling air to a contact surface of the roller 2.

[0022] The roller 2 is a heating means which produces resistive heat when an electric current is passed through. The roller 2 has a cylindrical shape and is made of an electrically-conductive material such as copper or ferrite. In the present embodiment, sheet metal repair jig 1 includes two rollers of the same size and shape, or, the roller 2 includes two portions (rollers 2a, 2b) of the same size and shape. A gap between the two rollers 2a, 2b is preferably as small as possible as long as the function of the discharge port 6b is achieved, although it depends on a size of a discharge port 6b to be described later.

[0023] Here, the roller 2 is made of copper or ferrite, and not of carbon as disclosed in JP Utility Model Appl. Publ. No. 3,154,968, which is mentioned above. This is

due to the following reasons. In JP Utility Model Appl. Publ. No. 3,154,968, heat generation performance is maintained without generating an arc. However, as pointed out in JP Utility Model Appl. Publ. No. 3,154,968, carbon is less wear-resistant than copper and wears down at a higher rate. Therefore, when used for a roller, there were cases where a part of a sheet metal to be repaired could not be flattened out appropriately due to worn away unsmooth carbon. In the present embodiment, this disadvantage of carbon is eliminated by adjusting a current flowing into the roller, as well as by providing a cooling means described below and using copper or ferrite which is more wear-resistant.

[0024] The roller support shaft 3 is a rod-shaped object which pivotably supports the two rollers 2a, 2b. The roller support shaft 3 has a hollow section extending from one end to an intermediate position, i.e., an almost central position in the width direction, forming a cooling channel 6 to be described hereinafter. Further, the discharge port 6b described below is formed in a gap part between the two rollers 2a, 2b.

[0025] The support 4 is U-shaped in a plan view and is configured to support the roller support shaft 3 at both end portions. In the present embodiment, as shown in Fig. 1, the roller support shaft 3 is internally-threaded at both end portions and is secured to the support 4 with nuts N such that the support 4 is sandwiched therebetween. It is to be noted that the method of securing the support shaft 3 to the support 4 is not limited to this securing manner, but any publicly-known various securing methods may be employed as long as the roller support shaft 3 is secured to the support 4.

[0026] The electrode 5 is formed at a bottom part of the U-shape of the support 4 having a U-shaped configuration in a planar view and is disposed in a direction perpendicular to the roller support shaft 3. The electrode 5 serves as a connecting portion to be electrically connected to an external current supply unit, which is not shown. As such a current supply unit, a publicly-known device such as the one disclosed as a sheet metal repair jig body in JP Utility Model Appl. Publ. No. 3,154,968 is used.

[0027] The roller 2, the roller support shaft 3, the support 4 and the electrode 5 are each comprised of an electrically-conductive member. An electric current which is input into the electrode 5 via the external current supply unit, which is not shown, flows into the roller 2 through the support 4 and the roller support shaft 3.

[0028] The cooling channel 6 is a cooling air conveying path that is formed in a hollow in the roller support shaft 3. At one end portion of the cooling channel 6, an air intake port 6a for introducing air from an external blower (publicly-known), which is not shown, is provided. At the other end portion thereof, the discharge port 6b that discharges the introduced air is provided. A flow channel 6c is formed between the air intake port 6a and the discharge port 6b.

[0029] The air intake port 6a is formed at one end por-

tion at which the support 4 pivotably supports the roller support shaft 3, and when an air-blast nozzle of the blower is connected to the air intake port 6a, the air intake port 6a becomes a port for introducing cooling air. The discharge port 6b in a gap between the two rollers 2 is formed at an axially central portion of the roller support shaft 3.

[0030] The discharge port 6b is formed by a nozzle 6n. With this nozzle 6n, a discharge direction of the discharge port 6b is directed towards a direction of a contact surface in which the roller 2 contacts the sheet metal, i.e., a direction perpendicular to a direction of a plane in the plan view of Fig. 2. A setting angle of the discharge direction is determined based on the reason described below. When using the sheet metal repair jig 1 in repair work, a connecting portion of a current supply unit, which is not shown, is connected to the electrode 5. The connecting portion of the current supply unit is exteriorly provided with a handle made of an insulating material. The operator grips the handle and moves the repair jig with the U-shaped plane surface of the support 4 being substantially aligned with the plane surface of the sheet metal (see Fig. 3). Therefore, with a discharge port being provided in a direction of the U-shaped planar surface of the support 4, the discharge port 6b can supply cooling air in the vicinity of the contact surfaces between the two rollers 2a, 2b and the sheet metal. As described above, the discharge direction of the discharge port 6b set by the nozzle 6n is directed toward the contact surface between the roller 2 and the sheet metal. However, the direction of the discharge port 6b can be varied appropriately, depending on an angular relationship between the electrode 5 or the operator handle and a surface of the sheet metal to be repaired. Preferably, the direction of the discharge port 6b is set in a direction in which cooling air directly hits a surface of the sheet metal to be repaired.

[0031] In the present embodiment, any type of gas, e.g., air and nitrogen, as well as carbonic acid gas (CO₂), can be used as air to be discharged from the discharge port 6b, as long as a part of the sheet metal to be repaired can be cooled.

[0032] The sheet metal repair jig 1 of the present embodiment constituted in the foregoing manner operates in the following manner. First, the electrode 5 of the sheet metal repair jig 1 is connected to an external current supply unit (publicly-known device is used), which is not shown. In turn, an air-blast nozzle of a blower (publicly-known), which is not shown, is connected to the air intake port 6a provided at one end of the roller support shaft 3 so as to define an air flow path of cooling air.

[0033] Next, the operator grips the handle provided at the connecting portion of the external current supply unit connected to the electrode 5 and starts operation. At this time, the current value of the external current supply unit is controlled to control the temperature at which the sheet metal repair jig 1 contacts the sheet metal.

[0034] Then, while gripping the handle, the operator makes the roller 2 contact a part of the sheet metal to be

repaired and rolls the roller 2 with respect to the surface to be repaired. At this time, a predetermined electricity flows into the roller 2 from the external current supply unit via the electrode 5, the support 4 and the roller support shaft 3 and a resistive heat is produced in the contact surface between the roller 2 and the sheet metal, and thereby a part of the sheet metal to be repaired is heated. Simultaneously, cooling air is supplied from the external blower. The cooling air passes through the air intake port 6a and the cooling channel 6 and is discharged from the discharge port 6b.

[0035] Here, as shown in a schematic side view of Fig. 3, when the sheet metal repair jig 1 is in use, the nozzle provided on the discharge port 6b of the cooling channel 6 is provided so as to be almost opposite a surface of the sheet metal to be repaired A. Therefore, cooling air to be discharged from the nozzle is discharged from a region between the two rollers 2a, 2b, hits the surface of the sheet metal to be repaired, spreads to right and left, and further spreads out across the contact surfaces between the rollers 2a, 2b and the sheet metal.

[0036] In the sheet metal repair jig 1 of the present embodiment described above, since the cooling air is discharged to an area in the vicinity of the roller 2 which is in contact with a part to be repaired, the heated part can be immediately cooled after the heating with the roller 2. Also, with the heating by such a roller, smoothing of the surface to be repaired with the roller as well as a drawing process is possible and a more precise repair is enabled.

[0037] Since a sheet metal used for automotive bodies or the like is formed into a curved surface or the like, a residual internal stress exists. In this case, after the heating, if the heated sheet metal is subjected to natural heat radiation or is left to let cool, the shape of the curved surface etc. of the sheet metal is distorted due to the residual stress. Therefore, the sheet metal needs to be cooled immediately after heating. In this respect, with the sheet metal repair jig 1 of the present embodiment, the sheet metal can be cooled immediately after heating, since cooling air is discharged from the discharge port 6b through the cooling channel 6 simultaneously with the heating by the roller 2. Particularly, it is possible to repair heat-sensitive materials, e.g., high tensile strength steel sheets, at a low temperature since the steel sheet can be prevented from reaching an unnecessarily high temperature by being heated with the roller 2.

[0038] Conventionally, since the heating means and the cooling means were separately provided, after a part of a sheet metal to be repaired has been heated, the operator puts down the sheet metal repair jig 1 used for the heating and then holds a cooling device to carry out cooling. In this respect, with the sheet metal repair jig 1 according to the present embodiment, both heating and cooling can be performed with a single device, thereby significantly eliminating the burden on the operator.

[0039] As a device for discharging gases in the vicinity of the point of operation, such devices as those used for

CO₂ welding or MAG welding are typically known. However, the discharge gas of these devices serves as a shielding gas for preventing a metal melted by arc welding from being exposed to air. Accordingly, this discharge gas totally differs from the cooling air of the sheet metal repair jig according to the present invention in terms of the technical idea.

[0040] The temperature of the roller 2 may increase above the control temperature due to an increase or decrease in the resistance depending on the extent of contact area, or due to contact over a long period of time. In this respect, with the sheet metal repair jig 1 of the present embodiment, since the sheet metal can be immediately cooled by the cooling means after the roller has contacted the sheet metal, the temperature is less influenced by the contact area or the contact time. Thus, in sheet metal repair works in which expert skills are ultimately of importance, it is possible to provide a jig that eliminates the difference in skill between the inexperienced operator and the expert.

[0041] Also, a plurality of rollers 2 are arranged along the axis of rotation, or, the roller 2 is divided into portions (in this case, into two), and the discharge port 6b for discharging cooling air is formed in a gap therebetween. Therefore, as shown in Fig. 3, the cooling air can be supplied uniformly in the width direction of the contact surface between a part of the sheet metal to be repaired and the roller (in direction of the roller shaft). Particularly, in the present embodiment, two rollers are arranged along the axis of rotation, or, the roller is divided into two sections, and a port for discharging cooling air is formed in a gap situated centrally between the rollers. By discharging the cooling air from the discharge port formed opposite the contact surface between the roller and the sheet metal, the cooling air can be supplied uniformly across the entire contact surface between the roller and a part of the sheet metal to be repaired.

2. Other embodiment

[0042] The present invention is not limited to the aforementioned embodiment but may include the embodiment described below. Specifically, although in the present embodiment, two rollers 2 are arranged along the axis of rotation, or, the roller 2 is divided into two sections, and the discharge port 6b is formed in the support shaft 3 centrally between the two rollers, the present invention is not limited to this embodiment, and three or four, or more rollers may be provided, or, the roller may be divided into three or four, or more sections.

[0043] For example, like a sheet metal repair jig 10 shown in Fig. 4, three rollers 20 are arranged along the axis of rotation, or, the roller 20 is divided into three, and two air intake ports 60a are provided at both ends of the rollers 20 so that the discharge ports 60b are formed in the two gaps between the rollers 20. In this embodiment, as shown in Fig. 4, the constitution can be employed as follows. Flow channels 60c are formed by the hollow sec-

tions of a roller support shaft 30, the flow channels 60c extending from both ends of the roller support shaft 30, respectively, to the first discharge ports 60b situated in the one-third positions in the width direction so that two cooling channels 60 beginning from both ends are formed, and two discharge ports 60b are formed accordingly. Also, as a variant, although not shown, another constitution may be employed wherein a hollow section is formed to extend from one end of the roller support shaft to the two-thirds position in the width direction so that a flow channel is provided, and discharge ports are provided in the middle and end portions.

[0044] In this embodiment, the discharge direction of the nozzle 6n comprised of the discharge port 6b is directed in a direction perpendicular to the direction of the plane in the plan view of Fig. 2. However, the present invention is not limited to this embodiment, but for example, the discharge direction of the nozzle 6n can be directed in the same direction as the axis of the electrode 5, i.e., in a directly downward direction in a perspective view of Fig. 1 or in a schematic view of Fig. 3. Alternatively, the discharge direction of the nozzle 6b may be directed in an oblique direction, which is an intermediate direction between the direction perpendicular to the direction of the plane of the plan view of Fig. 2 and a direction which is the same as the direction of the axis of the electrode 5. In other words, depending on the angle at which the roller 2 contacts a part of the sheet metal to be repaired, the discharge direction of the nozzle 6n is preferably directed in the same direction as the direction in which the roller contacts the sheet metal. It is also possible to employ another constitution wherein, for example, the nozzle 6n is pivotably attached to the support shaft 3 so that the discharge direction of the discharge port 6b for cooling air with the nozzle 6n is variable.

[0045] As a variant of the embodiment shown in Fig. 1, in addition to the embodiment in which cooling air is introduced from the end portion of the support shaft 3, an embodiment shown in Fig. 5 is possible. Fig. 5 is a schematic plan view of a sheet metal repair jig 20 according to the variant. In Fig. 5, for the sake of convenience of explanation, the support 4 is cut out above the roller 2 and illustrated in cross section.

[0046] As with the sheet metal repair jig 20 shown in Fig. 5, another constitution may be employed wherein a cooling channel 61 is formed perpendicular to the support shaft 3 in a gap between the rollers 2a, 2b and an air intake port 61a for cooling air is formed in an end portion of the cooling channel 61. In order to supply air, a hose (shown by a phantom line in the drawing) extending from an external blower, which is not shown, is attached to the air intake port 61a of the cooling channel 61. Also, in this case, a discharge port 61b is formed on the straight line of the introduction path of the cooling channel 61. The manner of using the sheet metal repair jig 20 is the same as the embodiment shown in Fig. 3.

[0047] Also, in this embodiment, as shown in Fig. 5, it is also conceivable to provide a constitution in which, in

a portion of the support shaft 3 covered with the roller 2, the cooling channel 61 situated centrally between the rollers 2a, 2b diverges horizontally inside the support shaft 3 and penetrate into end portion positions of the support shaft 3, and the ventilation holes 61d which communicate the cooling channel 61 inside the support shaft 3 with the rollers 2a, 2b and, are provided at central portions of the rollers 2a, 2b.

[0048] In this way, by providing the ventilation holes 61d in a portion of the support shaft 3 covered with the rollers 2a, 2b, a flow of air discharged from the ventilation holes 61d is produced within small clearances between the support shaft 3 and the backside of the rollers 2a, 2b, as indicated by the arrows in Fig. 5. This enables the rollers 2a, 2b to be cooled by the cooling air. Thus, it is possible to carry out repair treatment while the rollers 2a, 2b are kept at a low temperature to some extent.

[0049] The ventilation hole 61d may be of a circular or rectangular shape. Also, the ventilation hole 61d may be a single hole or a plurality of holes provided in each roller. Further, in Fig. 5, from a design point of view, the cooling channel 61 penetrates through the support shaft 3, and both ends are closed with the nuts N with caps. However, there are no functional problems as long as both end portions of the cooling channel 61 extend from the central portion in which the air intake port 61a and the discharge port 61b are formed to the positions of both ventilation holes 61d.

Claims

1. A sheet metal repair jig for smoothening a sheet metal by heating and cooling a part of the sheet metal to be repaired, comprising:

at least one roller having a cylindrical shape, the roller being made of an electrically-conductive material and serving as a heating means;
a roller support shaft supporting the roller pivotably about an axis of rotation of the cylindrical shape;
a support supporting the roller support shaft and having an electrode electrically connected to the roller; and
a cooling channel serving as an air channel for discharging cooling air to a contact surface between the part of the sheet metal to be repaired and the roller,

wherein the cooling channel is formed inside the roller support shaft and has a discharge port that discharges the cooling air to the contact surface between the part of the sheet metal to be repaired and the roller.

2. The sheet metal repair jig according to claim 1, wherein the sheet metal repair jig includes a plurality

of rollers arranged along the axis of rotation, and the discharge port is formed in a gap between the plurality of rollers.

3. The sheet metal repair jig according to claim 2, wherein the sheet metal repair jig includes two rollers of the same size and shape arranged along the axis of rotation, and the discharge port is formed in a gap between the two rollers.

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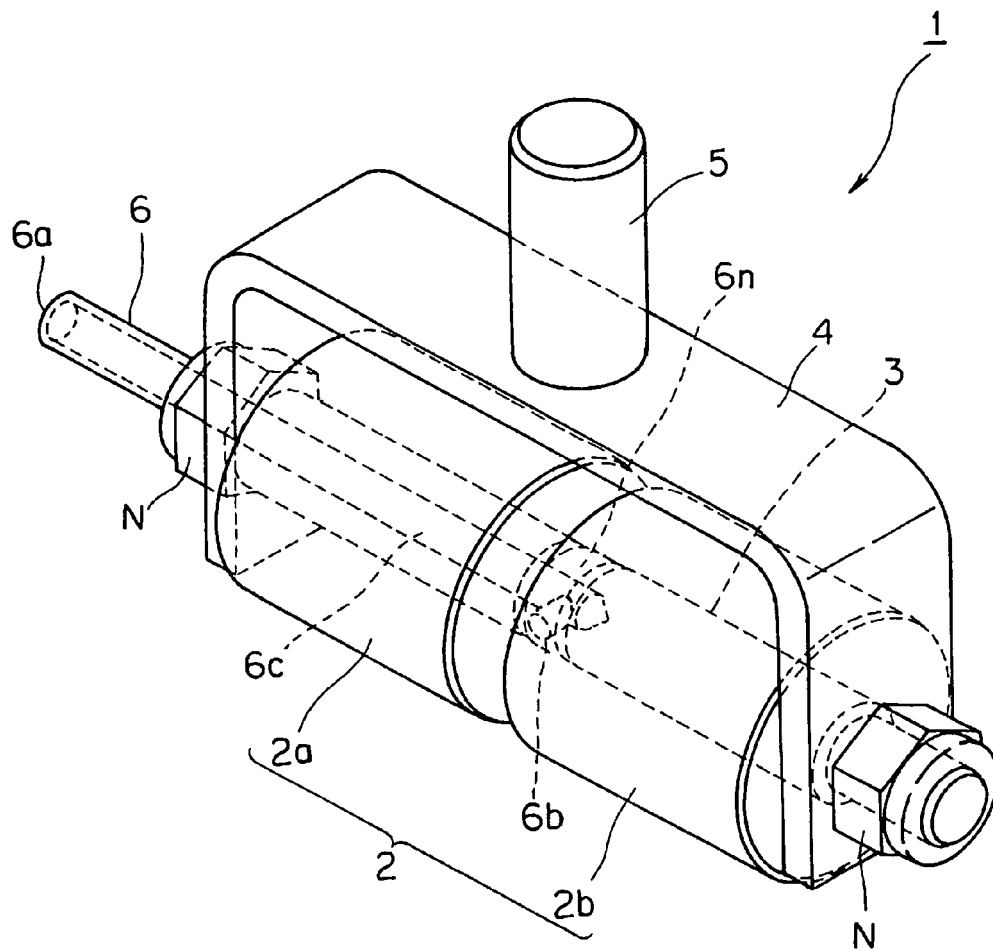
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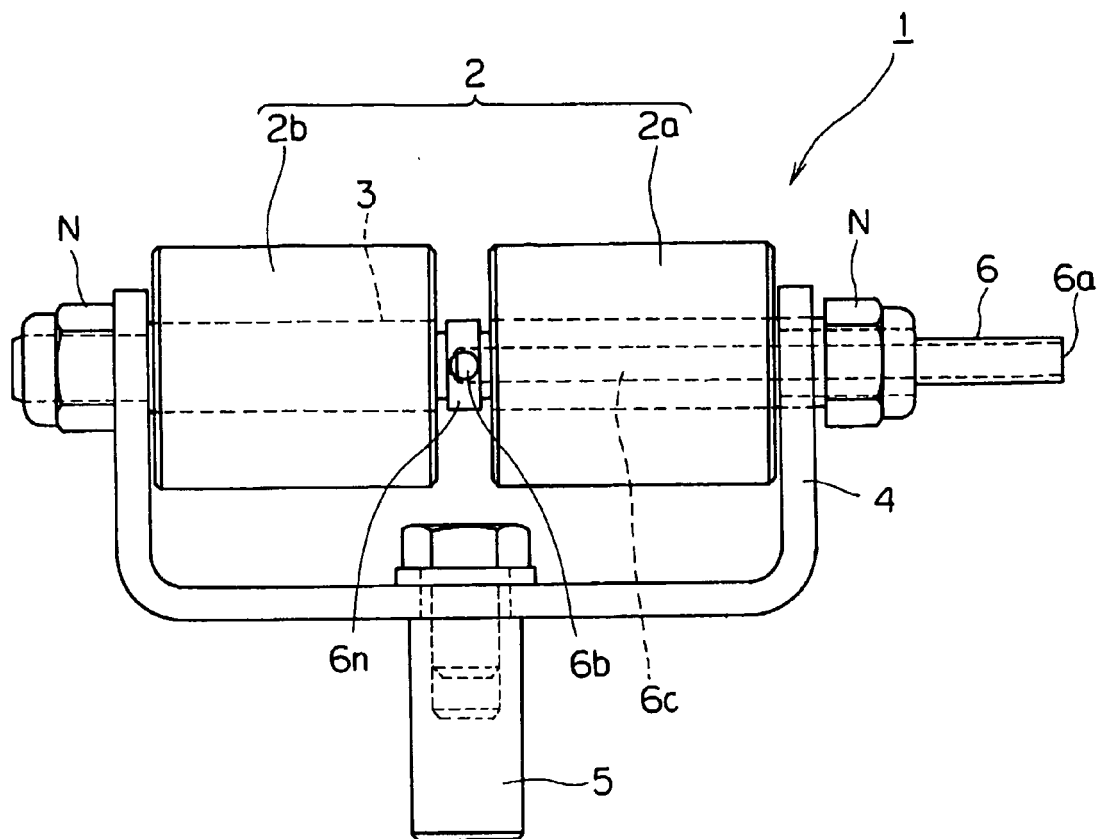
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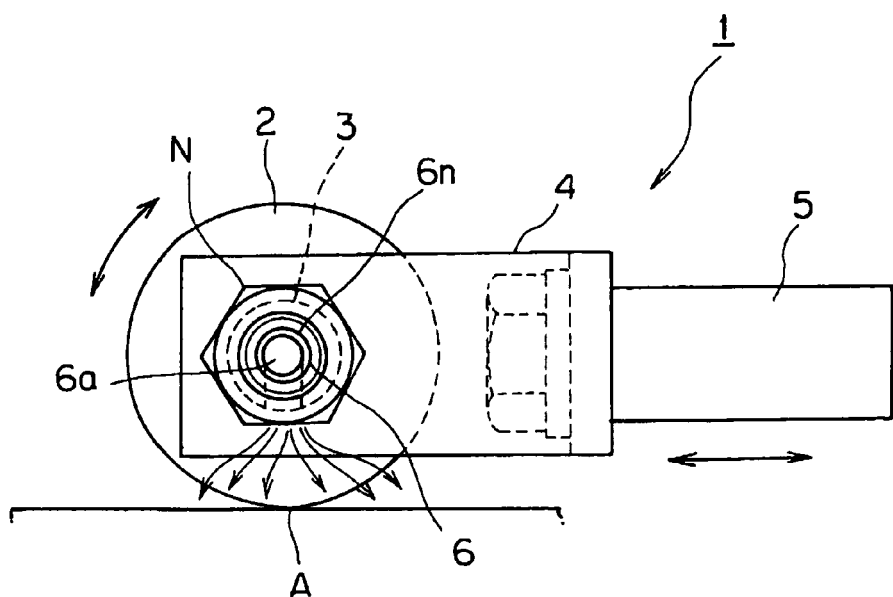
[FIG. 1]



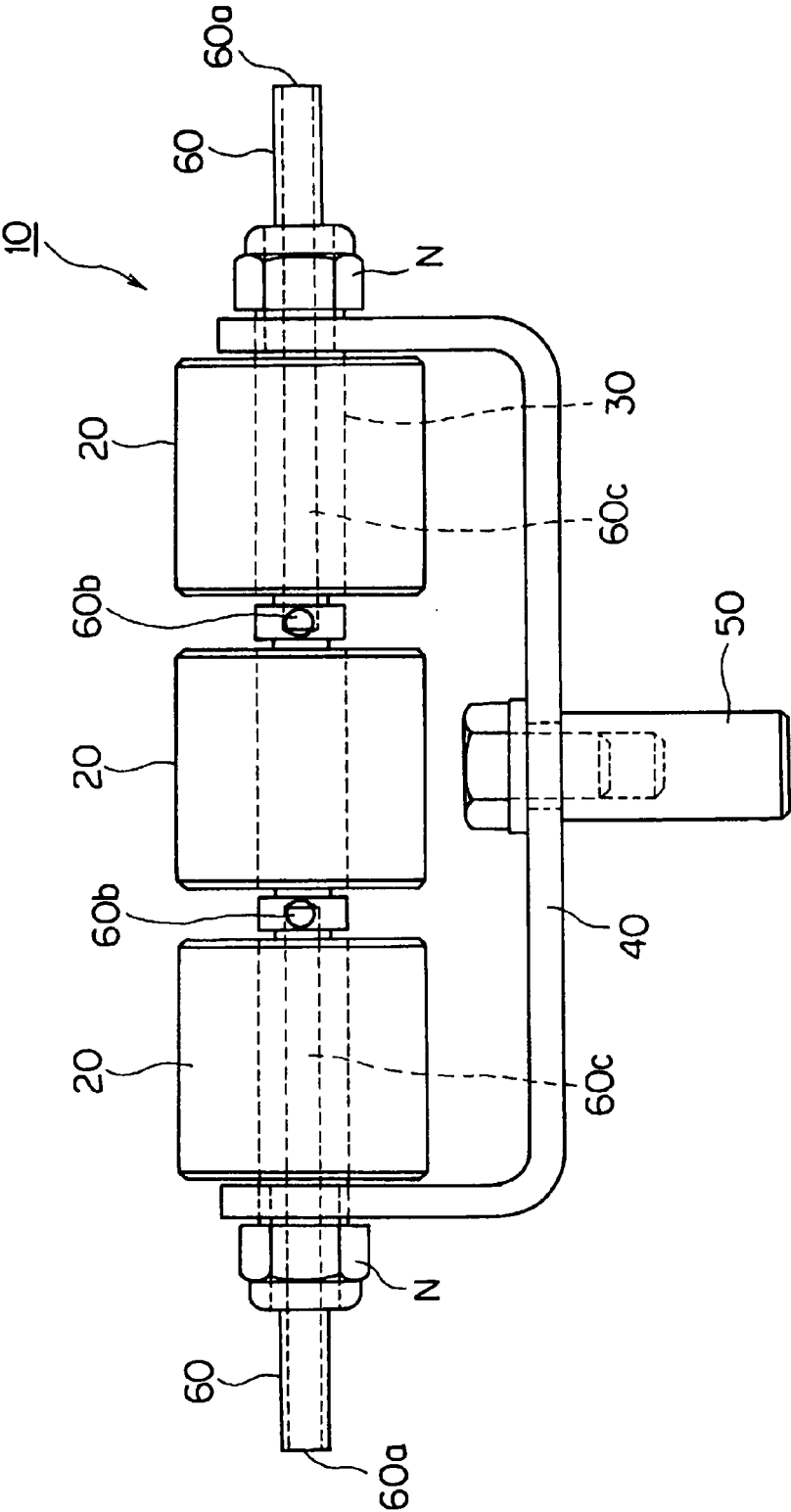
[FIG. 2]



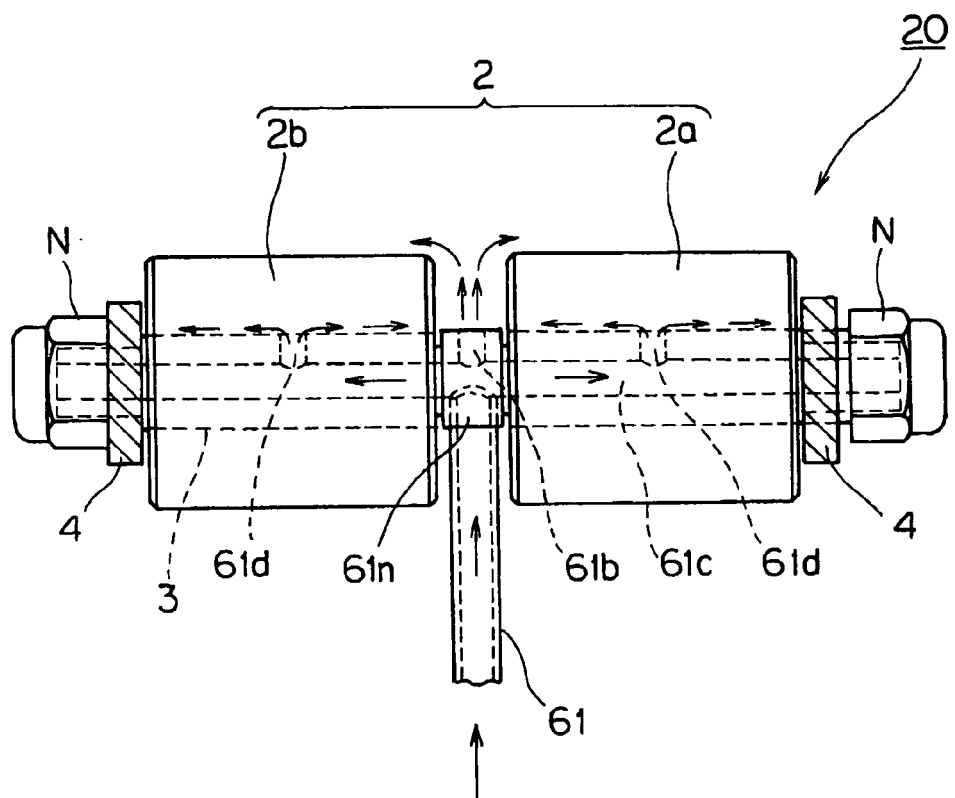
[FIG. 3]



[FIG. 4]



[FIG. 5]





EUROPEAN SEARCH REPORT

Application Number
EP 12 00 2805

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2008/053639 A1 (DENGEN CO LTD [JP]; HIGAMI SADA0 [JP]) 8 May 2008 (2008-05-08) * abstract; figures *	1	INV. B21D1/06
A	US 1 344 960 A (RAFF ERNEST G) 29 June 1920 (1920-06-29) * the whole document *	1	
A	JP 57 094425 A (HITACHI LTD) 11 June 1982 (1982-06-11) * abstract; figures *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 June 2012	Examiner Pieracci, Andrea
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 00 2805

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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27-06-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2008053639	A1	08-05-2008	NONE	
US 1344960	A	29-06-1920	NONE	
JP 57094425	A	11-06-1982	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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