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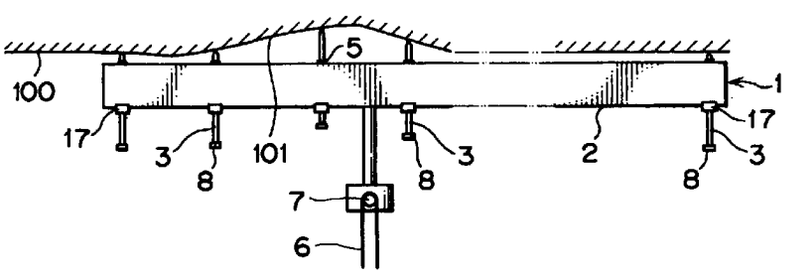
(54) Sheet metal repairing method and sheet metal working tool

(57) A dent portion in a sheet metal such as a car body is repaired by locating a bar above the dent portion, permitting a prescribed number of steel rods each having an engaging portion to be engaged to or inserted through the bar, welding one leading end of each of the steel rods to the dent portion in the sheet metal, and drawing the bar by using a drive means separately installed to pull up the steel rods together with the dent portion in the sheet metal, thereby to make the dent portion flat. The dent portion may be pulled out by locating a bar above the dent portion in the sheet metal, inserting a prescribed number of bolts through the bar, welding one leading end of each of the bolts to the dent portion in the sheet metal, screwing nuts to the bolts, and rotating the nuts to draw up the bolts. Thus, the dent portion can easily and appropriately be pulled out with a small rotating force.

F I G. 1



EP 0 916 424 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention:

[0001] This invention relates to a sheet metal repairing method and a sheet metal working tool for repairing mainly the body of an automobile. More particularly, this invention relates to a sheet metal repairing method and a sheet metal working tool for easily and suitably pulling out a dent portion in a sheet metal such as the body of an automobile.

2. Description of the Prior Art:

[0002] In a case where the body of an automobile is deformed due to a collision or any other causes, the car body is usually repaired in such a manner that a dent portion in the car body is pounded out from the back of the body panel or pulled out from the outside of the body panel. However, the repairing method for pounding out the dent portion from the inside of the car body disadvantageously calls for a work of removing upholstery in the automobile before being carried out. This work of removing the upholstery takes much time and labor and proves to be troublesome. Therefore, the repairing method of pulling out the dent portion from the outside of the car body is widespread in general.

[0003] For repairing the deformed car body, there has been so far used a sheet metal working puller having a long base which is provided at its both ends with slidable support legs and at its substantially middle portion between the support legs with pulling members. To the base, there is pivotally connected handles provided at their substantial center with a screw spindle piercing through the base and having hinged nut and ring through which the screw spindle is connected to the respective handles. By operating the handles, the pulling member moves to and fro in the axial direction of the screw spindle. When using the puller, the contact ends of the support legs are brought into contact with the sheet metal surface to be repaired upon adjusting the space between the support legs, and then, the screw spindle is joined at its one end to a catch member welded to the sheet metal surface upon adjusting the length of the screw spindle. Thereafter, the handles are rotated to move the screw spindle upward, thereby to pull out the dent portion. (cf. Japanese Utility Model Publication No. SHO 62-27290)

[0004] However, when making repairs on the side surface of the car body, which have been carried out extremely frequently in reality, the version of the conventional puller as noted above requires a worker to adjust the space between the support legs and the length of the screw spindle, press the support legs on the car body, and join the screw spindle to the portion to be repaired of the car body while keeping the support legs in the state pressed against the car body. This turns out to be a very troublesome chore. Particularly, the conventional puller is disadvantageous in that the work of holding the end portions of the handles, which are distant from the center of gravity of the puller for positioning the puller relative to the car body imposes a burden on the worker.

OBJECT OF THE INVENTION

[0005] An object of this invention is to provide a sheet metal repairing method for easily and suitably pulling out a dent portion in a sheet metal by a small pulling force, and a sheet metal working tool simple in structure for use in performing the repairing method.

SUMMARY OF THE INVENTION

[0006] To attain the object described above according to this invention, first, there is provided a sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, permitting a prescribed number of steel rods each having an engaging portion to be engaged to or inserted through the bar, welding the leading ends of the steel rods to the portion to be repaired of the sheet metal, and drawing the bar by using a drive means separately installed to pull up the steel rods, thereby to pull out the portion to be repaired of the sheet metal.

[0007] Secondly, the present invention provides a sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, welding a prescribed number of welding members to the portion to be repaired of the sheet metal, uniting the welding members to the leading ends of steel rods, and drawing the bar by using a drive means separately installed to pull up the steel rods together with the portion to be repaired of the sheet metal through the welding members.

[0008] Thirdly, the present invention provides a sheet metal working tool comprising a bar having a plurality of insertion holes bored therein, and steel rods to be inserted through the bar, wherein the bar has a hook member for being pulled, and each of the steel rods has an engaging portion to be engaged to the periphery of the insertion hole in the bar.

[0009] Fourth, the present invention provides a sheet metal working tool which comprises a bar having a plurality of insertion holes bored therein, and steel rods to be inserted through the insertion holes in the bar, wherein the bar has a hook member for being pulled, and each of the steel rods has an engaging portion to be engaged to the bar.

[0010] Fifth, the present invention provides a sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, inserting a prescribed number of bolts through the bar, welding the leading ends of the bolts to the portion to be

repaired of the sheet metal, screwing nuts to the bolts, and rotating the nuts to draw up the bolts together with the portion to be repaired of the sheet metal.

[0011] Sixth, the present invention provides a sheet metal working tool comprises a bar having a plurality of insertion holes bored therein, bolts to be inserted through the insertion holes in the bar, and nuts screwed to the bolts.

[0012] Other and further objects of this invention will become obvious upon an understanding of the illustrative embodiments about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is an explanatory diagram showing one embodiment of the sheet metal working tool according to this invention.
FIG. 2 is an explanatory diagram showing the aforesaid embodiment of the invention.
FIG. 3 is an explanatory diagram showing the aforesaid embodiment of the invention.
FIG. 4 is an enlarged perspective view showing a bar in the sheet metal working tool of the invention.
FIG. 5 is an enlarged perspective view showing a modified bar in the tool of the invention.
FIG. 6 is an enlarged perspective view showing a steel rod in the tool of the invention.
FIG. 7 is an enlarged perspective view showing a modified steel rod in the tool of the invention.
FIG. 8 is an explanatory diagram showing another embodiment of the sheet metal working tool according to this invention.
FIG. 9 is an explanatory diagram showing still another embodiment of the invention.
FIG. 10 is an explanatory diagram showing yet another embodiment of the invention.
FIG. 11 is an enlarged section showing the tool of FIG. 10.
FIG. 12 is an enlarged section showing the state of fixing the bar in the tool of the invention onto a car body.
FIG. 13 is an enlarged side view showing one example of a space retainer in the tool of the invention.
FIG. 14 is an enlarged side view showing the state of supporting the bar as one example.
FIG. 15 is an enlarged perspective view showing in part a further embodiment of the invention.
FIG. 16 is an enlarged perspective view showing in part a still further embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] One embodiment of this invention will be described in detail hereinafter with reference to the accompanying drawings.

[0015] Reference numeral 1 denotes a sheet metal working tool which comprises a bar 2 and steel rods 3. The bar 2 is formed in a long square pillar with front and rear walls each having a plurality of inserting holes 4 longitudinally arranged at regular intervals. Into each insertion hole 4, a ring 5 serving as an insulator is fitted. As shown in FIG. 5, the insertion hole 4 may preferably be made long in width, so that the steel rod 3 can be set at a desired position in the insertion hole 4, and further, the space between the adjoining steel rods 3 can be adjusted. On the substantially center portion of the front wall of the bar 2, there may be disposed a hook member 7 such as a chain block for holding a chain 6 to be connected to a drive means (not shown) in order to pull up the bar 4. The steel rod 3 is provided on its base with an engaging portion 8 to be engaged to the periphery of the insertion hole 4.

[0016] The engaging portion 8 may be formed integrally or fixedly on one end of the steel rod 3, or the engaging portion 8 may be separated from the steel rod 3 so as to be located at a desired position of the steel rod 3 relative to the longitudinal direction. Fundamentally, it is optional to form the steel rod 3 of a round bar, square bar, pipe or the like. Further, the steel rod may be fixedly provided at its one end with the engaging portion 8 which is larger in diameter than the insertion hole 4 or made long. If need arises, a holding member 17 may be placed between the bar 2 and the engaging member 8.

[0017] As another way, there may be used a bolt and a nut in place of the steel rod 3 and the engaging member 8, respectively. Or, the engaging member 8 may be formed of the holding member 17 and a nut. The holding member 17 may be secured astride the bar 2 and provided with a through hole 171 for permitting the bar 2 to pass freely therethrough.

[Embodiment 1]

[0018] In repairing a dent portion 101 formed in the car body of an automobile 100 to be subjected to sheet metal working by using the sheet metal working tool 1 which comprises the bar 2 and the steel rod 3 having the engaging member 8 as shown in FIGS. 1, 2, 3, 4 and 5, the bar 2 is first positioned above the dent portion 101, the steel rods 3 are inserted through the insertion holes 4 on the both end portions of the bar, and then, the leading ends of the steel rods are welded to the frame body or other solid portions of the car body 100 by arc welding or the like to steadily hold the bar. Next, the prescribed number of the steel rods 3 corresponding to the size of the dent portion 101 are inserted through

the intermediate insertion holes 4, and then, the leading ends of the steel rods are welded to the car body 100 by arc welding or the like. At this time, the length of the steel rod 3 projected to the deeper part of the dent portion 101 is different from that of the steel rod 3 projected to the shallower part of the dent portion 101 as a matter of course, as shown in FIG. 1. Thereafter, upon hooking the chain 6 on the hook member 7, the drive means such as a motor is operated to pull the bar 2. Consequently, the bar 2 is first pulled, and then, the steel rods 3 welded to the dent portion 101 are pulled in the order from the rod protruding largely by the lengths equivalent to the depths at which the steel rods are placed. As a result, the entire dent portion 101 is evenly pulled up to be made flat as shown in FIG. 3. When the dent portion is made flat, the work of pulling up the dent portion 101 is finished, the steel rods 3 welded to the bar are separated by use of a tool or by being rotated without use of any tool, and then, pulled out of the bar 2. It does not matter if the dent portion 101 is completely made flat. The dent part resultantly left may be pulled out by use of any other tool. When occasion demands, steel rods 3 having different lengths may be used.

[0019] FIG. 6 shows another embodiment making use of modified steel rods 3. Each of the steel rods 3 has a base with an engaging portion 9 to be engaged to the bar 2. An insertion hole in the bar as seen in the foregoing embodiment is not absolutely necessary to this embodiment. Instead, a structure shown in FIG. 7 may be adopted as one example. In this embodiment, the bar 2 should not necessarily be formed in a cylindrical shape, but may be formed in a plate or stick. However, the steel rod 3 may preferably be formed in a cylindrical shape capable of stably supporting the rod at two points.

[Embodiment 2]

[0020] FIGS. 8, 9 and 10 illustrates another embodiment of the present invention. In this embodiment, the sheet metal working tool 1 comprises a long bar 12 having a prism-like cylindrical shape and a plurality of through holes 14, bolts 13 to be inserted through the holes bored in the bar 12, and nuts 15 to be screwed on the bolts 13. The bolts 13 are welded at their tip ends to the dent portion 101 in the car body 100, and the nuts 15 are screwed on the other ends of the bolts 13. By rotating the nuts, the bolts 13 are pulled out together with the dent portion 101 through the bar 12, thereby to make the dent portion 101 substantially flat.

[0021] To secure the bar 12 on the car body 100, the bolts 13 are welded to the car body 100 at the positions opposed to the both ends of the bar 12, and inserted through the through holes 14 in the bar, or otherwise, placed on the bolts 13. The bolts for supporting the bar 12 is provided with retaining members such as nuts 23 for being prevented from moving forward. When the nut 15 is rotated, the bolts 13 welded to the dent portion 101 remain unmoved, but the nuts 15 move forward to push the bar 12 forward by means of the holding member 17. As a result, since the bar 12 is prevented from moving by the bolts 13 set at the both ends of the bar or a space retaining member 20, the bolts 13 are pulled out, consequently to pull out the dent portion 101 to which the bolts are welded. Thus, in a case where the dent portion 101 is large, it is pulled out little by little at some points at regular intervals. The small dent portion is pulled out at one or two points.

[0022] In the aforementioned Embodiment 2, the holding member 17 into which a pin 16 is inserted in order for preventing the bolt 13 from rotating is required to be detachably attached to the position opposite to the insertion hole 14 in the bar 12 as shown in FIG. 13. Furthermore, the bolt 13 must be prevented from rotating by forming a fitting groove 18 for admitting the aforesaid pin 16. When separating the welded part of the bolt 13 from the car body, the holding member 17 is released from the bar and rotated to wrench the welded part of the bolt 13 out of the car body.

[0023] It is preferable to place the space retaining member 20 between the bar 2 or 12 and the flat surface of the car body 100 out of the dent portion 101 to be repaired in order to stably position the bar 2 or 12 above the dent portion 101 so as to space out the bar 2 or 12 and the car body 100. The space retaining member 20 may be formed of a resin block 22 slidably attached to the bar 2 or 12 as illustrated in FIG. 13 as an example. Further, a magnet 21 may be used in place of the bolt 13 to magnetically secure the bar 12 to the car body 100 as shown in FIG. 14.

[Embodiment 3]

[0024] In a case that the dent portion 101 in the car body 100 is large, a prescribed number of welding members 30 such as washers may be formed at the leading end portion of the steel rod 3 or bolt 13. In such a case, a support member 31 disposed at the leading end of the steel rod 3 or bolt 13 may be formed in a bifurcated shape so that the welding members 30 are supported by an axle 32 detachably inserted through the bifurcated support member 31. Or, the axle 32 may be supported at one end of the support member 31 formed in a hook shape like a cantilever, so that the welding members 30 are supported by the axle 32. It is desirable that the support member 31 is detachably screwed on the steel rod 3 so as to be removed.

[0025] Prior to the use of the sheet metal working tool of the invention, the desired number of the welding members 30 are welded to the dent portion 101 at arbitrary intervals by conventionally known electric welding. Next, the bifurcated support member 31 is held 50 as to accommodate the welding members 30 therein, and the axle 32 is inserted through holes in the support member 31 and holes of the welding members 30. At this time, if the axle 32 is inserted into the welding members 30, the

welding members 30 may not necessarily be accommodated within the support member 31. The steel rod 3 and bolt 13 are pulled up in the same way as those in the aforementioned Embodiments 1 and 2.

[0026] In another manner, the bar 2 or 12 may be magnetically attached to the car body 100 by use of the magnet 21 so as to secure the support member 211 on the magnet 21. At this time, the bar 2 or 12 pressed against the car body 100 through the resilient block 22 serving as a cushion is preferably fixed onto the space retaining member 20 by use of a screw 201 or the like.

[0027] As is apparent from the foregoing description, according to the sheet metal repairing method of this invention, which comprises locating the bar above a portion to be repaired of sheet metal, permitting the prescribed number of steel rods each having the engaging portion to be engaged to or inserted through the bar, welding the leading ends of the steel rods to the portion to be repaired of the sheet metal, and drawing the bar by using the drive means separately installed to pull up the steel rods, even a largely dented portion in the sheet metal of a car body or the like can be pulled out very easily by use of a conventional drive means. Further, even a linear dent portion can be easily be pulled out in the so-called line-pulling method. Moreover, the sheet metal working tool of the invention, which comprises the bar having an arbitrary length, the steel rods each having the engaging portion to be engaged to the bar or inserted through the holes in the bar, the hook member formed on the bar for pulling out the bar, and the retaining members disposed on the leading ends of the steel rods for retaining the prescribed number of welding portions, produces the effect of easily pulling a wide, shallow dent portion in addition to the effect described above.

[0028] The sheet metal repairing method of the invention may comprise locating the bar above a portion to be repaired of a sheet metal, inserting a prescribed number of bolts through the bar, welding the leading ends of the bolts to the portion to be repaired of the sheet metal, screwing nuts to the bolts, and rotating the nuts to draw up the bolts, thereby to pull out the portion to be repaired of the sheet metal. This method brings about the effect of suitably pulling out the dent portion in the sheet metal of the car body or the like bit by bit with the plurality of steel rods arranged at small intervals. Thus, the portion to be repaired of the sheet metal can easily be pulled out to be made flat by a simple operation of rotating the nuts without using any other drive means. It is a matter of course that the nuts may be more easily rotated by use of air pressure or other possible driving means. Besides, by screwing the nuts one by one in order, the work of pulling out the dent portion can easily and smoothly be carried out with a small rotating force without being forced to rotate. In addition to the effect of carrying out the pulling work with a simple operation, the dent portion can be repaired accurately to be made flat and smooth with bearing a burden lightly. Moreover, according to the sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, inserting a prescribed number of bolts through the bar, welding the leading ends of the bolts to the portion to be repaired of the sheet metal, screwing nuts to the bolts, and rotating the nuts to draw up the bolts, this invention brings about an effect of easily pulling out even a wide, deep dent portion in addition to the effects described above.

[0029] Since the device of the invention has the rotation preventing structure comprising the pin detachably fitted in the fitting groove in the bolt at the position opposite to the insertion hole in the bar for preventing the rotation of the bolt, the bolt can be securely pulled out without rotating, and the welded portion of the bolt can be undone with extreme ease by releasing the rotation preventing structure from the bar and rotating the bolt.

[0030] Furthermore, since the device of the invention has the ring serving as an insulator which is fitted in the insertion hole, the leading end of the steel rod or bolt can be securely welded in safety to the sheet metal without causing leak of electricity to the bar. Furthermore, by making the insertion hole slender, the position of the steel rod or bolt can be finely adjusted, consequently to make a more accurate repairing work possible. Since the space retaining member is disposed between the bar and the common surface of the sheet metal to secure the space therebetween, the effect of reducing pressure exerted on the portion to be repaired so as not to damage the portion to be repaired can be brought about.

[0031] As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

Claims

1. A sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, permitting a prescribed number of steel rods each having an engaging portion to be engaged to or inserted through said bar, welding one leading end of each of said steel rods to said portion to be repaired of said sheet metal, and drawing said bar by using a drive means separately installed to pull up said steel rods together with said portion to be repaired of said sheet metal.

2. A sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, permitting a prescribed number of steel rods each having an engaging portion to be engaged to or inserted through said bar, welding a prescribed number of welding members to said portion to be repaired of said sheet metal, uniting said

welding members respectively to one leading end of each of steel rods, and drawing said bar by using a drive means separately installed to pull up said steel rods through the welding members, thereby to pull out the portion to be repaired of the sheet metal through the welding members.

3. A sheet metal working tool comprising a bar having a plurality of insertion holes bored therein, and steel rods to be inserted through the bar, said bar being provided with a hook member for being pulled, said steel rods each having an engaging portion to be engaged to the periphery of said insertion hole in said bar.

4. A sheet metal working tool comprising a bar having an arbitrary length, and steel rods to be engaged with said bar, said bar being provided with a hook member for being pulled, said steel rods each having an engaging portion to be engaged to said bar.

5. A sheet metal working tool comprising a bar having an arbitrary length and a plurality of insertion holes bored therein, and steel rods each having a hook member to be inserted through said insertion holes in said bar, said bar having an engaging portion to be engaged to said bar.

6. A sheet metal repairing method which comprises locating a bar above a portion to be repaired of a sheet metal, inserting a prescribed number of bolts through insertion holes bored in said bar, welding one leading end of each of said bolts to said portion to be repaired of said sheet metal, screwing nuts to said bolts, and rotating said nuts to pull out said bolts together with said portion to be repaired of said sheet metal.

7. A sheet metal working tool comprises a bar having a plurality of insertion holes bored therein, bolts to be inserted through said insertion holes in said bar, and nuts screwed to said bolts.

8. A sheet metal repairing method which comprises locating a bar having a plurality of insertion holes bored therein above a portion to be repaired of a sheet metal, inserting a prescribed number of bolts through said insertion holes, welding a prescribed number of welding members to said portion to be repaired of said sheet metal, uniting said welding members respectively to one leading end of each of steel rods, screwing nuts on rear ends of said bolts, and rotating said nuts to draw up said steel rods through the welding members, thereby to pull out the portion to be repaired of the sheet metal through the welding members.

9. A sheet metal working tool comprises a bar having a plurality of insertion holes bored therein, bolts to be inserted through said insertion holes in said bar, and nuts screwed to said bolts.

10. A sheet metal working tool claimed in claim 7 or claim 9, further comprising rotation preventing means in which a pin is detachably attached to said bolt at the position opposite to said insertion hole in said bar for preventing rotation of said bolt, and said bolt has a fitting groove into which said pin is fitted.

11. A sheet metal working tool claimed in any of claims 3, 4, 7 and 9, wherein a ring serving as an insulator is fitted in said insertion hole.

12. A sheet metal working tool claimed in any of claims 3, 5, 7 and 9, wherein said insertion hole is made slender.

13. A sheet metal working tool claimed in any of claims 3, 5, 7 and 9, further comprising a space retaining member disposed between said bar and a common surface of said sheet metal to secure a space therebetween.

FIG. 1

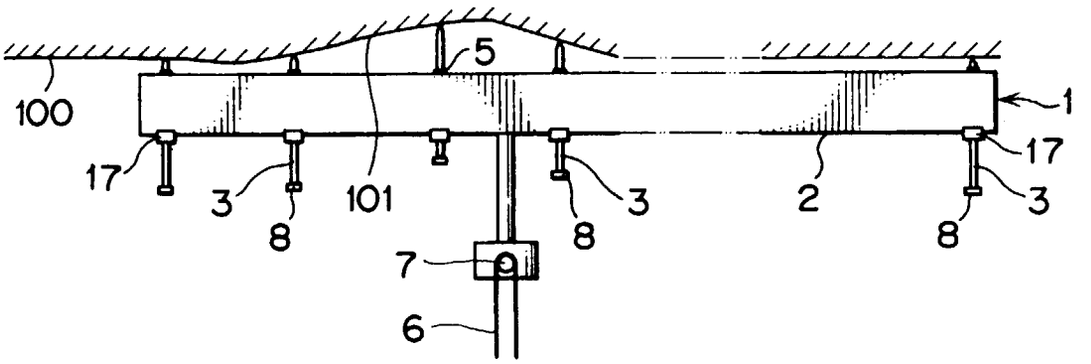


FIG. 2

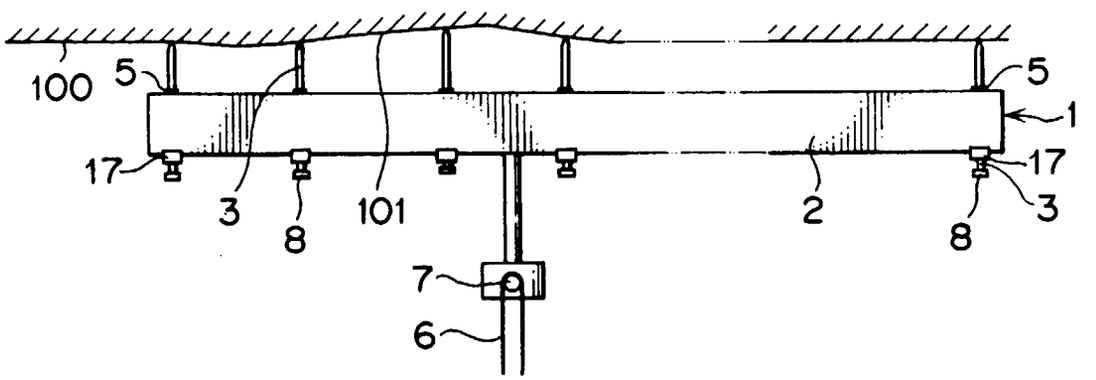


FIG. 3

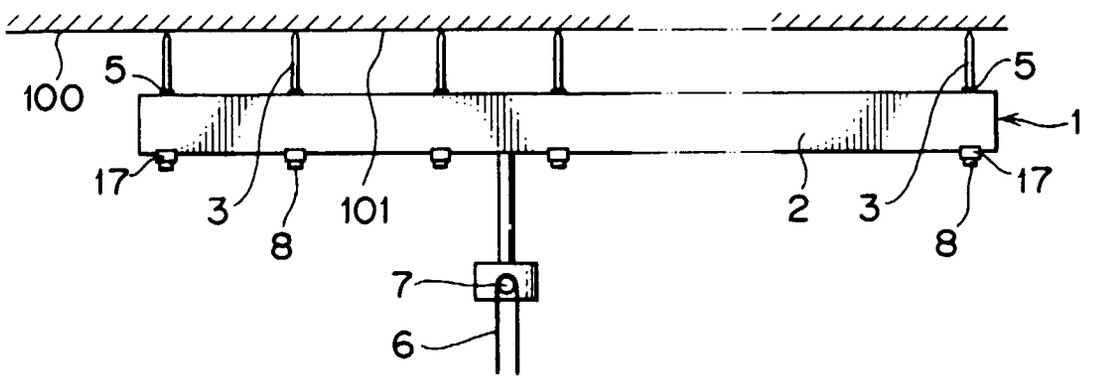


FIG. 4

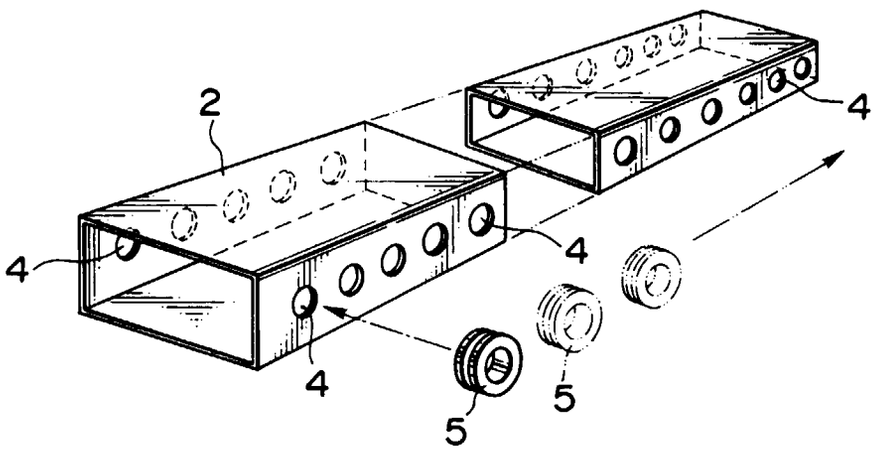


FIG. 5

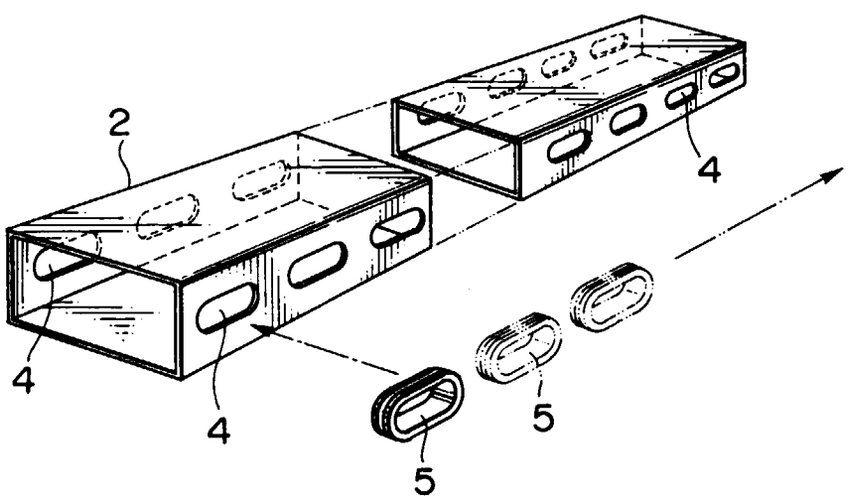


FIG. 6

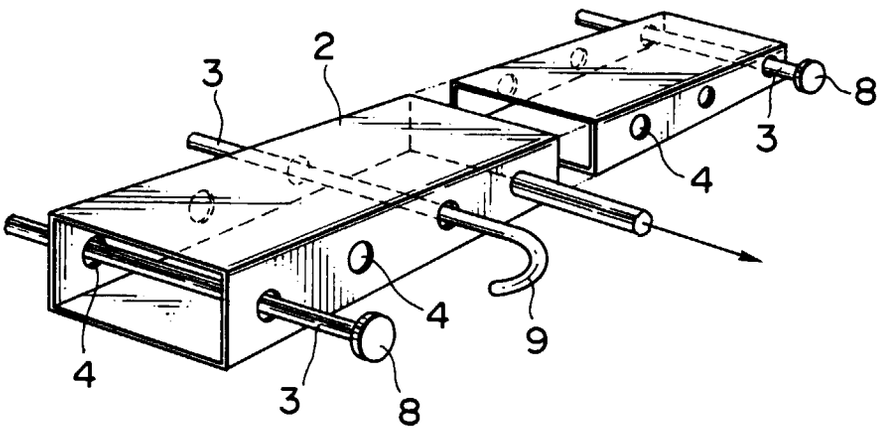


FIG. 7

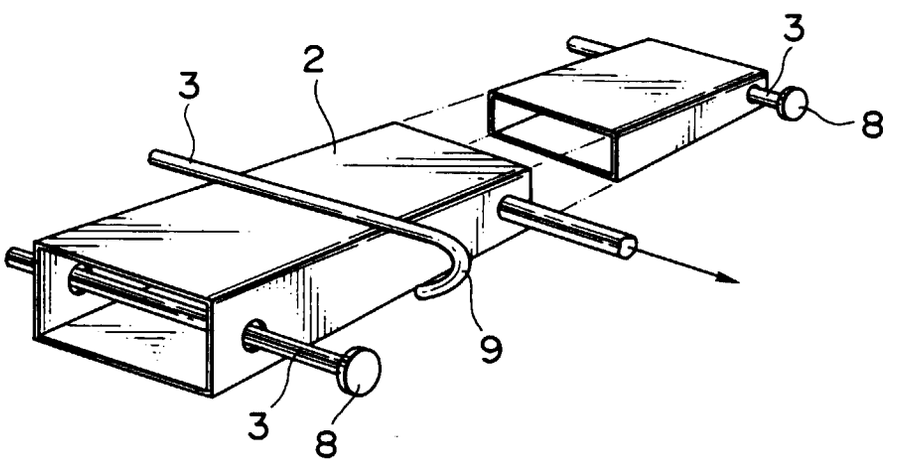


FIG. 8

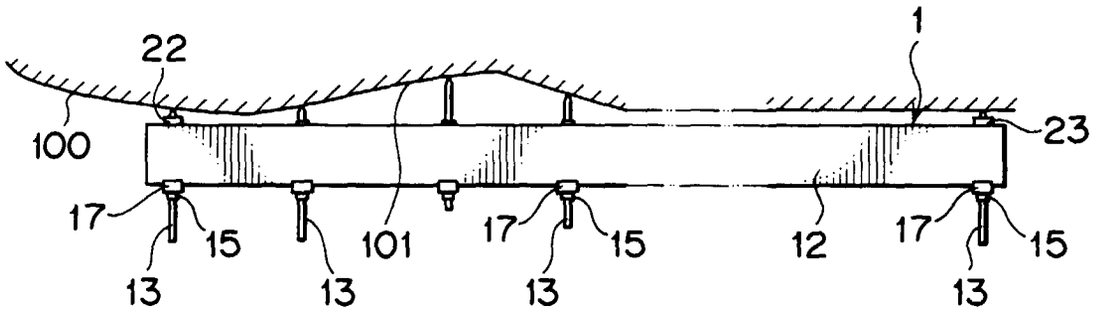


FIG. 9

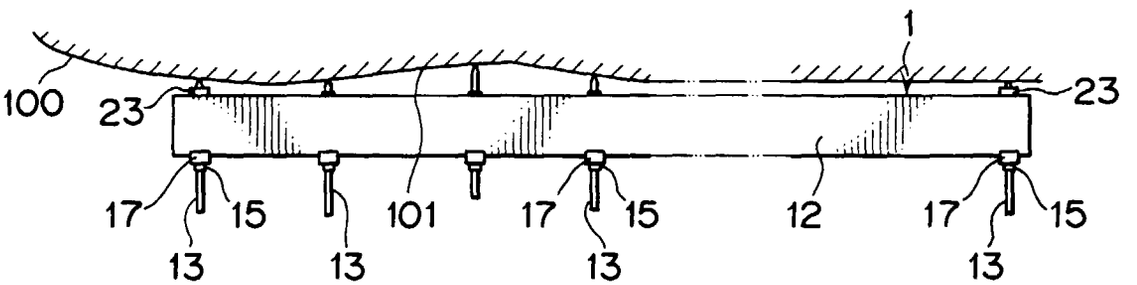


FIG. 10

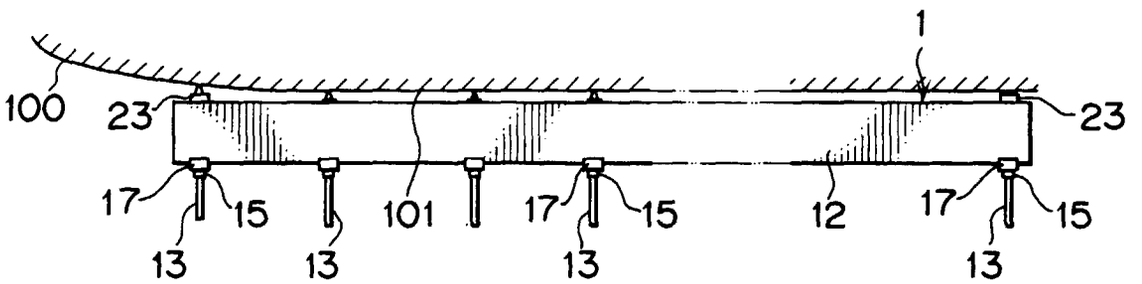


FIG. 11

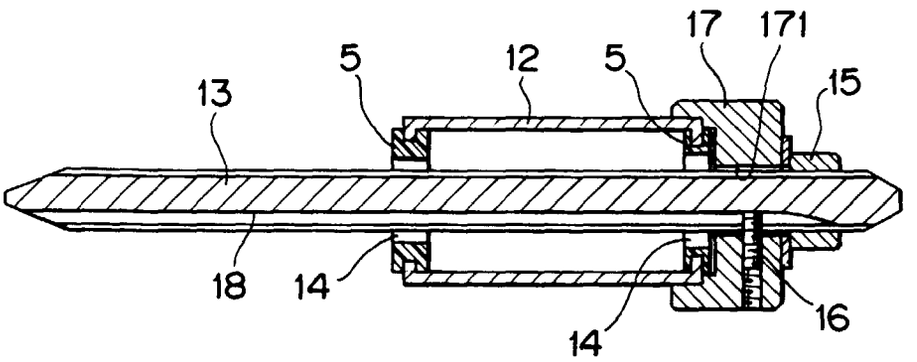


FIG. 12

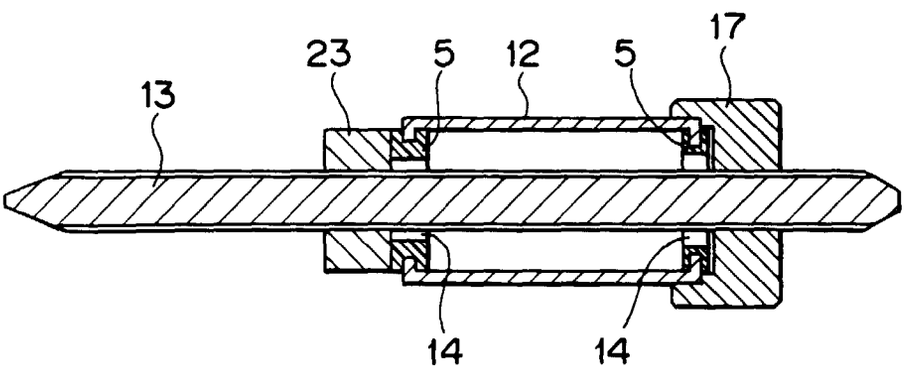


FIG. 13

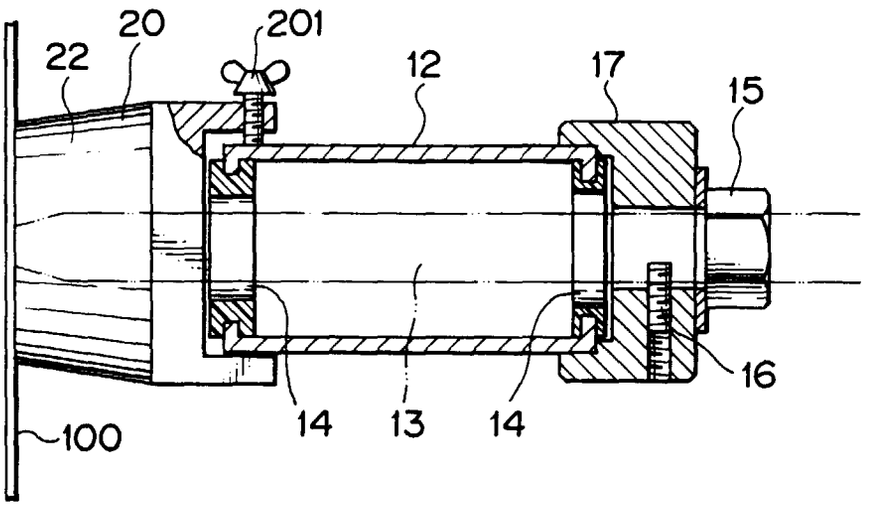


FIG. 14

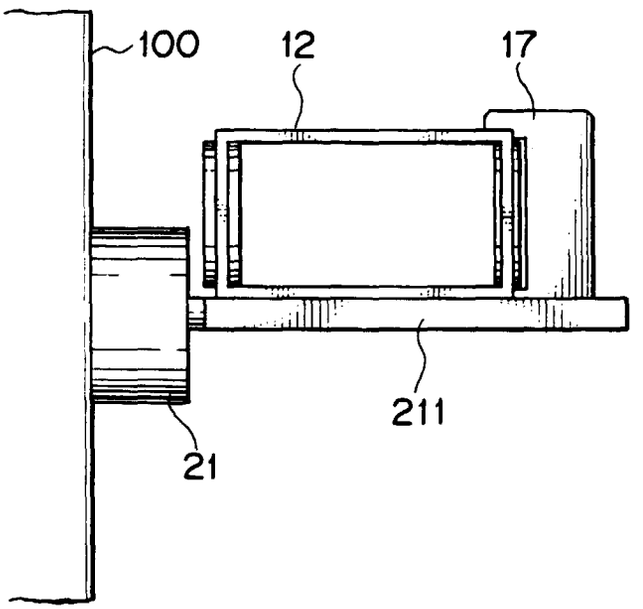


FIG. 15

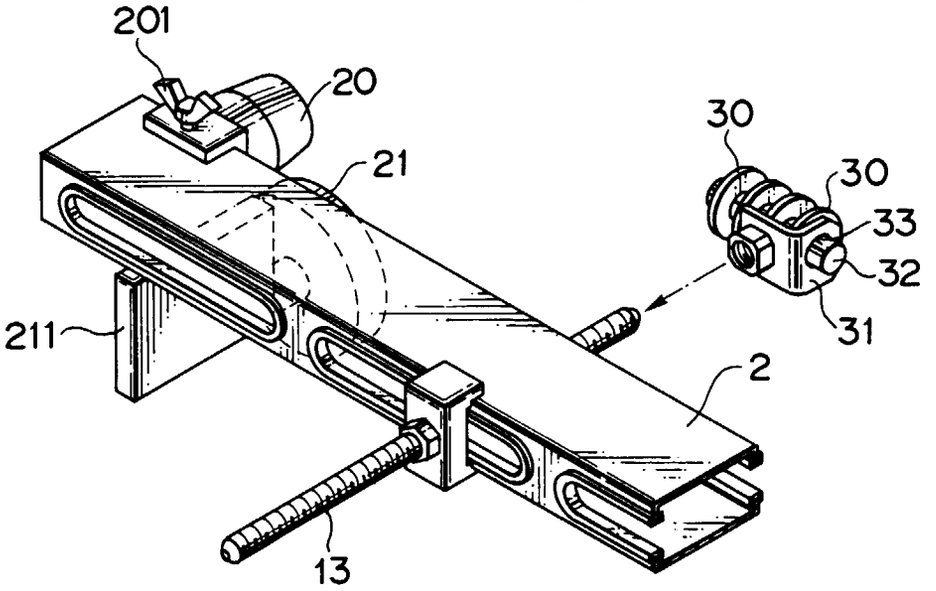


FIG. 16