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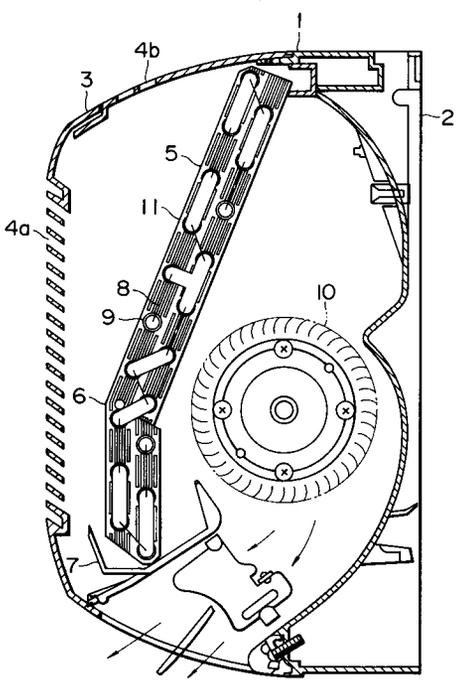
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(54) Air conditioner.

(57) An air conditioner accommodates therein a heat exchanger (5) having a plurality of plate fins (11) and a plurality of heat exchanging pipes (9), and a once-through fan (10) located rearwardly of the heat exchanger. A V-shaped cut-out (14) is provided only in one side of the plate fin toward the blower. An upper portion of the plate fin above the cut-out (14) and a lower portion of the plate fin below the cut-out are bent substantially into an L-shaped configuration at a predetermined angle to form the heat exchanger (5). A bent portion (6) on the heat exchanger (5) is positioned in the vicinity of a level of a center of rotary axis of the once-through fan (10).

FIG. 1



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BACKGROUND OF THE INVENTION

The present invention relates to an air conditioner and, more particularly, to an indoor unit of the air conditioner, in which a heat exchanger of plate fin type is improved.

In recent years, an indoor unit of a split-type or separate-type air conditioner is arranged such that air intake or suction ports thereof are arranged in a front surface and an upper surface of the unit, to secure a large suction area. Japanese Utility Model Unexamined Publication No. 60-118430 and Japanese Patent Unexamined Publication No. 3-5637, for example, have been known which disclose a structural example of a heat exchanger of plate fin type which is accommodated or received in such indoor unit. That is, the heat exchanger of plate fin type disclosed in these publications is constructed such that cut-outs are provided respectively in surfaces of fins facing toward a surface of an air blowing port of the heat exchanger and in a surface opposite to the first-mentioned surfaces, and the heat exchanger of plate fin type is bent substantially into an L-shaped configuration at the cut-outs. The arrangement is such that the bent heat exchanger is received within the unit, and air drawn through the suction ports provided in the front surface and the upper surface of the unit flows toward the heat exchanger.

However, the heat exchanger of plate fin type disclosed in Japanese Utility Model Unexamined Publication No. 60-118430 has the following problem. That is, since the heat exchanger is bent substantially into the L-shaped configuration, a V-shaped space is formed at the bent section, that is, cut-outs provided respectively in the fins are formed. In this manner, if the V-shaped cut-out is formed in a part of the heat exchanger, air is apt to flow into the space more than other portions. Flow speed or velocity of the air flow is higher than those in other portions, so that eddy or vortex, and turbulent flow occur. Heat exchange is not almost effected in the space.

Further, for the reason discussed above, a technique disclosed in Japanese Patent Unexamined Publication No. 3-5637, for example, is such that the V-shaped cut-out is covered by a spacer of a metallic seal or the like. However, there is a fear that the fins of the heat exchanger are crushed and are damaged upon mounting of the spacer.

Moreover, increase in the number of parts or components increases manufacturing steps more than those in the conventional technique. Furthermore, a rear surface of the spacer becomes negative in pressure at blowing or ventilation, and turbulent flow can be produced. Thus, there is a problem such that the air cannot smoothly flow.

SUMMARY OF THE INVENTION

It is an object of the invention to solve the above-discussed problems of the prior art, and to provide an air conditioner in which a spacer and the like which must conventionally be provided in the heat exchanger can be dispensed with the number of parts can be reduced, and manufacturing steps can be reduced.

It is another object of the invention is to provided an air conditioner in which occurrence of turbulent flow at the time of ventilation can be suppressed.

In order to solve the above-discussed problem, the invention provides an air conditioner in which a heat exchanger having a number of plate fins arranged in parallel relation to each other at constant intervals and a plurality of heat exchanging pipes extending through the plate fins, the heat exchanger being bent substantially into an L-shaped configuration at a predetermined position in a longitudinal direction of the plate fins, and a blower located rearwardly of the heat exchanger are built in a casing having a plurality of suction openings and a plurality of blowoff openings, and in which V-shaped cut-outs are provided only on one sides of the plate fins toward the blower, and an upper portion of the heat exchanger above the cut-outs and a lower portion of the heat exchanger below the cut-outs are bent substantially into an L-shaped configuration at a predetermined angle.

Specifically, the arrangement is such that the cut-outs are provided only in one side of the plate fins of the heat exchanger toward the blower, the plate fins are bent toward the blower, and the plate fins are formed such that the upper portions and the lower portions of the plate fins are made to abut against each other.

Further, the bent portions of the plate fins is positioned in the vicinity of the center of the rotary axis of the blower.

With the above arrangement of the invention, since the cut-outs used for bending the heat exchanger incorporated into the indoor unit are provided only in the side toward the blower, it is possible to disperse with a spacer and the like, although the spacer and the like have conventionally been incorporated into the heat exchanger.

Moreover, the bent portion of the heat exchanger according to the invention is positioned in the vicinity of a level of the center of the rotary axis of the blower, so that it is possible to suppress occurrence of turbulent flow at the rear surface of the heat exchanger due to blowing. Thus, indoor air flows smoothly, making it possible to improve heat exchanging performance of the heat exchanger.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a longitudinally cross-sectional view showing an indoor unit of an air conditioner which receives therein a heat exchanger of plate fin type according to an embodiment of the invention;

Fig. 2 is a top plan view a plate fin which is used in the indoor unit illustrated in Fig. 1;

Fig. 3 is an enlarged view showing a principal portion of the plate fin illustrated in Fig. 2;

Fig. 4 is a fragmentary enlarged, perspective view showing the plate fin illustrated in Fig. 2; and

Fig. 5 is a longitudinally cross-sectional view showing a part or portion of an indoor unit of a prior air conditioner of split or separate type.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 5 shows a part or portion of an indoor unit of a prior air conditioner of split type or separate type. A heat exchanger 25 of plate fin type is constructed such that cut-outs 24 are formed at a bent portion of the heat exchanger 25, and the cut-outs 24 define a V-shaped space. Air is apt to flow into the V-shaped space which is low or small in resistance. A flow velocity va of the air flow flowing through the V-shaped space is greater than flow velocities v_b and v_c of air flow which passes through an upper portion and a lower portion of the heat exchanger 25 of plate fin type. Accordingly, eddy or turbulent flow occurs as shown in Fig. 5. The reference numeral 20 denotes a once-through fan, while the reference numeral 27 denotes a drain pan.

An embodiment of the invention will hereunder be described with reference to Figs. 1 to 4.

Fig. 1 is a longitudinal cross-sectional view showing an indoor unit of an air conditioner which receives therein a heat exchanger of plate fin type according to an embodiment of the invention. Fig. 2 is a top plan view showing a plurality of plate fins which are used in the indoor unit illustrated in Fig. 1. Fig. 3 is an enlarged view of principal portions of the plate fins illustrated in Fig. 2. Fig. 4 is an enlarged perspective view showing a portion of each of the plate fins.

As shown in Fig. 1, the reference numeral 1 denotes an indoor unit of an air conditioner of split or separate type; 2, a body; and 3, a dress or decorative frame which is combined or associated with the body 2 and which cooperates with the body 2 to form a casing. A plurality of air suction ports or openings 4a are formed in a front surface of the decorative frame 3, while a plurality of air suction openings 4b are formed in an upper surface of the decorative frame 3. The reference numeral 5 denotes a heat exchanger of plate fin type bent substantially into an L-shaped configuration (here, plates for retaining both ends of the heat exchanger are omitted from illustration), and a structure of the heat exchanger 5 will be described later. The reference numeral 6 denotes a bent section of the heat exchanger 5; and 7, a drain pan which is arranged below the heat exchanger 5.

The reference numeral 11 denotes a plurality of plate fins which are arranged in parallel relation to each other at constant intervals and through which air flow passes; and 9, a plurality of heat exchanging pipes which extend through the plate fins 11 and through which refrigerant flow passes. The plate fines 11 and the heat exchanging pipes 9 cooperate with each other to form the heat exchanger of plate fin type.

As shown in Fig. 1, broken lines 8 which connect axes of respective bend tubes to each other show bent sections or hair-pin sections of the heat exchanging pipes 9. The reference numeral 10 denotes a once-through fan which relates to a blower arranged rearwardly of the heat exchanger 5. Upon rotation of the once-through fan 10, indoor air flows as shown by solid-line arrows.

Here, a shape or configuration of each of the plate fins 11 in the aforesaid heat exchanger 5 is as shown in Fig. 2.

In Fig. 2, the reference numeral 12 denotes a plurality of through bores through which the heat exchanging pipes 9 extend respectively; 12a, collars formed respectively around the through bores 12 (see Fig. 4); and 13, a plurality of cut-and-raised elements which are provided on each of the plate fins 11. A V-shaped cut-out 14 is formed in a trailing edge of each of the plate fins 11 (on the side toward the once-through fan 10 when the plate fins 11 are incorporated into the body 1). Further, a bore 15 is formed at a tip end of the cut-out 14. Fig. 3 is an enlarged view of a principal portion thereof.

As shown in Fig. 3, a cut-out angle of the cut-out 14 defines the cut-out 14 such that an upper side 14a extends perpendicularly to the fin end face, and a lower side 14b forms a predetermined bending angle equal to or less than about 30° with respect to the upper side 14a when the heat exchanger is bent. The predetermined bending angle is one in which dew developed or produced on the upper portion of each of the plate fins 11 does not fall so that the dew flows down onto the drain pan 7 along the plate fins 11. As seen from Fig. 1, it is at least necessary that a length of the upper side 14a of the cut-out 14 is smaller than that of the lower side 14b. The bore 15 formed at the tip end of the cut-out 14 is available to increase durability of a trimming metal mold without a sharp edge,

which mold is used to work the cut-out 14 in the plate fins. Moreover, the bore 15 acts to prevent creases or folds which would be produced when the plate fins are bent toward the blower direction, to fill or intervene between the fins, to thereby hinder or impede ventilation. Provision of such cut-out 14 is helpful to have the upper fins and the lower fins abutting against each other with a small gap as shown in Fig. 1 when the heat exchanger is bent, so that such upper and lower fins behave as a single integral fin.

Accordingly, it is unnecessary to receive a spacer or the like in the cut-out like the prior art. Thus, it is possible to secure that condensed water adhering to an upper portion of the heat exchanger above the cut-outs 14 at the time of cooling is retained by a lower portion of the heat exchanger below the cut-outs 14, making it possible to collect the condensed water onto the drain pan 7 without havint it dropping to any other locations.

Subsequently, the heat exchanger 5 is mounted such that the bent section 6 of the heat exchanger 5 within the indoor unit is positioned in the vicinity of a level of a center of a rotary axis of the once-through fan 10. By doing so, it is possible to suppress occurrence of turbulent flow about a rear surface of the heat exchanger due to ventilation, so that indoor air flow smoothly, making it possible to improve heat exchanging performance of the heat exchanger.

As apparent from the foregoing, the heat exchanger according to the embodiment of the invention can dispense with the spacer and the like which have conventionally been had to be provided, making it possible to reduce the number of parts. Furthermore, it is possible to reduce manufacturing steps.

Further, since the upper portion and the lower portion of the heat exchanger abut against with each other with a slight gap, condensed water produced at the time of cooling can smoothly be collected from the upper portion to the lower portion without dropping to anywhere.

Moreover, it is possible to suppress occurrence of turbulent flow when air is sent by the once-through fan.

As described above in detail, according to the invention, it is possible to dispense with spacer and the like which have conventionally been had to be received within the heat exchanger, making it possible to reduce the number of parts. Furthermore, it is possible to provide the air conditioner which enables reducing the manufacturing steps.

Moreover, it is possible to provide the air conditioner which can suppress occurrence of turbulent flow at the time of blowing.

Claims

1. An air conditioner (1) comprising a heat exchanger (5) having a plurality of plate fins (11) arranged in parallel relation to each other at constant intervals and a plurality of heat exchanging pipes (9) extending through said plate fins, said heat exchanger being bent substantially into an L-shaped configuration at a predetermined position in a longitudinal direction of said plate fins, a blower (10) located rearwardly of said heat exchanger, and a casing (2, 3) having a plurality of suction openings (4a, 4b) and a plurality of blowoff openings and accommodating therein said heat exchanger and said blower,

   characterized in that a V-shaped cut-out (14) is provided only on one side of said plate fin toward the blower, and that an upper portion of said plate fin above said cut-out and a lower portion of said plate fin below said cut-out are bent substantially into an L-shaped configuration at a predetermined angle.

2. An air conditioner according to claim 1, wherein said cut-out in said heat exchanger is positioned in the vicinity of a level of a center of a rotary axis of said blower.

3. An air conditioner according to claim 1 or 2, wherein an upper side of the V-shaped cut-out is smaller in length than a lower side thereof.

4. An air conditioner according to any one of claims 1 to 3, wherein said cut-out comprises a bore at a tip end of said V-shaped configuration.

FIG. 1

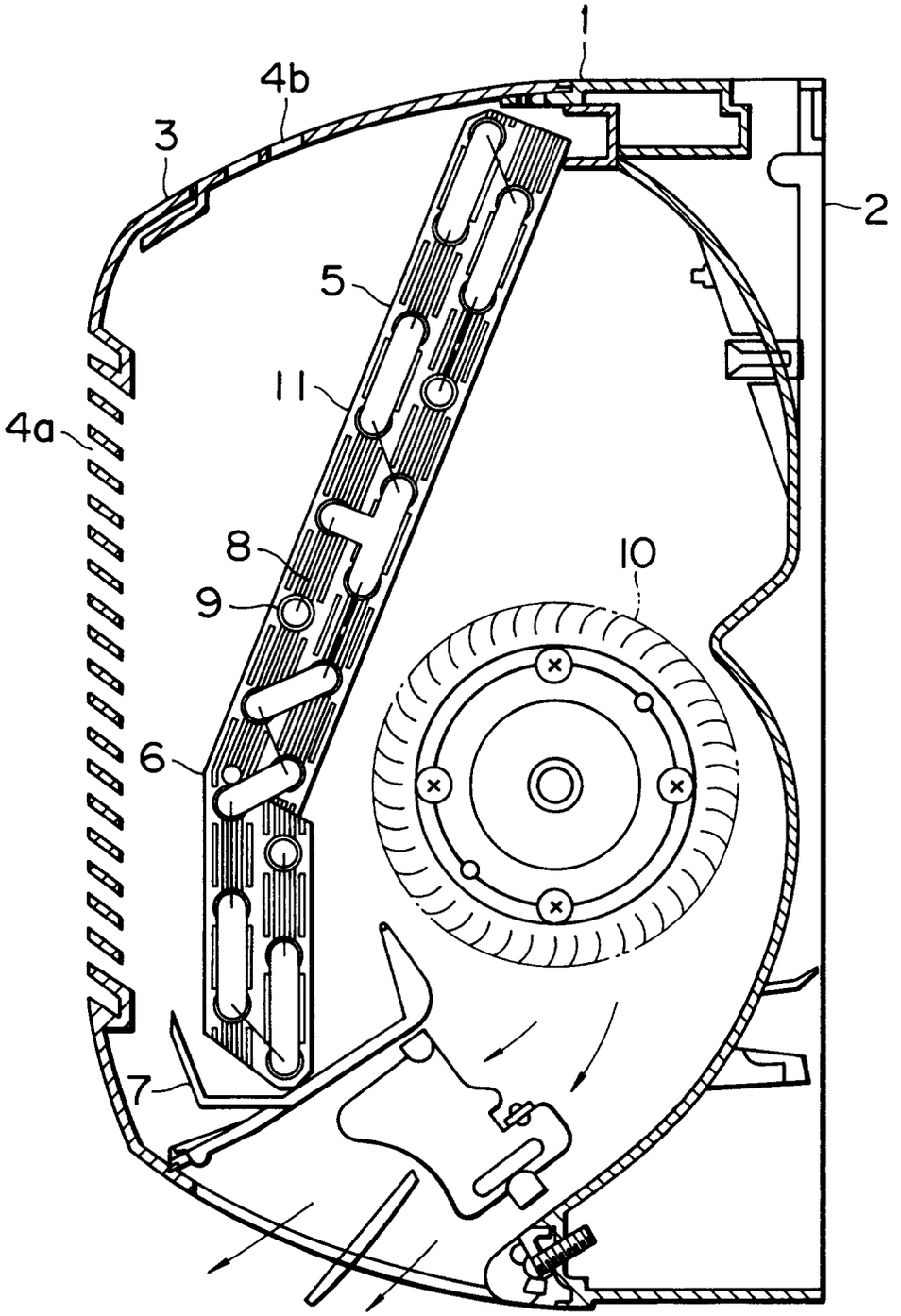


FIG. 2

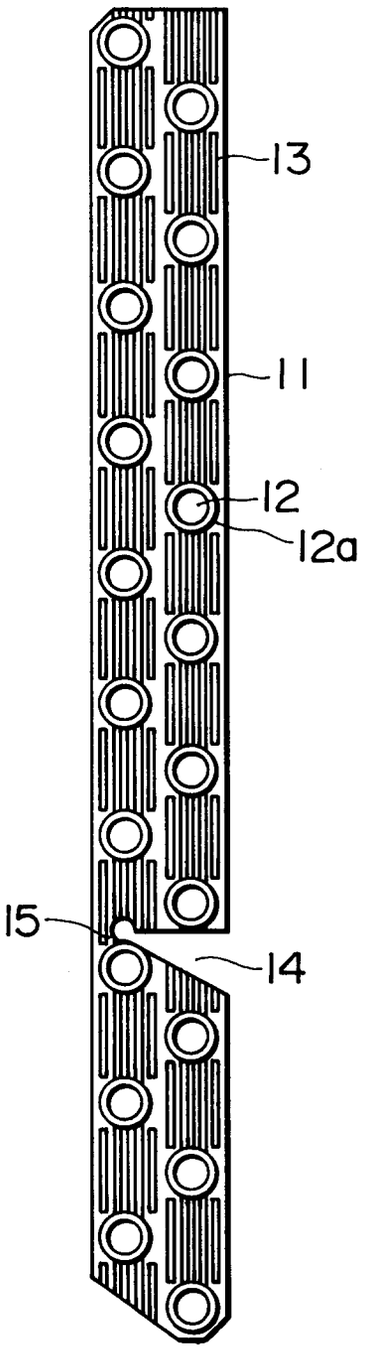


FIG. 3

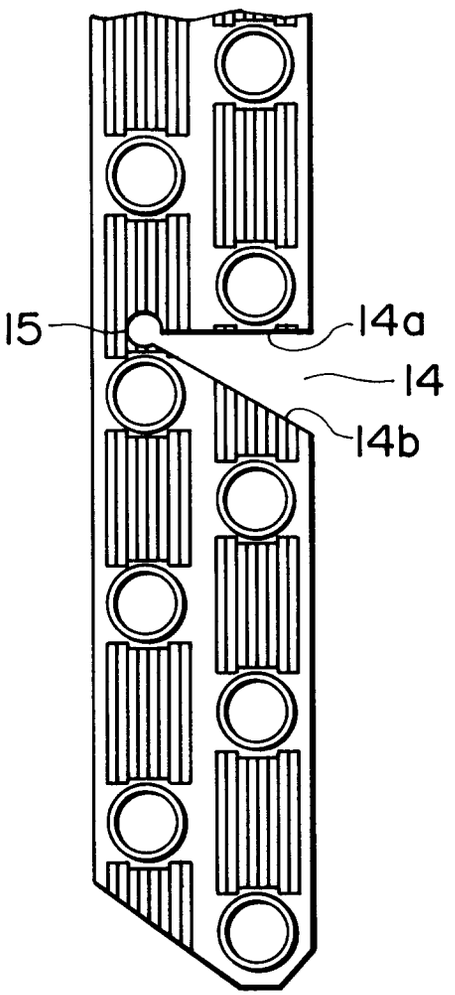


FIG. 4

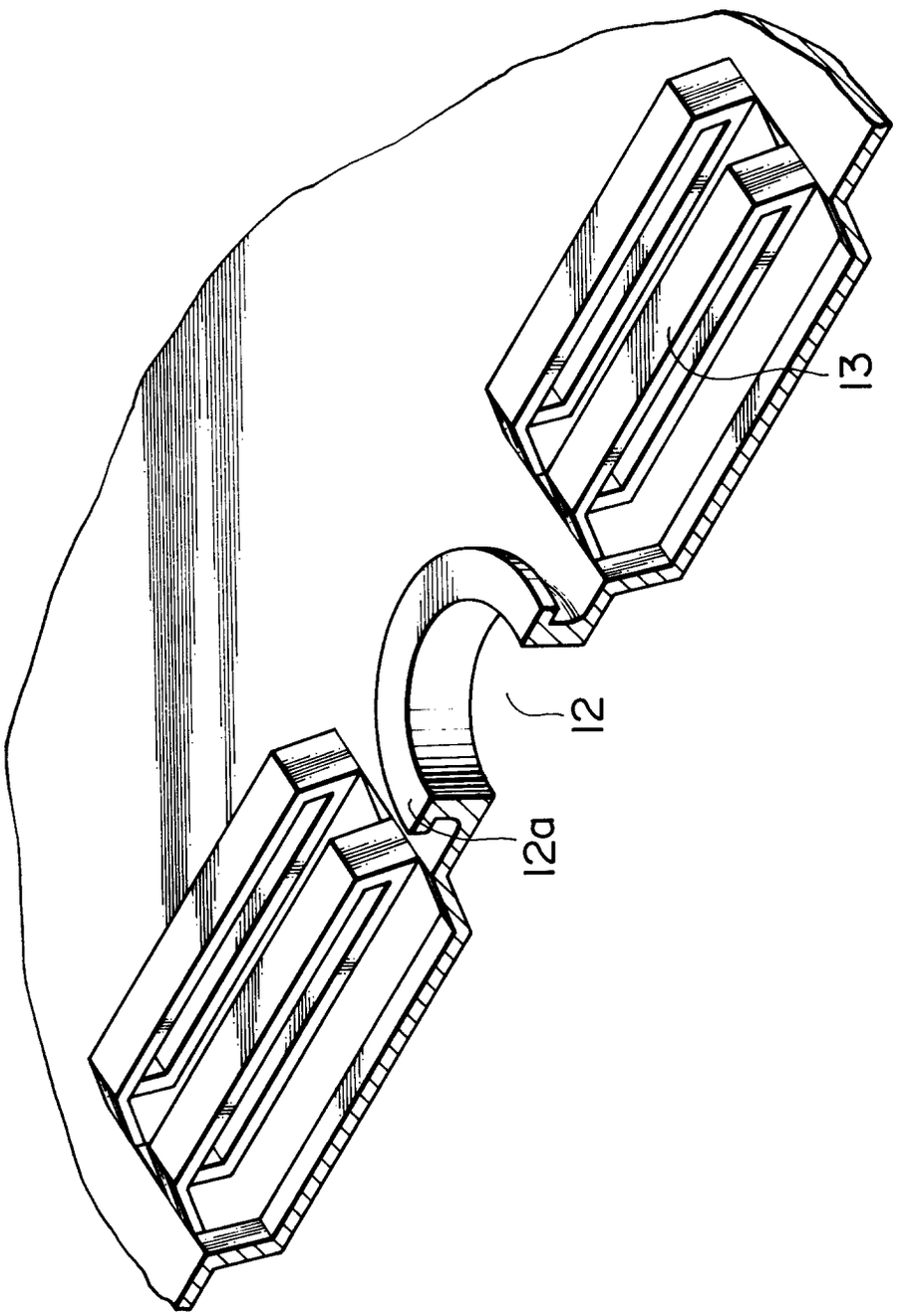


FIG. 5

