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(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Kadoma-shi, Osaka-fu (JP)

(72) Inventors:
- **Sakai, Hirokazu,**
Matsushita Elec. Ind. Co., Ltd.
Kadoma-shi, Osaka-fu (JP)
- **Sugio, Takashi,**
Matsushita Elec. Ind. Co., Ltd.
Kadoma-shi, Osaka-fu (JP)
- **Higashi, Chiaki,**
Matsushita Elec. Ind. Co., Ltd.
Kadoma-shi, Osaka-fu (JP)

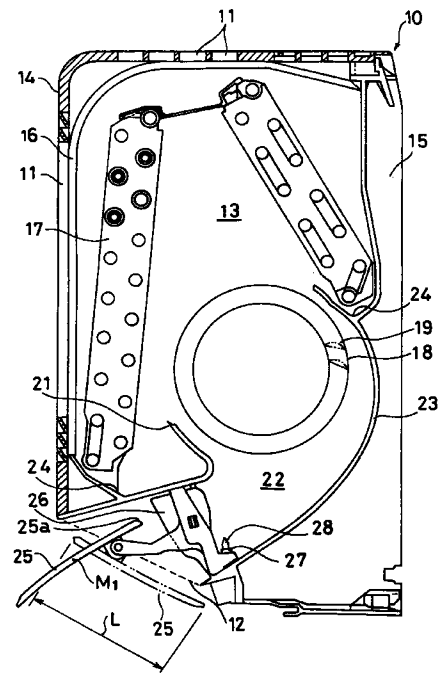
(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) Cross flow blower

(57) The constitution is characterized by installing a cross flow fan (18) having impellers composed of plural blades (19) arranged in a columnar form, inside a casing forming a draft path inside comprising suction ports and a blowing port(12); disposing a stabilizer (21) forming and a rear quide (23) which forms a diffuser from the cross flow fan (18) and the blowing port(12); and forming a vertical guide blade (25) for controlling the stream of air flow in the vertical direction at the blowing port (12),

wherein the vertical guide blade (25) is disposed so that 1/2 or more of the chord length may be present outside of the diffuser in the normal operation state.

FIG. 1



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Description

Field of the Invention

The present invention relates to a cross flow blower used in an air-conditioner or the like, and more particularly to a wind direction control technology of blowing unit.

Background of the Invention

As a cross flow blower used in a conventional air-conditioner, one as shown in Fig. 10 is known. In Fig. 10, the cross flow blower has suction ports 201 in upper side and ceiling part, and a blowing port 202 in lower side, and a draft path 203 is formed between the suction ports 201 and the blowing port 202. Inside the draft path 203, a detachable air filter 206 to be inserted to the ceiling side position of a main body base frame 205, heat exchangers 207 disposed at front side and back side, and a cross flow fan 208 located inside enclosed by the heat exchangers 207 are disposed along the inner side of a front cover 204. The cross flow fan 208 is composed by arranging plural blades 209 in a columnar form to form an impeller, and assembling a plurality of impellers in the direction or axis of rotation.

In the draft path 203 at the downstream side of the cross flow fan 208, a stabilizer 211 located closely and oppositely to the cross flow fan 208, and a rear guide 213 forming a diffuser 212 extending from the cross flow fan 208 to the blowing port 202 between it and the stabilizer 211 are arranged. Part of the rear guide 213 and the stabilizer 211 forms a drain pan 214 for receiving dehumidified water dropping from the heat exchangers 207.

The blowing port 202 comprises a vertical guide blade 215 for controlling the direction of air flow blowing out into the room in the vertical direction, and a lateral guide blade 216 for controlling in the lateral direction. The vertical guide blade 215 is positioned inside of the diffuser 212 in most part, during a normal operation. When the operation is stopped, the vertical guide blade 215 forms the contour of the blower and is hence formed in a plate shape along the contour line. A coupling beam 217 for moving the lateral guide blade 216 by interlock is disposed orthogonally to a rotary shaft 218 of the lateral guide blade 216.

In the cross flow blower having such constitution, the air flow blown out from the cross flow fan 208 passes through the vertical guide blade 215 and is separated, and collides at the leading end of the vertical guide blade 215. This has been was the cause of increase of noise. Moreover, at the upper side and lower side of the vertical guide blade 215, front edge peeling occurs and the flow rate performance is decreased significantly. The same also occurs in the coupling beam 217 for moving the lateral guide blade 216 by interlock.

The coupling beam 217 is also a severe resistance to flow, and the flow rate performance is decreased greatly.

Disclosure of the Invention

To solve the above problems, the cross flow blower of the invention is characterized by installing a cross flow fan having impellers composed of plural blades arranged in a columnar form, inside a casing which forms a draft path inside comprising suction ports and a blowing port; disposing a stabilizer and a rear quide which form a diffuser from the cross flow fan and the blowing port; and forming a vertical guide blade for controlling the stream of air flow in the vertical direction at the blowing port,

wherein the vertical guide blade is disposed so that 1/2 or more of chord length may be present outside of the diffuser in a normal operation state.

In this constitution, the air flow running through the diffuser is slowest at the blowing port. On the other hand, since 1/2 or more of the chord length of the vertical guide blade is present outside of the diffuser, its front edge is present near the blowing port, that is, in a distance of 1/2 or less of the chord length. Therefore, the air flow blown out of the cross flow fan collides against the front edge of the vertical guide blade in considerably lowered flow velocity. As a result, no extreme increase of noise occurs, and no notable peeling is caused at the upper side and lower side of the vertical guide blade, and a smooth flow field is formed, so that the flow rate performance is enhanced. Moreover, since 1/2 or more of the vertical guide blade is present outside the diffuser, flow direction of the air flow can be conlrolled accurately.

In a preferred constitution, the vertical guide blade is disposed in at least two positions at the upper side and lower side at the blowing port, and the lower vertical guide blade is disposed so that 1/2 or more of the chord length may be outside the diffuser in a normal operation state.

In this constitution, the air flow blown out of the cross flow fan collides against the front edge of the lower vertical guide blade in considerably lowered flow velocity, causing no extreme increase of noise. Although a narrow passage formed between the lower vertical guide blade and the rear guide is large in draft resistance, since 1/2 or more of the chord length of the vertical guide blade is present outside the diffuser, the distance of the narrow passage is short, and therefor, flow rate performance does not deteriorate.

In a preferred constitution, the vertical guide blade is formed in a wing shape, with the upper side and lower side raised toward the outer side in a sectional shape.

In this constitution, in the flow field formed by the air flow blown out of the cross flow fan in the diffuser, the vertical guide blade is in an appropriate wing shape small in draft resistance, and peeling that occurs at the front edge and rear edge of the vertical guide blade is suppressed ultimately, and the flow rate performance is enhanced.

In a preferred constitution, the vertical guide blade has the front edge formed in an arc form in a sectional shape, and the upper side and lower side are in a shape smoothly continuous through the front edge.

In this constitution, the fluid noise occurring when the air flow collides against the front edge of the vertical guide blade is suppressed.

In a preferred constitution, the vertical guide blade is formed in an elliptical or oblong form in a sectional shape.

In this constitution, the noise caused by collision of air flow against the leading end of the vertical guide blade is further suppressed, and peeling at the upper side and lower side of the vertical guide blade is further suppressed, the draft resistance is decreased, and the flow rate performance is enhanced. Besides, the vertical guide blade is in a shape suited to mass production by resin material.

The cross flow blower of the present invention is characterized by installing a cross flow fan having impellers composed of plural blades arranged in a columnar form, inside a casing which forms a draft path inside comprising suction ports and a blowing port; disposing a stabilizer and a rear guide which form a diffuser from the cross flow fan and the blowing port; forming a vertical guide blade for controlling the stream of air flow in the vertical direction, and lateral guide blades for controlling the stream of air flow in the lateral direction, at the blowing port, and forming a coupling beam which interlinks the lateral guide blades,

wherein the coupling beam is disposed along the stream of air flow in the diffuse.

In this constitution, the draft resistance given by the coupling beam to the air flow is minimum, and no increase of noise caused by collision of air flow against the leading end of the front edge of the coupling beam occurs, and occurrence of large peeling at the upper side and lower side of the coupling beam is prevented, and the flow rate performance is enhanced.

In a preferred constitution, the coupling beam is formed in an elliptical or oblong form in a sectional shape.

In this constitution, the noise caused by collision of air flow against the leading end of the coupling beam is further suppressed, and peeling at the upper side and lower side of the coupling beam is further suppressed, the draft resistance is decreased, and the flow rate performance is enhanced.

In a preferred constitution, the coupling beam is disposed at a position immediately before the upstream side of the vertical guide blade.

In this constitution, the vertical guide blade and coupling beam act as an integral existence to the stream of air flow. It hence suppresses the phenomena of occurrence of fluid noise and deterioration of flow rate performance due to draft resistance taking place individually in the vertical guide blade and coupling beam in the prior art. As a result, the noise quantity and deterioration portion of flow rate brought about by the vertical guide blade and coupling beam as an integral existence correspond to the noise quantity and deterioration portion of flow rate performance brought about by the vertical guide blade only in the prior art.

Brief Description of the Drawings

Fig. 1 is a cross sectional view of a first embodiment of the present invention;

Fig. 2 is a cross sectional view of a second embodiment of the present invention;

Fig. 3 is a cross sectional view of a third embodiment of the present invention;

Fig. 4 is a cross sectional view of a fourth embodiment of the present invention;

Fig. 5 is a cross sectional view of a fifth embodiment of the present invention;

Fig. 6 is a cross sectional view of a sixth embodiment of the present invention;

Fig. 7 (a) is a cross sectional view of a seventh embodiment of the present invention;

Fig. 7 (b) is a magnified view of a coupling beam 11 in the seventh embodiment of the present invention;

Fig. 8 is a first cross sectional view of an eighth embodiment of the present invention;

Fig. 9 is a second cross sectional view of the eighth embodiment of the present invention; and

Fig. 10 is a cross sectional view of a prior art.

Embodiments

Referring now to the drawings, embodiments of the invention are described below. Fig.1 is a cross sectional view of a first embodiment of the present invention.

In Fig. 1, a cross flow blower 10 has suction ports 11 at upper side and ceiling, and has a blowing port 15 at lower side, and a draft path 13 is formed between the suction ports 11 and blowing port 12. Inside the draft path 13, a detachable air filter 16 to be inserted to the ceiling side position of a main body base frame 15, heat exchangers 17 disposed at front side and back side, and a cross flow fan 18 located inside enclosed by the heat exchangers 17 are disposed along the inner side of a front cover 14. The cross flow fan 18 is composed by, assembling, in the direction of the axis of rotaion, a plurality of impellers, each of which is formed by arranging plural blades 19 in a columnar form.

In the draft path 13 at the downstream side of the cross flow fan 18, a stabilizer 21 located closely and oppositely to the cross flow fan 18, and a rear guide 23 forming a diffuser 22 extending from the cross flow fan 18 to the blowing port 12 between it and the stabilizer 21 are arranged. Part of the rear guide 23 and stabilizer 21 forms a drain pan 24 for receiving dehumidified water dropping from the heat exchangers 17.

The blowing port 12 comprises a vertical guide blade 25 for controlling the direction of air flow blowing out into the room in the vertical direction, and a lateral guide blade 26 for controlling in the lateral direction. The vertical guide blade 25 is positioned outside of the diffuser 22 in most part during normal operation. A coupling beam 27 which moves the lateral guide blade 26, is fitted to a coupling pin 28 for interlinking the lateral guide blade 26.

The state of the vertical guide blade 25 during operation is indicated by solid line, and that in stopped state by twin dot chain line. In operation, the vertical guide blade 25 is disposed outside of the diffuser 22 by 1/2 or more of the chord length. That is, the front edge of the vertical guide blade 25 is present at a position in a distance of 1/2 or less of the chord length L from the opening end of the blowing port 12. Incidentally, M1 indicates the middle point of the chord length L of the vertical guide blade 25.

In this constitution, the air flow passes through the suction ports 11, air filter 16, and heat exchangers 17, and flows into the cross flow fan 18, and further passes through the diffuser 22 formed between the rear guide 23 and stabilizer 21, and is controlled of the blowing direction by the vertical guide blade 25 and lateral guide blade 26, and is released into the room through the blowing port 12.

Meanwhile, the air flow running in the diffuser 22 is slowest at the blowing port 12. On the other hand, since 1/2 or more of the chord length of the vertical guide blade 25 is present outside the diffuser 22, its front edge 25a is present near the blowing port 12, that is, at a position in a distance of 1/2 or less of the chord length.

Therefore, the air flow blowing out of the cross flow fan 18 collides against the front edge of the vertical guide blade 25 in a state of considerably lowered flow velocity. As a result, no increase of noise is induced, and large peeling does not occur at the upper side and lower side of the vertical guide blade 25, and therefore a smooth flow field is formed and the flow rate performance is enhanced. Moreover, since 1/2 or more of the vertical guide blade 25 is present outside the diffuser 22, the control of running direction of air flow is more accurate.

Fig. 2 is a cross sectional view of a second embodiment of the present invention. Members acting same as in the first embodiment are identified with same reference numerals and explanation is omitted. In Fig. 2, upper guide blades 31, 32 are disposed in the blowing port 12 in upper position and lower position, and the both vertical guide blades 31, 32 are disposed so that 1/2 or more of the chord length may be present outside of the diffuser 22 during normal operation. Incidentally, M2 denotes the middle point of the chord length L of the upper vertical guide blade 31, and M3 is the middle point of the chord length L of the lower vertical guide blade 32.

In this constitution, since the both vertical guide blades 31, 32 are present outside of the diffuser by 1/2 or more of the chord length, their front edges 31a, 32a are positioned near the blowing port 12, that is, at a position in a distance of 1/2 or less of the chord length.

Therefore, the air flow blowing out of the cross flow fan 18 collides against the front edges 31a, 32a of the vertical guide blades 31a, 32a in a state of considerably lowered flow velocity. As a result, no increase of noise is induced, and large peeling does not occur at the upper side and lower side of the vertical guide blades 31, 32, and therefore a smooth flow field is formed and the flow rate performance is enhanced. Meanwhile, the narrow passage formed between the lower vertical guide blade 32 and rear guide 23 is large in draft resistance, but since 1/2 or more of the chord length of the vertical guide blade 32 is present outside of the diffuser, the distance of narrow passage is short, and the flow rate performance does not deteriorate.

Fig. 3 is a cross sectional view of a third embodiment of the present invention. Members acting same as in the second embodiment are identified with same reference numerals and explanation is omitted. In Fig. 3, vertical guide blades 41, 42 are shown in normal operation state, and the both vertical guide blades 41, 42 are disposed so that 1/2 or more of the chord length may be present outside of the diffuser 22 during normal operation.

The vertical guide blades 41, 42 are in a wing shape, having upper sides 41a, 42a and lower sides 41b, 42b raised to the outer side in a sectional shape.

In this constitution, in the flow field formed by the air flow blown out of the cross flow fan 18 in the diffuser 22, the vertical guide blades 41, 42 are in an optimum wing shape small in draft resistance, and peeling occurring at the front edge and rear edge of the vertical guide blades 41, 42 is extremely suppressed, so that the flow rate performance may be enhanced.

Fig. 4 is a cross sectional view of a fourth embodiment of the present invention. Members acting same as in the second embodiment are identified with same reference numerals and explanation is omitted. In Fig. 4, vertical guide blades 51, 52 are shown in normal operation state, and the both vertical guide blades 51, 52 are disposed so that 1/2 or more of the chord length may be present outside of the diffuser 22 during normal operation.

The vertical guide blades 51, 52 are shown in normal operation state. The vertical guide blades 51, 52 have the front edges 51a, 52a formed in an arc form in a sectional shape, and the upper sides 51b, 52b and lower sides 51c, 52c are continuous smoothly through the front edges 51a, 52a.

In this constitution, the fluid noise generated at the time of collision of air flow against the front edges of the vertical guide blades 51, 52 is suppressed.

Fig. 5 is a cross sectional view of a fifth embodiment of the present invention. Members acting same as in the second embodiment are identified with same reference numerals and explanation is omitted. In Fig. 5, vertical guide blades 61, 62 are shown in normal operation state, and the both vertical guide blades 61, 62 are disposed so that 1/2 or more of the chord length may be present outside of the diffuser 22 during normal operation.

The vertical guide blade 61 is an oblong shape in a sectional shape, and the vertical guide blade 62 is an elliptical shape in a sectional view.

In this constitution, the noise caused by collision of air flow against the leading ends of the vertical guide blades 61, 62 is further suppressed, and peeling at the upper side and lower side of the vertical guide blades 61, 62 is further suppressed, the draft resistance is decreased, and the flow rate performance is enhanced. Besides, the vertical guide blades are in a shape suited to mass production by resin material.

Fig. 6 is a cross sectional view of a sixth embodiment of the present invention. Members acting same as in the second embodiment are identified with same reference numerals and explanation is omitted. In Fig. 6, vertical guide blades 71, 72 are shown in normal operation state, and the both vertical guide blades 71, 72 are disposed so that 1/2 or more of the chord length may be present outside of the diffuser 22 during normal operation.

A coupling beam 73 is disposed along the stream of the air flow in the diffuser 22. In the case the coupling beam 73 is located between the lower vertical guide blade 72 and rear guide 23 in the height direction of the diffuser 22, when the slope angle α of the lower vertical guide blade 72, the slope angle β in the blowing port 12 of the rear guide 23, and the slope angle γ of the coupling beam 73 satisfy the following relation, the coupling beam 73 is in a position along the stream of the air flow.

$$\alpha \leqq \gamma \leqq \beta$$

In this constitution, as the draft resistance given by the coupling beam 73 to the air flow is minimum, noise is not increased extremely when the air flow collides against the leading end of the front edge of the coupling beam 73, and large peeling at the upper side and lower side of the coupling beam 73 is prevented, so that the flow rate performance may be enhanced.

Fig. 7 (a) and Fig. 7 (b) are cross sectional views of a seventh embodiment of the present invention. Members acting same as in the sixth embodiment are identified with same reference numerals and explanation is omitted. In Fig. 7, a coupling beam 81 for moving the lateral guide blade 26 by interlinking is formed in an elliptical or oblong shape in a sectional shape.

In this constitution, the noise caused by the air colliding against the leading end of the front edge of the coupling beam 81 can be further suppressed, and peeling at the upper side and lower side of the coupling beam 81 can be further suppressed, and therefore the draft resistance is smaller and the flow rate performance is further enhanced.

Fig. 8 is a cross sectional view of an eighth embodiment of the present invention. Members acting same as in the second embodiment are identified with same reference numerals and explanation is omitted. In Fig. 8, a coupling beam 91 is disposed at a position immediately before the upstream side of the upper vertical guide blade 31.

In this constitution, the vertical guide blade 31 and coupling beam 91 act as an integral existence to the stream of air flow, and it hence suppresses the phenomena of occurrence of fluid noise and deterioration of flow rate performance due to draft resistance taking place individually in the vertical guide blade and coupling beam in the prior art. As a result, the noise quantity and deterioration portion of flow rate brought about by the vertical guide blade 31 and coupling beam 91 as an integral existence correspond to the noise quantity and deterioration portion of flow rate performance brought about by the vertical guide blade only in the prior art.

Fig. 9 is a cross sectional view of a ninth embodiment of the present invention. Members acting same as in the eighth embodiment are identified with same reference numerals and explanation is omitted. In Fig. 9, a coupling beam 101 is disposed at a position immediately before the upstream side of the lower vertical guide blade 32. In this constitution, the vertical guide blade 32 and coupling beam 101 act as an integral existence to the stream of air flow, and it hence suppresses the phenomena of occurrence of fluid noise and deterioration of flow rate performance due to draft resistance taking place individually in the vertical guide blade and coupling beam in the prior art. As a result, the noise quantity and deterioration portion of flow rate brought about by the vertical guide blade 32 and coupling beam 101 as an integral existence correspond to the noise quantity and deterioration portion of flow rate performance brought about by the vertical guide blade only in the prior art.

Claims

1. A cross flow blower characterized by installing a cross flow fan having impellers composed of plural blades arranged in a columnar form, inside a casing that forms a draft path inside comprising suction ports and a blowing port; disposing a stabilizer and rear quide which form a diffuser from the cross flow fan and the blowing port; and forming a vertical guide blade for controlling the stream of air flow in the vertical direction at the blowing port,

   wherein the vertical guide blade is disposed so that 1/2 or more of chord length may be present outside of the diffuser in a normal operation state.

2. A cross flow blower of claim 1, wherein the vertical

guide blade is disposed in at least two positions at the upper side and lower side at the blowing port, and the lower vertical guide blade is disposed so that 1/2 or more of the chord length may be outside the diffuser in normal a operation state.

3. A cross flow blower of claim 1 or 2, wherein the vertical guide blade is formed in a wing shape, with the upper side and lower side raised toward the outer side in a sectional shape.

4. A cross flow blower of any one of claims 1 to 3, wherein the vertical guide blade has the front edge formed in an arc form in a sectional shape, and the upper side and lower side are in a shape smoothly continuous through the front edge.

5. A cross flow blower of any one of claims 1 to 4, wherein the vertical guide blade is formed in an elliptical or oblong form in a sectional shape.

6. A cross flow blower characterized by installing a cross flow fan having impellers composed of plural blades arranged in a columnar form, inside a casing which forms a draft path inside comprising suction ports and a blowing port; disposing a stabilizer and a rear quide which form a diffuser from the cross flow fan and the blowing port; forming a vertical guide blade for controlling the stream of air flow in the vertical direction, and lateral guide blades for controlling the stream of air flow in the lateral direction, at the blowing port, and forming a coupling beam which interlinks the lateral guide blades,

wherein the coupling beam is disposed along the stream of air flow in the diffuse.

7. A cross flow blower of claim 6, wherein the coupling beam is formed in an elliptical or oblong form in a sectional shape.

8. A cross flow blower of any one of claims 1 to 7, wherein the coupling beam is disposed at a position immediately before the upstream side of the vertical guide blade.

FIG. 1

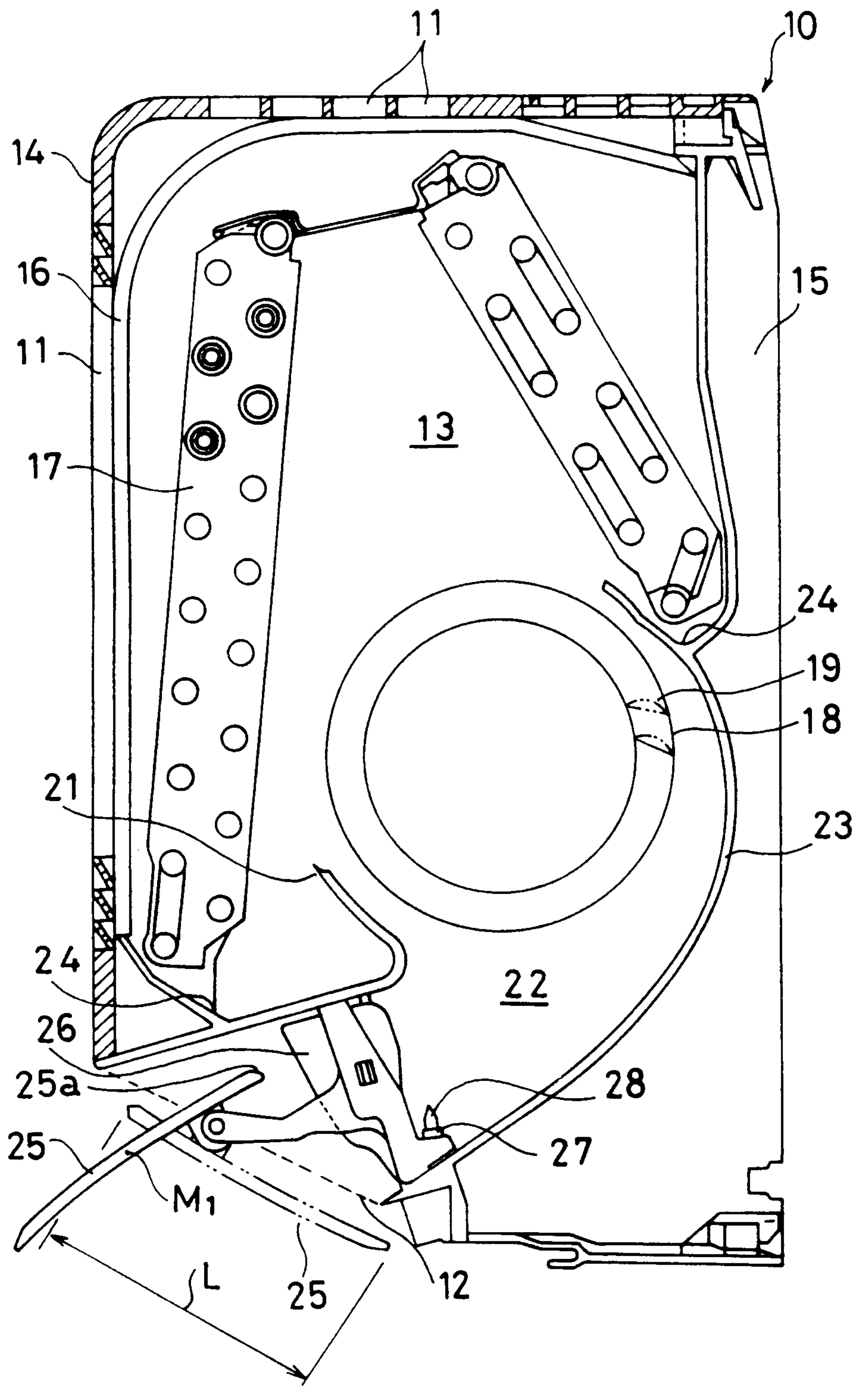

FIG. 2

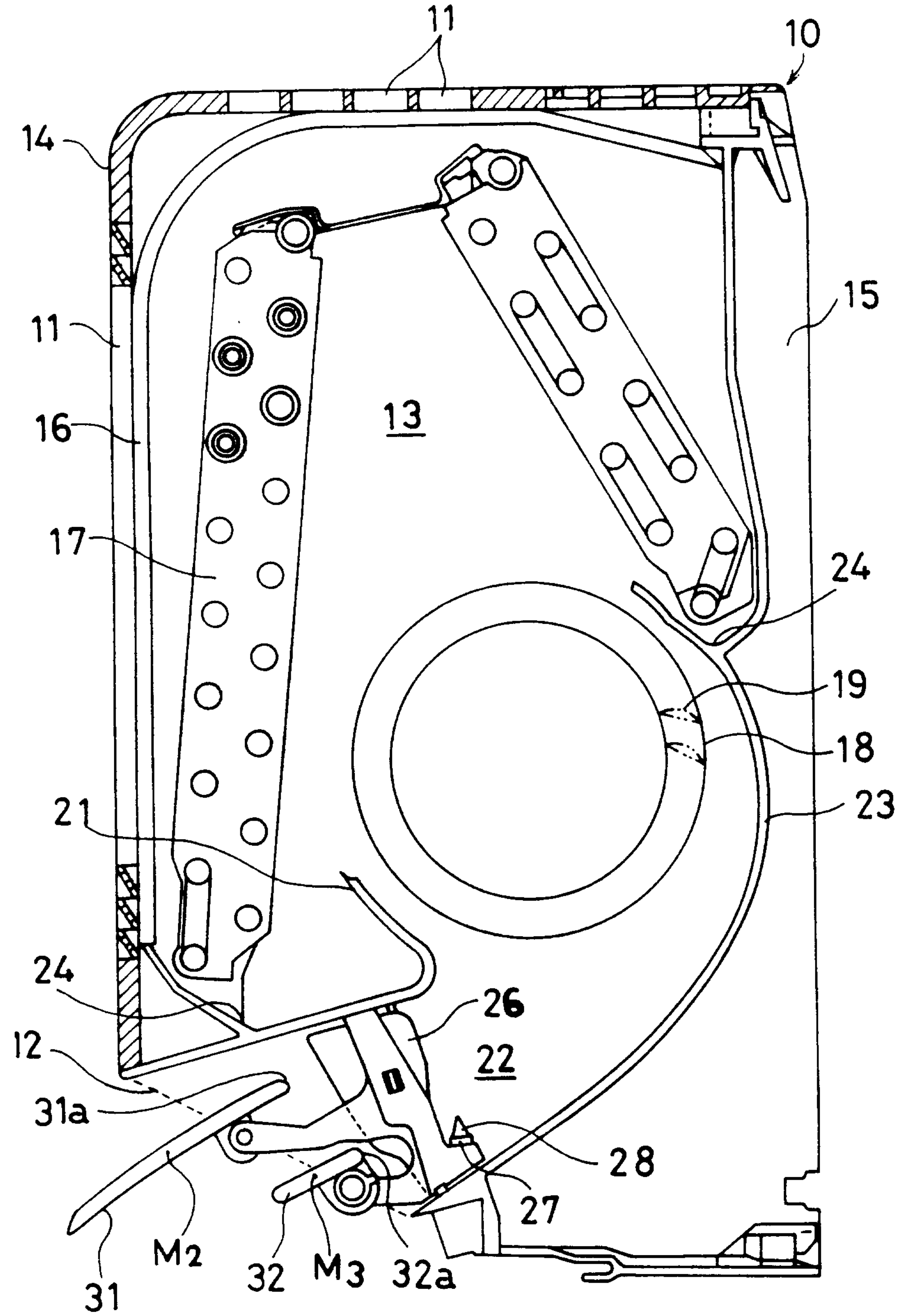
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FIG. 3

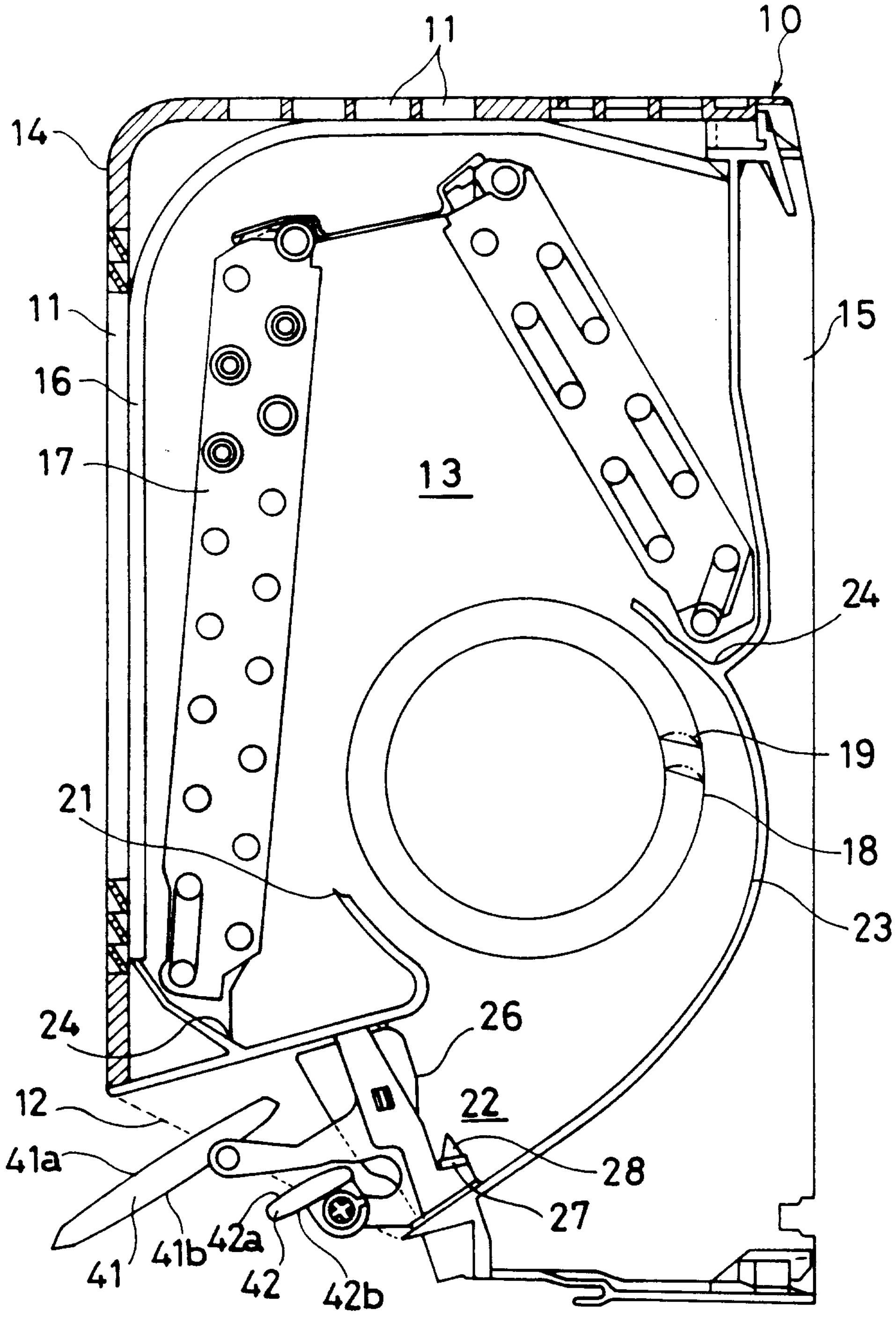

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FIG.4

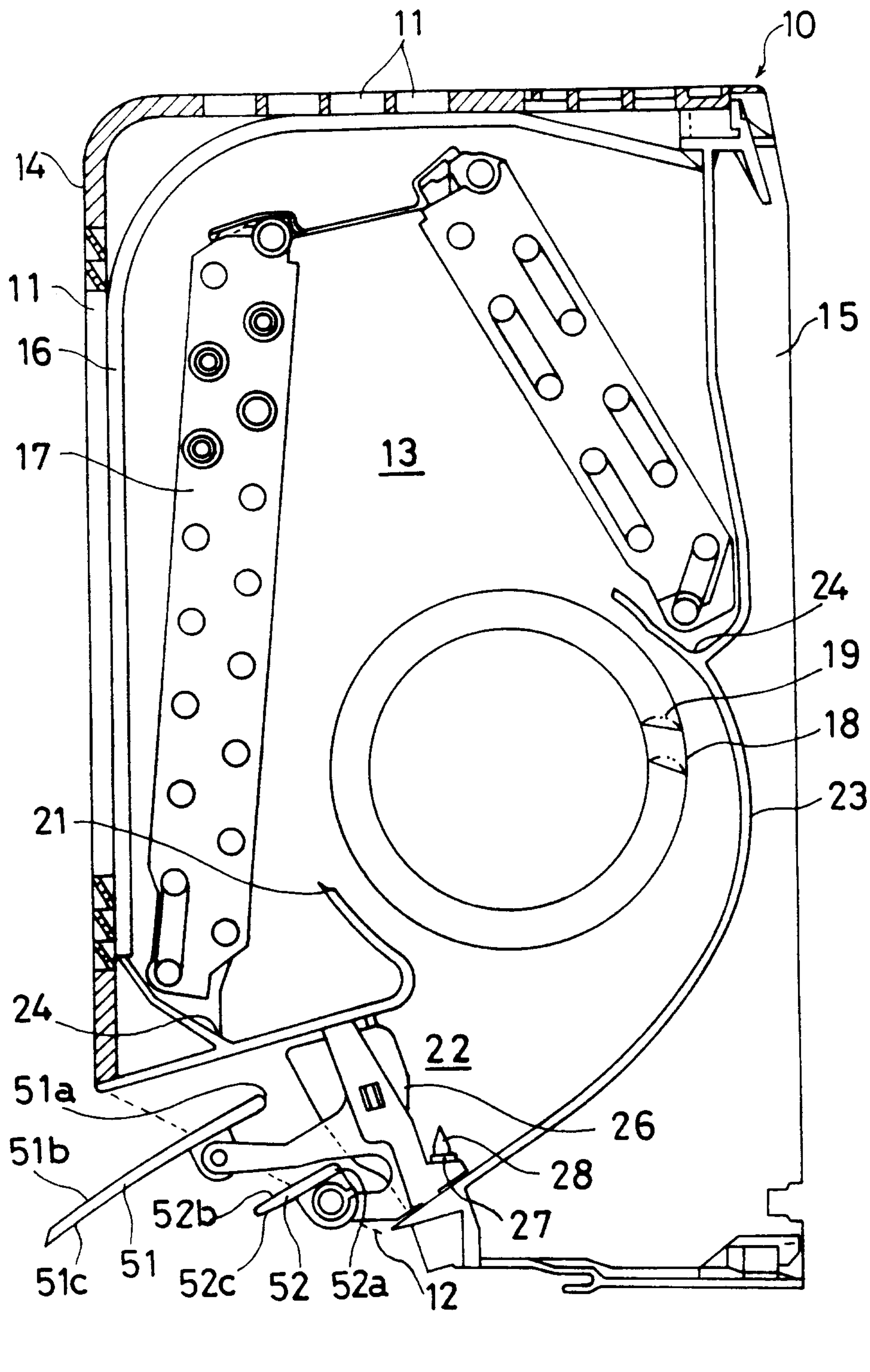
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FIG. 5

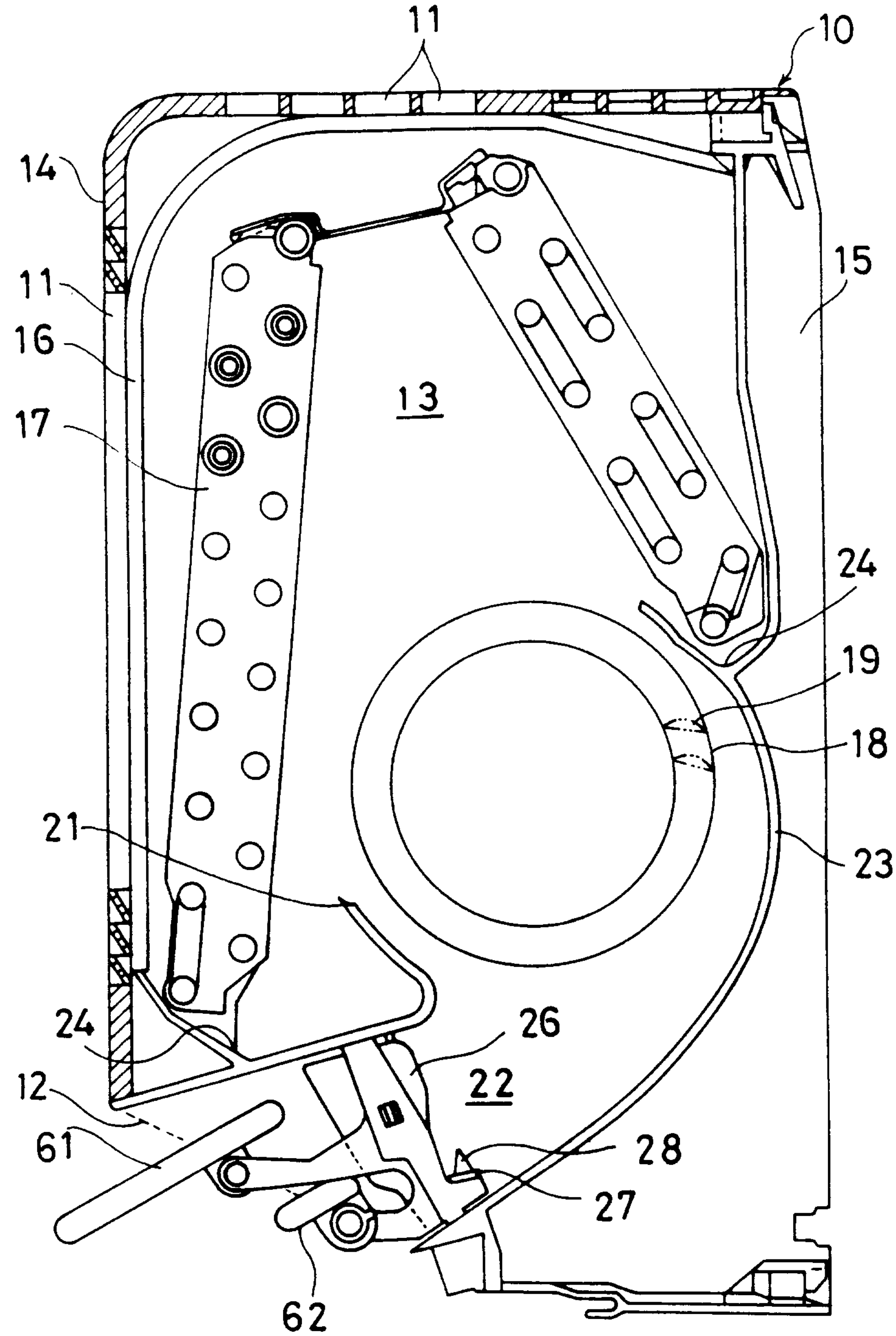


FIG. 6

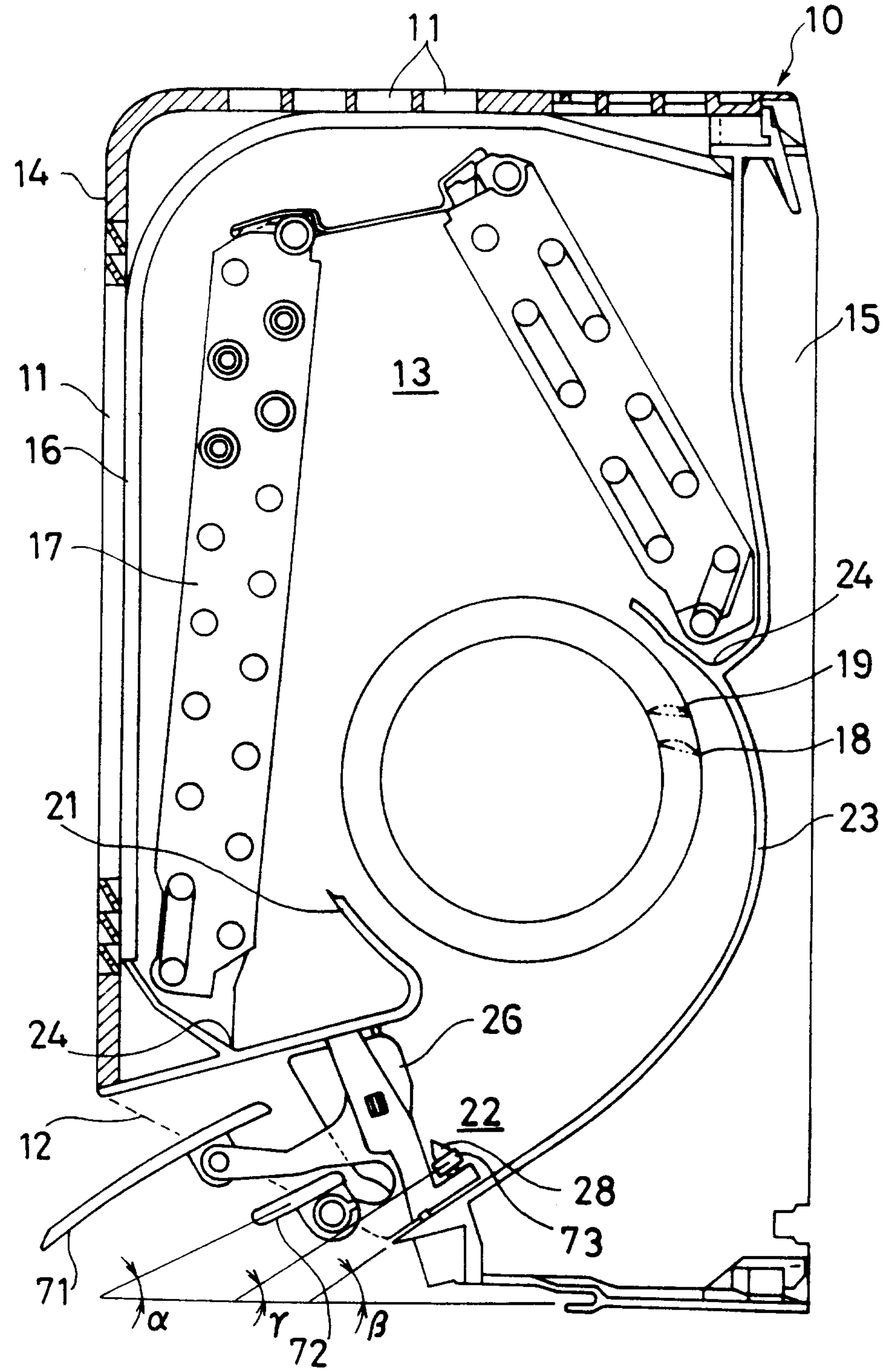


FIG. 7 (a)

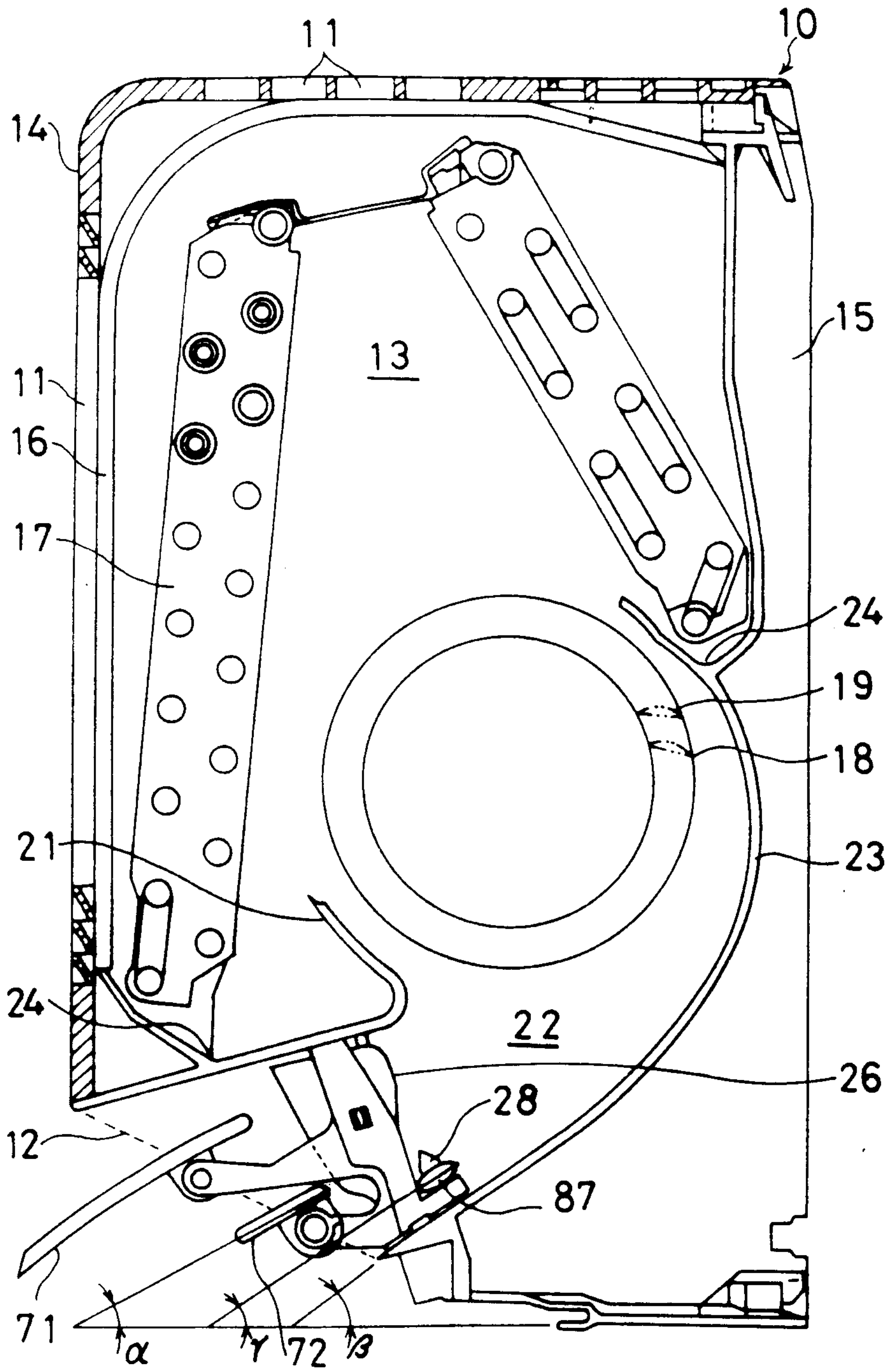


FIG.7(b)

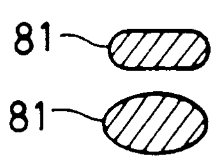


FIG. 8

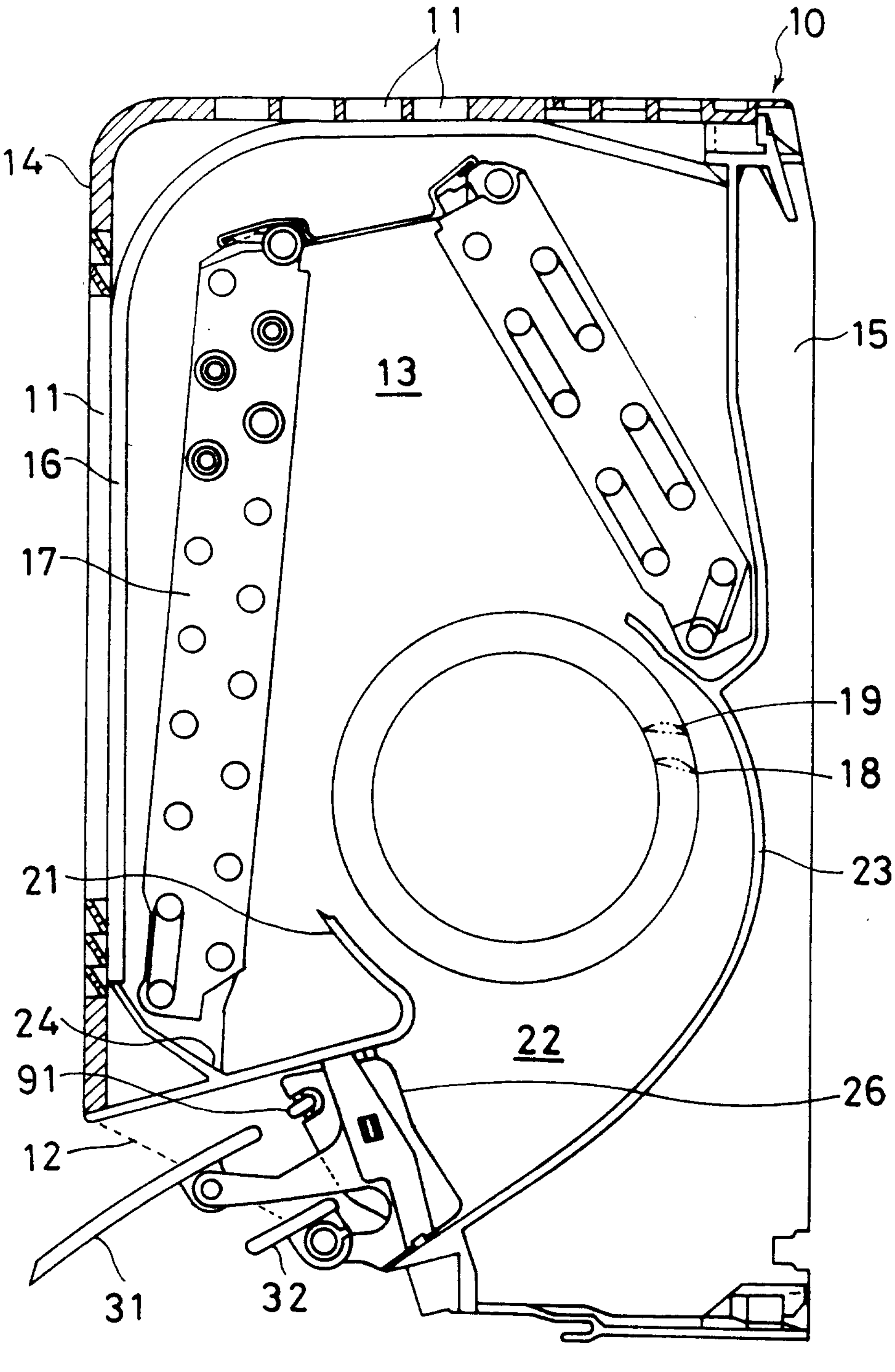


FIG. 9

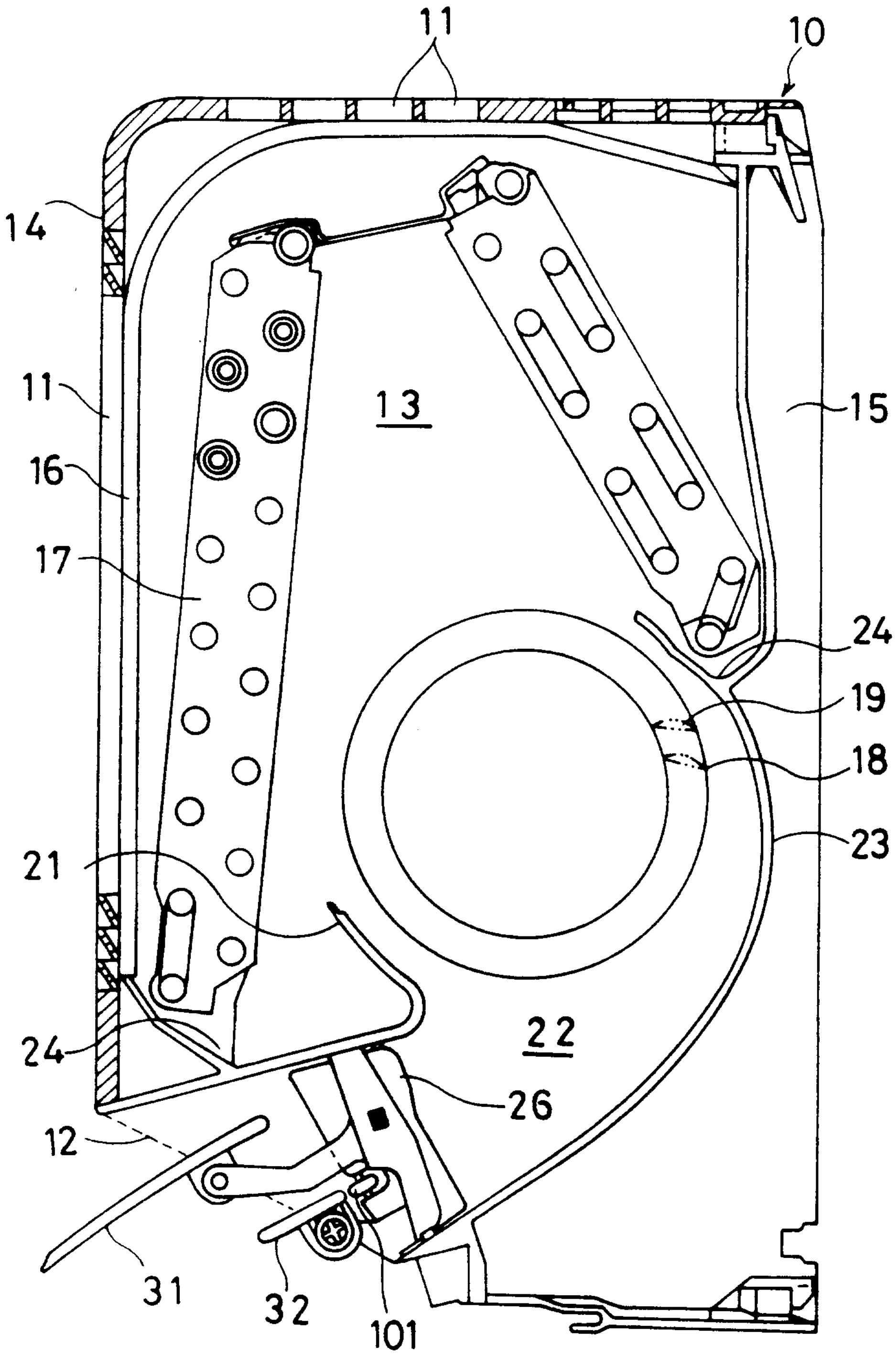
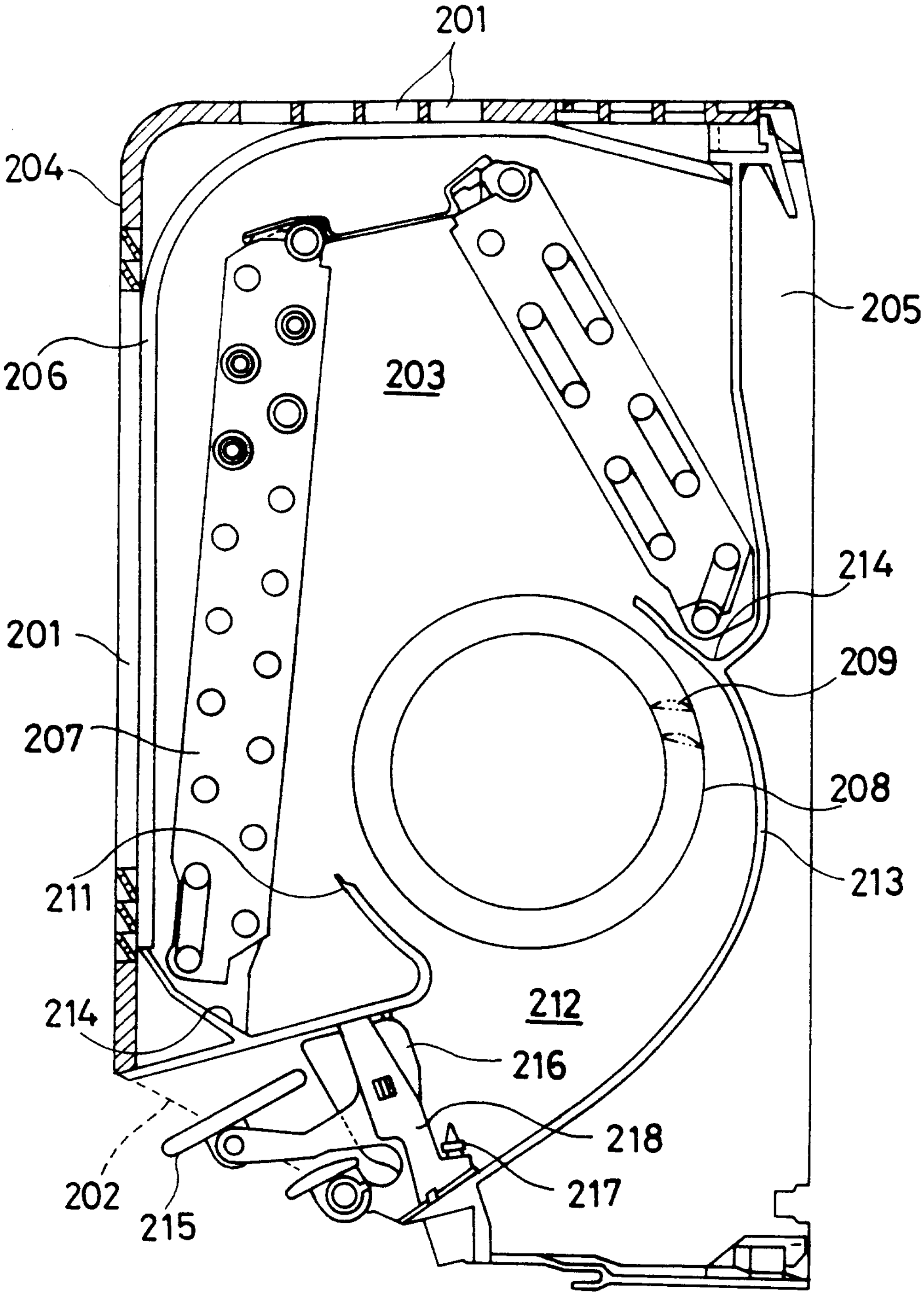


FIG.10

PRIOR ART



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 11 4662

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 657 701 (FUJITSU GENERAL LTD) 14 June 1995 * the whole document * ---	1-8	F24F1/00 F24F13/24
A	EP-A-0 560 037 (TOKYO SHIBAURA ELECTRIC CO) 15 September 1993 * abstract; figures * ---	1	
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 207 (M-165), 19 October 1982 & JP-A-57 112627 (MITSUBISHI DENKI KK), 13 July 1982, * abstract * ---	1	
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 645 (M-1517), 30 November 1993 & JP-A-05 203197 (MATSUSHITA ELECTRIC IND CO LTD), 10 August 1993, * abstract * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F24F F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 January 1997	Gonzalez-Granda, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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