



(11) **EP 1 881 739 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
23.01.2008 Bulletin 2008/04

(51) Int Cl.:
H04R 31/00 (2006.01) H04R 9/02 (2006.01)

(21) Application number: **06767083.6**

(86) International application number:
PCT/JP2006/312424

(22) Date of filing: **21.06.2006**

(87) International publication number:
WO 2006/137445 (28.12.2006 Gazette 2006/52)

(84) Designated Contracting States:
SK

(72) Inventor: **NISHIMOTO, Tatsuya**
c/o Matsushita Electric Industrial Co, Ltd
Shiromi, Chuo-ku, Osaka-shi
Osaka 540-6207 (JP)

(30) Priority: **22.06.2005 JP 2005181943**

(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Osaka 571-8501 (JP)

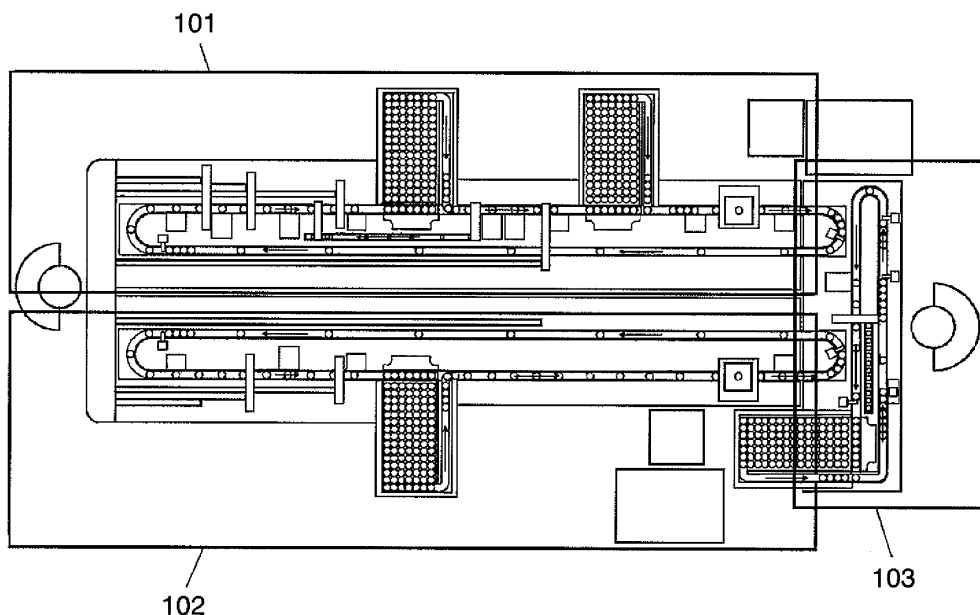
(74) Representative: **Pautex Schneider, Nicole**
Véronique et al
Novagraaf International SA
25, avenue du Pailly
1220 Les Avanchets - Geneva (CH)

(54) **PRODUCTION EQUIPMENT FOR LOUD SPEAKER MAGNETIC CIRCUIT**

(57) A production facility includes first production block (101) for manufacturing a first magnetic circuit and second production block (102) for manufacturing a second magnetic circuit. First production block (101) and second production block (102) are symmetrically ar-

ranged. The production facility further includes third production block (103) for attaching the first magnetic circuit and the second magnetic circuit. This production facility offers high productivity and ensures reliable high quality in manufacturing loudspeaker magnetic circuits having two or more magnets.

FIG. 1



EP 1 881 739 A1

Description**TECHNICAL FIELD**

[0001] The present invention relates to production facilities for manufacturing loudspeaker magnetic circuits employed in a range of audio equipment.

BACKGROUND ART

[0002] Fig. 7 is a layout of a conventional production facility for loudspeaker magnetic circuits that particularly have two or more magnets.

[0003] As shown in Fig. 7, this type of conventional production facility for manufacturing loudspeaker magnetic circuits is divided to production equipment 100 for manufacturing a first magnetic circuit, production equipment 200 for manufacturing a second magnetic circuit, and production equipment 300 for attaching the first magnetic circuit and the second magnetic circuit. Accordingly, three pieces of production equipment are needed in total.

[0004] Production equipment 100 manufactures the first magnetic circuit including a yoke, a first magnet, and a first plate; and is configured with a conveyor line which is production equipment for ordinary loudspeaker magnetic circuits. However, a belt conveyor line is not used in production equipment 200 for manufacturing second magnetic circuits and production equipment 300 for attaching the first and second magnetic circuits.

[0005] In other words, production of the second magnetic circuit and attachment of the first and second magnetic circuits are performed manually without using the conveyor line because the quantity of loudspeakers employing a magnetic circuit having two or more magnets has been small.

[0006] However, stronger demands on the market for downsizing, weight reduction, and better sound pressure level are increasing the need of loudspeakers employing a magnetic circuit having two or more magnets. The quantity of this type of loudspeakers is explosively growing, also boosted by its environment-friendly structure.

[0007] A prior art related to the present invention is, for example, Japanese Patent Unexamined Publication No. 2004-15502.

[0008] When loudspeakers employing a magnetic circuit having two or magnets are manufactured using the conventional production facility for loudspeaker magnetic circuits, production efficiency of production equipment 100 which uses the belt conveyor for manufacturing first magnetic circuits is satisfactory. However, since manual works are involved in production equipment 200 for manufacturing second magnetic circuits and production equipment 300 for attaching the first and second magnetic circuits, these processes require large manpower, resulting in low productivity.

[0009] In addition, semi-finished products need to be pooled before each drying step in production steps of the conventional production facility. Lead time thus increas-

es by transportation of semi-finished products and dried workpieces, removal of dust attached to semi-finished products, and pooled semi-finished products. This further disturbs productivity.

5 [0010] Capacity of the conventional production facility depends on human capability of personnel engaged in manufacturing loudspeaker magnetic circuits. Accordingly, production capacity varies and becomes unstable.

10 SUMMARY OF THE INVENTION

[0011] The present invention solves the above disadvantage, and provides a production facility for loudspeaker magnetic circuits that can ensure high productivity and reliable quality.

15 [0012] To solve the above disadvantage, the present invention provides the production facility for loudspeaker magnetic circuits having two or more magnets. The production facility for loudspeaker magnetic circuits includes a first production block for manufacturing a first magnetic circuit including a yoke, a first magnet attached to the yoke, and a first plate attached to the first magnet; and a second production block for manufacturing a second magnetic circuit including a second magnet and a second plate attached to the second magnet.

20 [0013] The production facility for loudspeaker magnetic circuits further includes a third production block for attaching the first magnetic circuit manufactured using the first production block and the second magnetic circuit manufactured using the second production block.

25 [0014] The present invention is thus designed for continuous production of the first magnetic circuit and the second magnetic circuit by employing a belt conveyor for the production facility. Accordingly, the present invention increases productivity of magnetic circuits and also ensures reliable quality.

30 [0015] Still more, production equipment for attaching the first magnetic circuit and the second magnetic circuit is also designed for continuous production. This further increases productivity of magnetic circuits and ensures reliable quality.

BRIEF DESCRIPTION OF DRAWINGS

35 [0016]

40 Fig. 1 is a layout of a production facility for loudspeaker magnetic circuits in accordance with a first exemplary embodiment of the present invention.

45 Fig. 2 is a plan view of the production facility for magnetic circuits in accordance with the first exemplary embodiment of the present invention.

50 Fig. 3 is an assembly process chart for a first production block in accordance with the first exemplary embodiment of the present invention.

55 Fig. 4 is an assembly process chart for a second production block in accordance with the first exemplary embodiment of the present invention.

Fig. 5 is an assembly process chart for a third production block in accordance with the first exemplary embodiment of the present invention.

Fig. 6 is a sectional view of a structure of a loudspeaker magnetic circuit in accordance with the first exemplary embodiment of the present invention.

Fig. 7 is a layout of a convention production facility for loudspeaker magnetic circuits.

REFERENCE MARKS IN THE DRAWINGS

[0017]

1, 28	Assembly and transfer jig cleaner
2	Copper cap feeder
3	Adhesive dispenser
4, 31	Plate feeder
5, 12, 30, 41	Adhesive dispenser
6	Magnet deviation preventing guide insertion device
7, 29	Magnet feeder
8, 14, 32	Pressure device
9, 15, 33, 43	Drier
10	Magnet deviation preventing guide unloader
11	Adhesion checker
13	Yoke feeder
16	Magnet and yoke adhesion checker
17, 34	Magnetizer
18, 38	Magnetized coil cooler
19, 35	Magnetization checker
20, 37	Magnetization power supply
21, 39	Unloader
22	First magnetic circuit loader
23	First assembly and transfer jig returning conveyor
24	Copper cap input conveyor
25, 46	Plate input conveyor
26, 47	Magnet input conveyor
27	Yoke input conveyor
36	Second assembly and transfer jig returning conveyor
40	Second magnetic circuit loader
42	First magnetic circuit and second magnetic circuit attachment device
44	First magnetic circuit and second magnetic circuit adhesion checker
45	Finished product unloader
48, 49	Operator
50	Copper cap
51	First plate
58	Second plate
52	Magnet deviation preventing guide
53	First magnet
57	Second magnet
54	Yoke
55	Finished first magnetic circuit
56, 61	Assembly and transfer jig

59	Finished second magnetic circuit
60	Finished product
101	First production block
102	Second production block
5 103	Third production block

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

10 [0018] An exemplary embodiment of the present invention is described below with reference to drawings.

(FIRST EXEMPLARY EMBODIMENT)

15 [0019] A production facility for loudspeaker magnetic circuits of the present invention is described below in accordance with the first exemplary embodiment.

[0020] The production facility for loudspeaker magnetic circuits in the first exemplary embodiment of the present invention is described with reference to Figs. 1 to 5.

[0021] Fig. 1 is a layout of the production facility for loudspeaker magnetic circuits in the first exemplary embodiment of the present invention. In Fig. 1, steps of manufacturing a first magnetic circuit are grouped as first production block 101 for manufacturing the first magnetic circuit. Steps of manufacturing a second magnetic circuit are also grouped as second production block 102 for manufacturing the second magnetic circuit. Third production block 103 is further provided to attach the first magnetic circuit and the second magnetic circuit manufactured, respectively. The production facility allowing continuous production is established by integrating these three pieces of on-line automated production equipment in steps of manufacturing magnetic circuits having two or more magnets.

[0022] It is apparent that production steps for the first and second magnetic circuits can be grouped to one block as production equipment for continuous production.

[0023] In this exemplary embodiment, production block 101 for manufacturing the first magnetic circuit and production block 102 for manufacturing the second magnetic circuit are symmetrically arranged.

45 [0024] This layout downsizes and achieves a compact production facility as a whole. Still more, production of the first magnetic circuit and production of the second magnetic circuit can be executed simultaneously in parallel. Production efficiency can thus be improved, and the number of personnel can also be reduced.

[0025] Production of magnetic circuits having two or more magnets, using this production facility, is described next.

[0026] Fig. 2 is a plan view of the production facility for loudspeaker magnetic circuits in the first exemplary embodiment of the present invention.

[0027] A structure of the production facility is described below.

[0028] As shown in Fig. 2, the production equipment for first magnetic circuits is configured as a block, and this production block of automated equipment includes a material feeder, adhesive dispenser 5, pressure devices 8 and 14, and driers 9 and 15. This production block also includes adhesion checker 11 and magnetizer 17.

[0029] A jig which also serves as a transfer jig for assembling the first magnetic circuit is used for creating a gap between the yoke and the plate so as to further ensure reliable quality.

[0030] This structure eliminates the need of an independent gap gauge, contributing to cost reduction. In addition, a gap-creation step also serves as a transfer step, improving production efficiency.

[0031] The production equipment for second magnetic circuits is designed into a block, and is symmetrically arranged relative to the production equipment for first magnetic circuits. This production block employing automated equipment includes a material feeder, adhesive dispenser 30, pressure device 32, drier 33 and magnetizer 34.

[0032] As the third block, a production block employing automated equipment includes adhesive dispenser 41, attachment device 42 for attaching the first magnetic circuit and the second magnetic circuit, drier 43, and adhesion checker 44.

[0033] The above three blocks are connected for continuous production. The production equipment for first magnetic circuits and the production equipment for second magnetic circuits are symmetrically arranged in the layout. This concentrates material feeding in a front section, and concentrates unloading of finished products in a rear section. Accordingly, the present invention can provide a reliable production facility that achieves extremely good production efficiency with a small number of personnel. In addition, provision of magnetizers 17 and 34 in the production facility allows automated production throughout the line, significantly improving the productivity.

[0034] Next, a production process is described.

[0035] Fig. 3 is an assembly process chart for the first production block in the first exemplary embodiment of the present invention. Fig. 4 is an assembly process chart for the second production block in the first exemplary embodiment of the present invention. Fig. 5 is an assembly process chart for the third production block in the first exemplary embodiment of the present invention.

[0036] First, operator 48 supplies a material for the first magnetic circuit and the second magnetic circuit to material feeding conveyors 24, 25, 26, 27, 46, and 47 in the first and second production blocks, respectively.

[0037] The production process in first production block 101 is described below.

[0038] After air-cleaning by assembly and transfer jig cleaner 1 every time, a workpieces is fed to the next step. Then, copper cap feeder 2 supplies copper cap 50 carried by copper cap input conveyor 24 to assembly and transfer jig 56, and then the workpiece is fed to the next step.

[0039] Then, adhesive dispenser applies adhesive to copper cap 50, and the workpiece is fed to the next step. Plate feeder 4 supplies first plate 51 carried by plate input conveyor 25 to assembly and transfer jig 56, and the workpiece is fed to the next step.

[0040] Next, adhesive dispenser 5 applies adhesive to first plate 51, and the workpiece is fed to the next step. Magnet deviation preventing guide insertion device 6 inserts magnet deviation preventing guide 52 to assembly and transfer jig 56, and the work piece is fed to the next step.

[0041] Magnet feeder 7 then supplies first magnet 53 carried by magnet input conveyor 26 to assembly and transfer jig 56. The workpiece is fed to the next step, and pressure device 8 presses the workpiece. Then, the work piece is fed to drier 9 that is the next step, dried for about 9 minutes, and then taken out.

[0042] After assembly and transfer jig 56 is taken out of drier 9, the workpiece is taken out using magnet deviation preventing guide removal device 10, and the workpiece is fed to the next step. Then, first magnet 53 and first plate 51 are checked using adhesion checker 11, and the workpiece is fed to the next step.

[0043] Then, adhesive dispenser 12 applies adhesive to first magnet 53, and the workpiece is fed to the next step. Yoke feeder 13 supplies yoke 54 carried by yoke input conveyor 27 to assembly and transfer jig 56. The workpieces is fed to the next step, and pressed by pressure device 14. Then, the workpiece is fed to drier 15 that is the next step, dried for about 9 minutes, and taken out.

[0044] After assembly and transfer jig 56 is taken out of drier 15, adhesion checker 16 checks adhesion between the yoke and the magnet, and the workpiece is fed to the next step. Magnetizer 17 then magnetizes the workpiece. Finally, magnetization checker 19 checks magnetization of the workpiece to complete finished first magnetic circuit 55. These steps are included in first production block 101.

[0045] Next, a production process of second production block 102 is described.

[0046] After air-cleaning by assembly and transfer jig cleaner 28 every time, the workpiece is fed to the next step. Magnet feeder 29 supplies second magnet 57 carried by magnet input conveyor 47 to assembly and transfer jig 61, and the workpiece is fed to the next step.

[0047] Next, adhesive dispenser 30 applies adhesive to second magnet 57, and the workpiece is fed to the next step. Plate feeder 31 supplies second plate 58 carried by plate input conveyor 46 to assembly and transfer jig 61. The workpiece is fed to the next step, and pressed by pressure device 32. Then, the workpiece is fed to drier 33 that is the next step, dried for about nine minutes, and taken out.

[0048] Magnetizer 34 magnetizes assembly and transfer jig 61 taken out of drier 33. Finally, magnetization checker 35 checks magnetization to complete finished second magnetic circuit 59. These steps are included in

second production block 102.

[0049] A production process of third production block 103 is described below.

[0050] Operator 49 takes out the first magnetic circuit manufactured in first production block 101 from unloader 21, and supplies the first magnetic circuit to a transfer jig in first magnetic circuit loader 22.

[0051] Operator 49 takes out the second magnetic circuit manufactured in second production block 102 from unloader 39, and supplies the second magnetic circuit to a transfer jig in second magnetic circuit loader 40.

[0052] The first magnetic circuit input to first magnetic circuit loader 22 is conveyed by the transfer jig, and adhesive dispenser 41 applies adhesive to the first magnetic circuit. The workpiece is then fed to the next step.

[0053] In attachment device 42 for the first magnetic circuit and the second magnetic circuit, the second magnetic circuit supplied by operator 49 and the first magnetic circuit to which adhesive is applied are attached. The workpiece is fed to drier 43 that is the next step, dried for about nine minutes, and taken out.

[0054] Adhesion checker 44 checks the first magnetic circuit and the second magnetic circuit in the transfer jig taken out of drier 43, and operator 49 takes out finished product 60 from finished product unloader 45.

[0055] Fig. 6 is a sectional view of a structure of finished product 60 of a loudspeaker magnetic circuit in the first exemplary embodiment of the present invention. Finished first magnetic circuit 55 includes copper cap 50, first plate 51, first magnet 53, and yoke 54. Finished second magnetic circuit 59 includes second plate 58 and second magnet 57. Finished product 60 is manufactured by attaching finished first magnetic circuit 55 and finished second magnetic circuit 59.

[0056] Using the above steps, the production facility for manufacturing loudspeaker magnetic circuits having two or more magnets can be designed for continuous production. This improves productivity and ensures reliable quality.

[0057] In addition, this production facility reduces the number of personnel required, contributing to significant cost reduction.

INDUSTIRAL APPLICABILITY

[0058] The production facility for loudspeaker magnetic circuits of the present invention is effectively applicable to production facilities for loudspeaker magnetic circuits employed in a range of audio equipment.

Claims

1. A production facility for loudspeaker magnetic circuits having at least two magnets, the production facility comprising:

a first production block for manufacturing a first

magnetic circuit, and

a second production block for manufacturing a second magnetic circuit;

wherein the first magnetic circuit includes:

a yoke;

a first magnet attached to the yoke; and

a first plate attached to the first magnet; and

the second magnetic circuit includes

a second magnet; and

a second plate attached to the second magnet.

2. The production facility for loudspeaker magnetic circuits of claim 1, further comprising a third production block for attaching the first magnetic circuit manufactured in the first production block and the second magnetic circuit manufactured in the second production block.

3. The production facility for loudspeaker magnetic circuits of claim 1, wherein the first production block and the second production block are symmetrically arranged.

4. The production facility for loudspeaker magnetic circuits of claim 1, wherein a gap between the yoke and the first plate is formed by using a jig that serves both as a magnetic circuit assembly and transfer jig and a gap formation jig.

5. The production facility for loudspeaker magnetic circuits of claim 1, wherein each of the first production block and the second production block includes a magnetizer.

FIG. 1

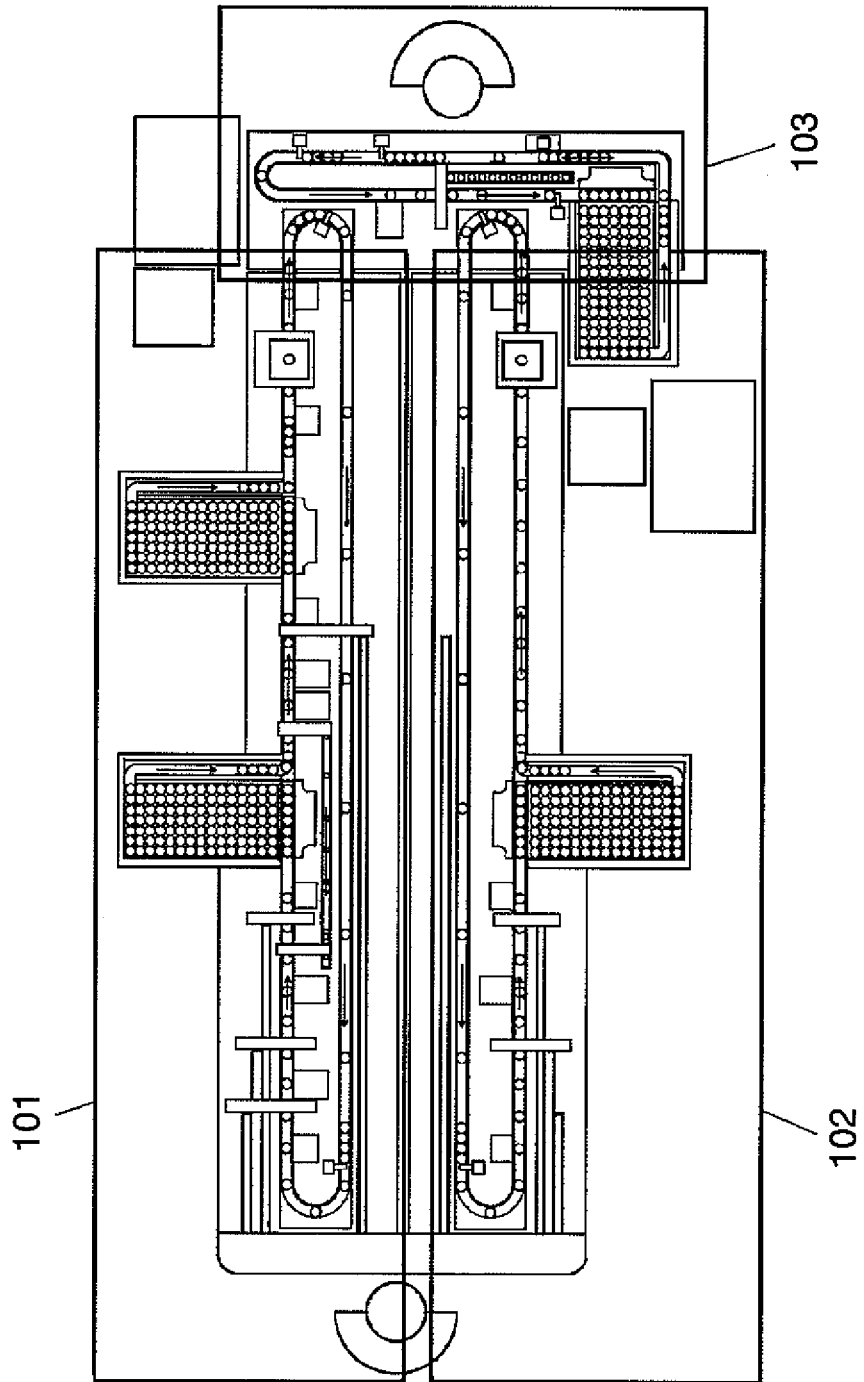


FIG. 2

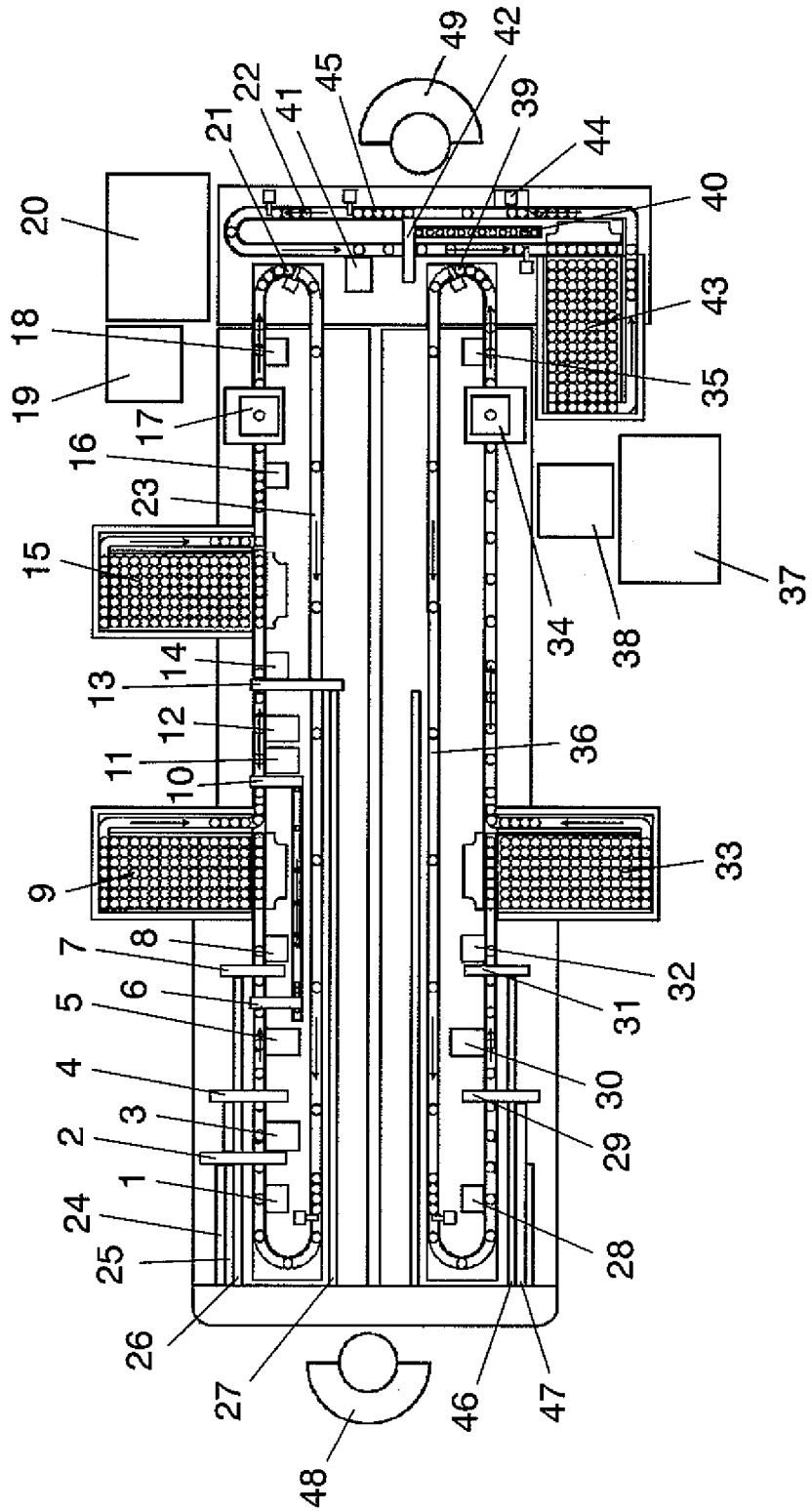


FIG. 3

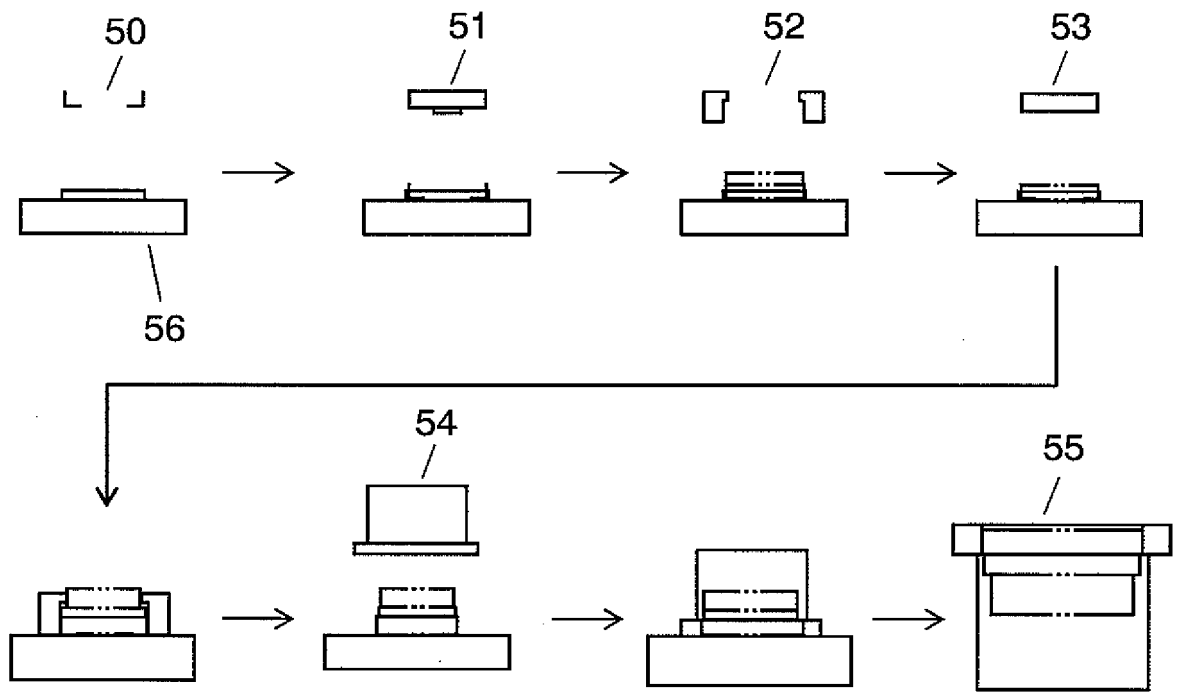


FIG. 4

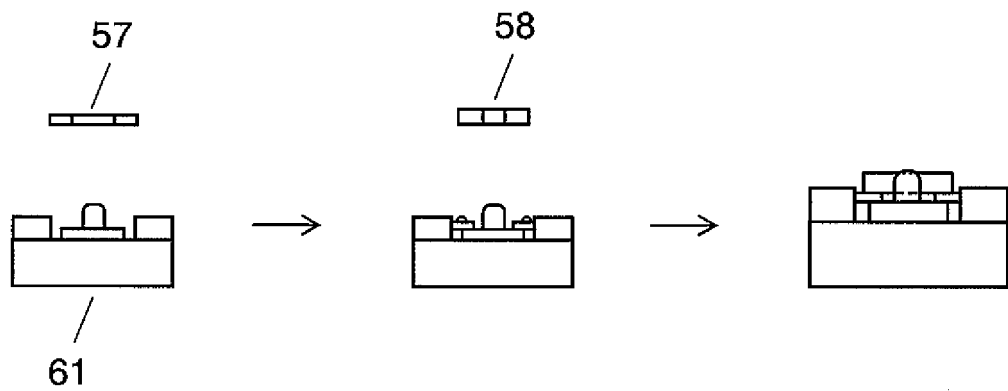


FIG. 5

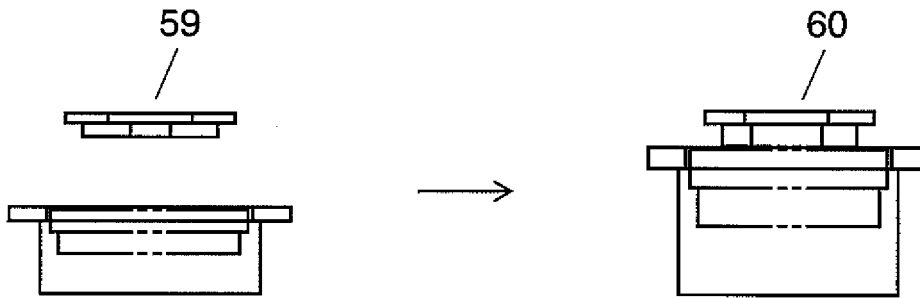


FIG. 6

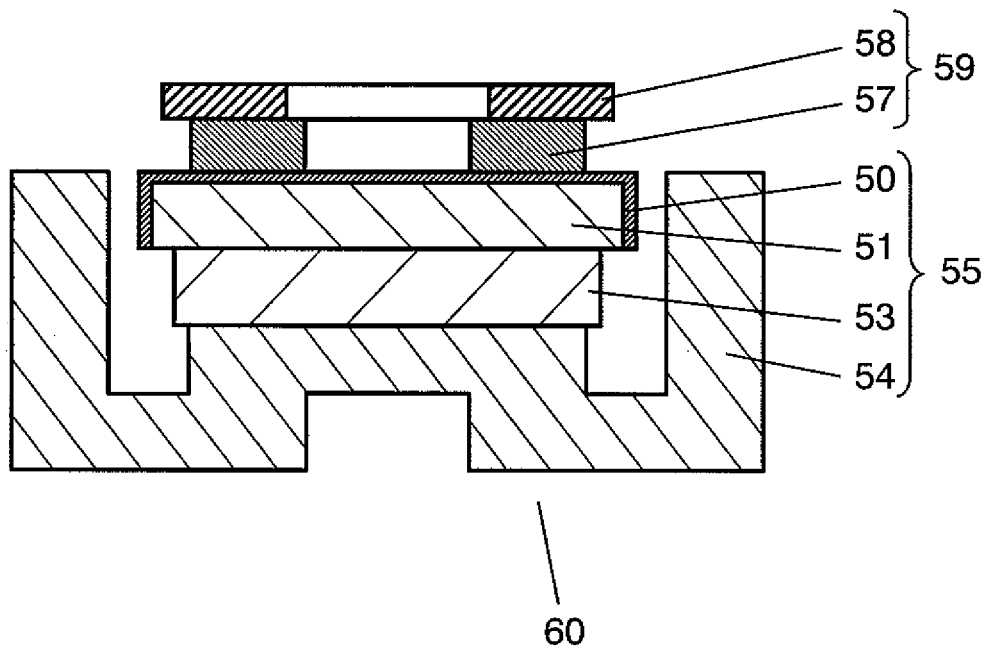
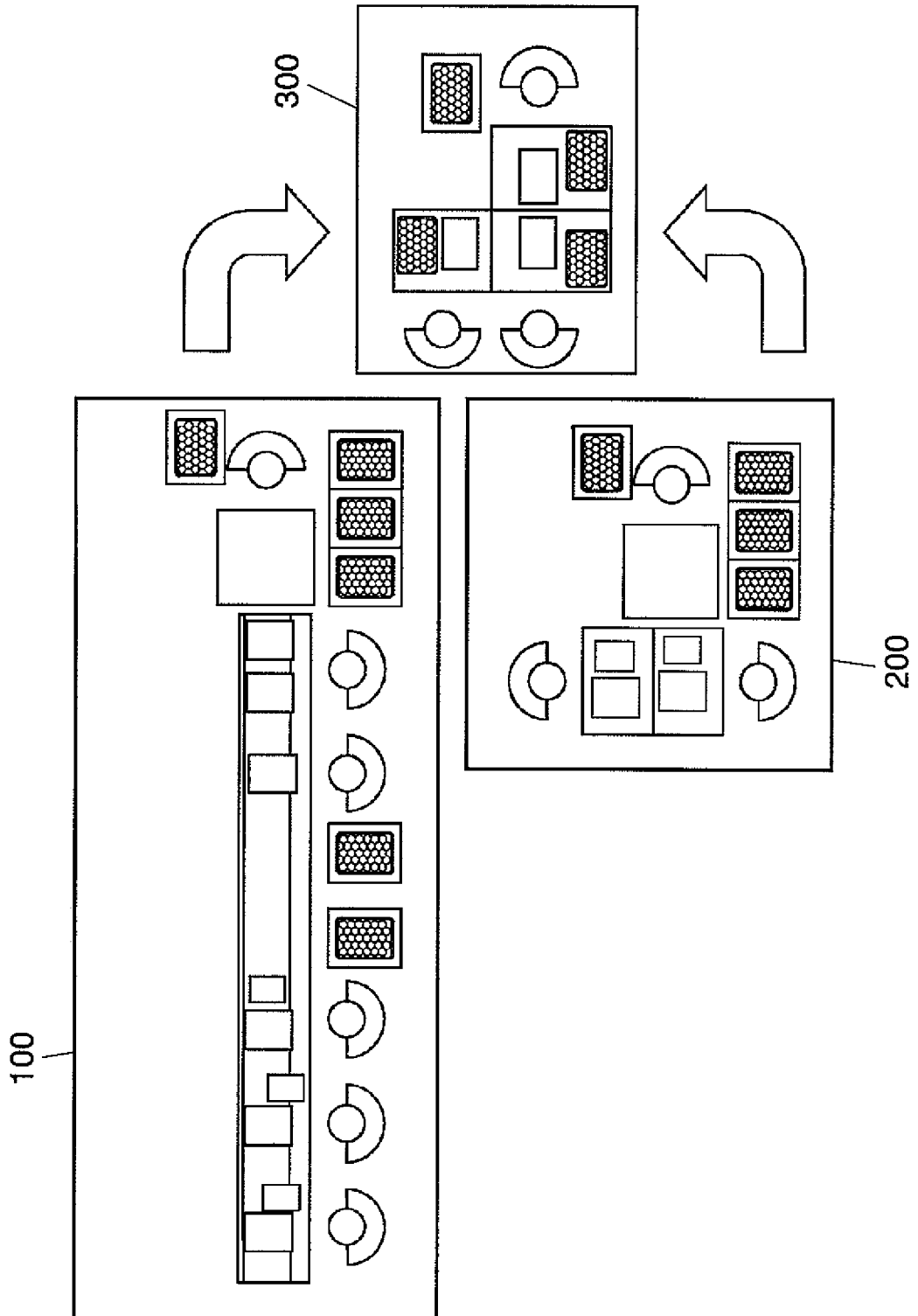


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/312424

A. CLASSIFICATION OF SUBJECT MATTER H04R31/00(2006.01)i, H04R9/02(2006.01)i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) H04R31/00, H04R9/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006 Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2004-15502 A (Matsushita Electric Industrial Co., Ltd.), 15 January, 2004 (15.01.04), Full text; all drawings & US 2005-5430 A1 & EP 1511355 A1 & WO 03/105526 A1 & CN 1568635 A & TW 223568 B	1, 2, 5 3, 4
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 2494/1983 (Laid-open No. 108398/1984) (Kabushiki Kaisha Suehiro Tekkosho), 21 July, 1984 (21.07.84), Full text; all drawings (Family: none)	3, 4
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 25 July, 2006 (25.07.06)	Date of mailing of the international search report 01 August, 2006 (01.08.06)	
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	
Facsimile No.	Telephone No.	

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/312424

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 63-261993 A (Matsushita Electric Industrial Co., Ltd.), 28 October, 1988 (28.10.88), Full text; all drawings (Family: none)	5
A	JP 57-163030 A (Ariake Kogyo Kabushiki Kaisha), 07 October, 1982 (07.10.82), Full text; all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2004015502 A [0007]