(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 472 968 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
03.11.2004 Bulletin 2004/45

(21) Application number: **02791986.9**

(22) Date of filing: **25.12.2002**

(51) Int Cl.[7]: **A47L 23/20**, D06F 58/10

(86) International application number:
PCT/JP2002/013517

(87) International publication number:
WO 2003/056999 (17.07.2003 Gazette 2003/29)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(30) Priority: **28.12.2001 JP 2001401114**

(71) Applicant: **Stecks Co., Ltd.**
Sakaiminato-shi, Tottori 684-0072 (JP)

(72) Inventor: **KIMURA, Takayuki, STECKS CO., LTD.**
Sakaiminato-shi, Tottori 684-0072 (JP)

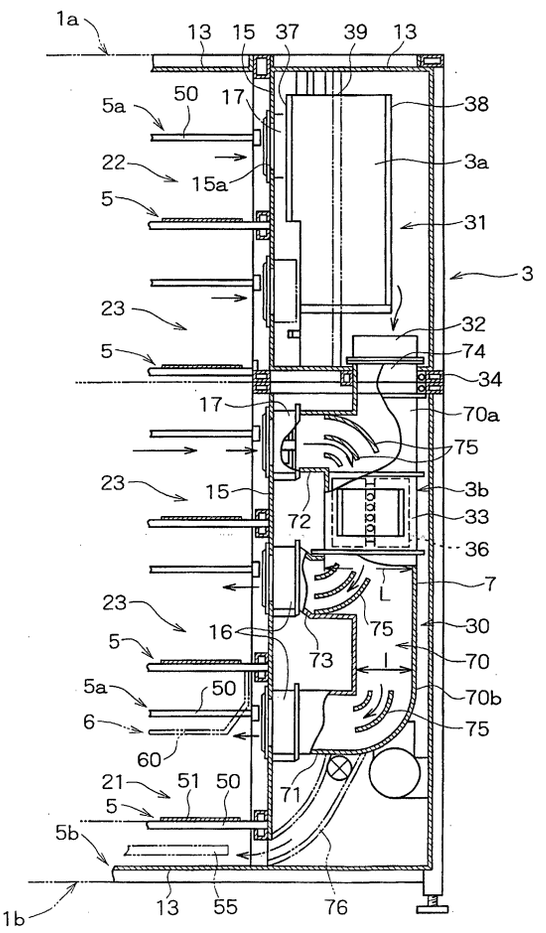
(74) Representative: **Lord, Hilton David**
MARKS & CLERK,
57-60 Lincoln's Inn Fields
London WC2A 3LS (GB)

(54) **DRYING DEVICE**

(57) The present invention is a drying apparatus (1), comprising a storage part (2) formed with plural stages of drying chambers for removably storing objects to be dried, a blowing part (3) for blowing and circulating air in the storage part (2) laterally from one side to the other side, and a heater part (3b) for heating the air circulated in the storage part (2), wherein the blowing part (3) is formed as a hollow vertical blowing chamber (30) and a blowing tube (7) forming an independent tubular air path (71) for blowing the air heated by the heater part (3b) from either of the upper and lower drying chamber sides to the other drying chamber side is installed in the blowing chamber (30).

The heater part (3b) is installed in the blowing tube (7), and a blowing fan (32) is installed on the upstream side of the blowing tube (7). The storage part (2) and the blowing part (3) are dividedly formed on an upper body (1a) side and a lower body (1b) side.

FIG. 4



EP 1 472 968 A1

Description

TECHNICAL FIELD

[0001] This invention relates to a drying apparatus for drying objects to be dried such as outfits including boots and clothes or utensils with the objects removably stored in a storage part.

BACKGROUND ART

[0002] As a drying apparatus for drying a large number of boots as an object to be dried with the boots removably stored in a storage part formed with plural stages of drying chambers having doors and shelves, an apparatus having a construction disclosed in Japanese Patent Laid-open No. Hei-11-30479 has been heretofore known.

[0003] This drying apparatus is constructed such that a hollow blowing part provided with a suction fan and a blowing fan is installed on one side communicating with each drying chamber, a blowing guiding part for blowing air blown to one drying chamber side to another drying chamber side is installed on the other side, and air circulating in the storage part is heated by a heating part.

[0004] The drying apparatus having the construction as disclosed in the above-described publication is designed such that air sucked from one drying chamber is blown to the other drying chambers through the hollow blowing part as a direct air path. Therefore, the apparatus has problems that not only a large amount of heat is radiated from a peripheral side wall forming the air path but also turbulent flow of air is easily caused in the blowing chamber and therefore, it is difficult to uniformly blow air to a plurality of drying chambers in a rectifying state.

[0005] Further, when the storage part is constructed to have a plurality of stages and a large width by the construction as described above, there arises problems that when drying a large number of boots at same time, uniform drying is hardly performed because drying time varies greatly from boots to boots, whereas when drying sufficiently all the boots, running cost is increased.

[0006] The present invention is made to solve the above-described problems and an object of the present invention is to provide an apparatus where air in the storage part is sucked from one drying chamber and through a blowing tube formed and installed separately from a chamber wall in a blowing chamber, the air heated by a heater part of the blowing tube is blown to the other drying chamber, whereby the heated air is blown effectively in the drying chambers while being prevented from radiation and the air in the storage part is circulated to effectively dry an object to be dried.

[0007] A second object of the present invention is to provide an apparatus where an object to be dried is dried, moisture of humidified air to be blown to the upper stage side is eliminated by a dehumidifier, the dehumidified air is blown to the heater part of the lower blowing tube and heated, and the heated air is blown to the drying chambers on the lower stage, whereby the object to be dried in the storage part is effectively dried.

[0008] A third object of the present invention is to provide an apparatus where previously heated and dried air is capable of being blown to the drying chambers because dehumidified air is introduced into the blowing tube and heated by a heater part, and insulation of the heated air which is dehumidified and dried in the blowing part is improved because the heater part is capable of being collectively installed in the blowing tube.

[0009] A fourth object of the present invention is to provide an apparatus where a blowing fan to be connected with a blowing tube is installed on the upper body side, whereby the blowing tube is installed and formed freely on the lower body side, dehumidified air is blown from the dehumidifier side to the blowing tube, and the construction and assembly of a large-sized drying apparatus are simplified.

[0010] A further object of the present invention is to provide an apparatus where treatment of miscellaneous bacteria in air, air cleaning treatment and the like are performed in a barrier-free hollow chamber by a miscellaneous bacteria treatment part or a fragrance treatment part installed in a hollow chamber of a blowing guiding part as a circulation path of the storage part, or ultraviolet rays or the like at the treatment are prevented from leaking from the closed blowing guiding part, and a maintenance operation is capable of being easily performed.

[0011] Other objects and advantages of the present invention will become apparent in the detailed description of the invention.

DISCLOSURE OF THE INVENTION

[0012] A drying apparatus of the present invention is an improved one of a drying apparatus 1 comprising a storage part 2 formed with a plurality of stages, rows or levels of drying chambers for removably storing objects to be dried, a blowing part 3 for blowing and circulating air in the storage part 2 laterally from one side to the other side, and a heater part 3b for heating the air circulated in the storage part 2.

[0013] As a first improved point, the blowing part 3 is formed as a hollow vertical blowing chamber 30 and a blowing tube 7 forming an independent tubular air path 71 for blowing the air heated by the heater part 3b from either of the upper and lower drying chambers to the other drying chamber is installed in the blowing chamber 30, and the heater part 3b is installed in the blowing tube 7. Further, a blowing fan 32 is installed on the upstream side of the blowing tube 7.

[0014] The storage part 2 and the blowing part 3 are dividedly formed on an upper body 1a side and a lower body 1b side, and a dehumidifier 3a is installed in the blowing chamber 30 on the upper body 1a side. On the other hand, the blowing tube 7 is installed in the blowing

chamber 30 on the lower body 1b side, and the lower body 1b and the upper body 1a are joined to allow the blowing tube 7 to communicate with an exhaust side of the dehumidifier 3a.

[0015] Furthermore, the blowing part 3 and the blowing guiding part 4 communicating with each drying chamber are connected onto one side and the other side of the storage part 2, and an air treatment part for performing one or more treatments of sterilizing treatment, deodorizing treatment and fragrance treatment on circulating air is installed in the blowing guiding part 4.

[0016] In a drying chamber in a specific area out of the drying chambers formed in a plurality of stages, a reverse support structure 6 is installed for supporting footwear W as an object to be dried in a reversed attitude (or in an up-side down or inverted orientation), and the object to be dried is dried in the reversed attitude in the drying chamber. A water-draining mechanism 5b for receiving water dropping from the footwear W and discharging the water from the storage part 2 is installed below the footwear W supported in the reversed attitude by the reverse support structure 6.

[0017] In a drying chamber in a specific area out of the drying chambers formed in a plurality of stages, a reverse support structure 6 is installed for supporting footwear W as an object to be dried in the reversed attitude, and the object to be dried is dried in the reversed attitude in the drying chamber, and the reverse support structure 6 is installed in a drying chamber on the lowermost stage to form a most quickly drying chamber 21.

[0018] Furthermore, out of the drying chambers formed in a plurality of stages in the storage part 2, the drying chamber on the lowermost stage is formed as the most quickly drying chamber 21 provided with the reverse support structure 6, the drying chamber on the uppermost stage is formed as a quickly drying chamber 22 by installing a fan 18 for blowing air downward on the upper part of the drying chamber on the uppermost stage to quickly dry the object to be dried, and the other drying chambers are formed as a normal drying chamber 23 for storing the object to be dried in a normal dry state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a partially broken front view of a construction of a drying apparatus according to the present invention.

FIG. 2 is a perspective view showing a construction of an upper body and a lower body of the drying apparatus of Fig. 1.

FIG. 3A is a partially broken front view of a construction of a storage part on the upper body.

FIG. 3B is a sectional side view of FIG. 3A.

FIG. 4 is a sectional front view showing a construction of the storage part and a blowing part.

FIG. 5 is a sectional side view showing a construction of the blowing part of FIG. 4.

FIG. 6 is a sectional plan view of a heater part.

FIG. 7 is a sectional plan view showing a construction of a branched air path of a blowing tube.

FIG. 8 is a perspective view showing a construction of a shelf part and a reverse support structure or the like.

FIG. 9 is a front view showing a construction of the shelf part and the reverse support structure or the like of FIG. 8.

FIG. 10 is a sectional side view showing a construction of the shelf part and the reverse support structure or the like of FIG. 9.

FIG. 11 is a sectional side view showing a construction of another embodiment of the shelf part and the reverse support structure or the like of FIG. 8.

FIG. 12 is a sectional side view showing a construction of another embodiment of a shelf board.

FIG. 13 is a sectional side view showing a construction of another embodiment of the shelf board.

FIG. 14 is a perspective view showing a construction of another embodiment of a drying apparatus in a vertically divided arrangement.

BEST MODE FOR CARRYING OUT THE INVENTION

[0020] One embodiment of the present invention produced to dry boots is described based on the drawings. A reference numeral 1 is a drying apparatus of the present invention, and the drying apparatus 1 shown in FIG. 1 comprises a hollow storage part 2 for singly storing and drying a plurality of pairs of work boots W as objects to be dried for use in a cooking place of restaurants or hotels, a packing house and the like, and a blowing part 3 installed on one side (right side) of the storage part 2 to blow dried air into the storage part 2. The drying apparatus 1 further comprises a blowing guiding part 4 vertically installed on the other side (left side) of the storage part 2 to turn air in the storage part 2 so as to circulate the air to the blowing part 3 side through the inside of the storage part 2.

[0021] Furthermore, in the drying apparatus 1 of this embodiment, the above-described component parts are divided in a transverse straight line into an upper part and a lower part as shown in FIG. 2, whereby the component parts are dividedly formed as a unit on an upper body 1a side and a lower body 1b side. By virtue of this construction, an installation structure and production or the like of shelf parts 5 each storing a large number of boots W in the storage part 2 are simplified. In addition, by dividing vertically the large-scaled drying apparatus 1, operations such as transportation and setting or the like are capable of being efficiently performed.

[0022] A lower surface of the upper body 1a and an upper surface of the lower body 1b each is formed into a flat surface and both of the surfaces are joined and fixed so as to be overlapped with each other, whereby

an air recirculation path is continuously formed by the blowing part 3, the storage part 2 and the blowing guiding part 4 and therefore, efficient drying of a large number of boots W is enabled.

[0023] The upper body 1a and the lower body 1b form a cubic-shaped box frame by connecting a plurality of vertical frames 10 with upper and lower lateral frames 11, in which the vertical frames 10 and the lateral frames 11 both serve as supports. Further, the upper and lower lateral frames 11 on the front side are connected by the vertical frames 10 at a storage interval for the storage of boots W, whereby entry doors of boots W are horizontally partitioned. A door 20 made of a transparent plate is attached between the vertical frames 10 so as to be allowed to open and close and make rotational motion with a hinge part as its supporting point. By fitting a seal member around the door 20, the inside part is formed into an airtight structure and closed to be freely opened, whereby leakage of inside air by pressurized air is prevented.

[0024] Furthermore, on the outer peripheral surface other than the front face, wall panels composed of stainless-steel plates or the like are attached, whereby an airtight box frame body on which peripheral walls 13 each is formed is produced.

[0025] Inside the right and left peripheral walls 13, internal side walls 14 and 15 on which a plurality of ventilations 14a and 15a are provided by piercing are stretched in parallel with the peripheral walls 13 at a predetermined interval, whereby each chamber of the blowing guiding part 4 and the blowing part 3 is formed on both sides of the storage part 2.

[0026] Incidentally, as shown in FIG. 3A, in the upper body 1a, a shelf part 5 for placing the boots W is provided at almost the same position as that of the lateral frames 11 in the lowermost part in the storage part 2, and above the shelf part 5, another shelf part 5 having the same structure is provided in the middle of the vertical frames 10, whereby the drying chambers in two stages of upper and lower serving also as a lateral air recirculation path are formed. In the lower body 1b, three shelf parts 5 are provided in the storage part 2, whereby the drying chambers in three stages of upper, central and lower are formed.

[0027] Thus, in the drying apparatus 1 shown in figures, in the state where the upper body 1a is joined on the lower body 1b, the lateral air recirculation paths in five stages are formed in the storage part 2 and the air recirculation path of the lowermost stage is formed as the most quickly drying chamber 21. At the same time, the air recirculation path of the uppermost stage also is formed as a quickly drying chamber 22 and the air recirculation paths in three stages between the drying chambers 21 and 22 are formed as normal drying chambers 23. By the construction, drying suitable for various requirements of users, such as the moisture condition of the boots W is capable of being performed while freely selecting the drying forms of each drying chamber provided collectively in the storage part 2.

[0028] A blowing fan 16 is installed at each ventilation 14a on the internal side wall 14 in the upper body 1a (FIG. 1), and a suction fan 17 is installed at each ventilation 15a on the other internal side wall 15 (FIG. 4), whereby in the quickly drying chamber 22 and the lower normal drying chamber 23 on the upper body 1a, an air stream from the blowing guiding part 4 to the blowing part 3 is orderly formed in the storage part 2 as indicated by arrows in FIG. 1.

[0029] On this occasion, the blowing fan 16 and the suction fan 17 correspondingly installed on either side of the above-described respective drying chambers are separated from each other, in which case, however, a blown air is formed because the shelf part 5 serves also as a partition wall guide of the topside or downside of an air path. Further, in the shelf part 5 extending from one side to the other side, a part of the air is also blown vertically from a gap of the shelf boards to adjacent drying chamber sides by an air pressure of the blowing air and therefore, air circulation in each chamber is accelerated while a horizontal air flow is formed, so that the boots W are effectively dried while homogenization of dried air in the storage part 2 is increased.

[0030] Next, a construction of the shelf part 5 is described by referring to FIG. 1, FIG. 3 and FIGS. 8 to 10. The shelf part 5 shown in the figures are constructed such that front and rear vertical frames 10 and 10 stood at an interval for placing two pairs of boots W in the storage part 2 are connected by a lateral rail 25 in the longitudinal direction at an installation position of the shelf. On the lateral rails 25, 25 opposed each other, a plurality of round pipe-shaped shelf rails 50 (three rails in figures) are attached and supported by sparsely being inserted in the longitudinal direction. On each of the shelf rails 50, a shelf board 51 formed to have about a width for one pair of boots is removably placed, and a gap between the shelf boards is formed between the adjacent shelf boards 51 as shown in FIG. 1 to enable vertical ventilation, whereby vertical ventilation in the drying chambers is accelerated.

[0031] In the shelf part 5, an auxiliary shelf part 5a for placing objects to be dried such as house shoes or other arbitrary small articles is installed above the space for storing the boots W.

[0032] In the auxiliary shelf part 5a shown in figures, a plurality of shelf rails 50 (three rails) composed of a small-diameter rails are attached and supported on the lateral rails 25. The shelf rails 50 are installed at the inner-side (rear side) position of the storage part 2, and other footwear such as house shoes is capable of being stored and dried in the drying chamber in the normal service attitude (hereinafter referred to as a normal attitude) where soles of boots are placed on the shelf board 51.

[0033] Further, the shelf board 51 of the shelf part 5 forms ventilation gaps in all directions and therefore, air flow in each drying chamber is formed not only in the

horizontal direction but also in the vertical direction, so that drying in tubes of the respective boots W is also capable of being sufficiently performed.

[0034] In such a storage part 2, the above-described quickly drying chamber 22 constructed on the uppermost stage of the storage part is designed to have such a structure that as shown in FIG. 3, a blowing fan 18 is installed downward on the peripheral wall (top plate) 13 as a ceiling of the chamber through a fitting bracket 13a in a state where the fan is opposed to each lower shelf board 51, and a part of the blown air crossing the quickly drying chamber 22 is forcibly blown toward the inner side of the tube in each pair of the lower boots W from the top plate 13 side.

[0035] Thus, in the quickly drying chamber 22 of the uppermost stage, even when boots W contain a large amount of water in the inside, they are capable of being dried quickly, whereas when the boots W contain a small amount of water, they are capable of being dried more quickly than the boots W in the normal drying chamber 23.

[0036] On the other hand, the most quickly drying chamber 21 is installed also on the lowermost stage of the storage part 2 in the lower body 1b. In the relevant most quickly drying chamber 21, the same shelf parts 5 as those described above are formed in series and the reverse support structure 6 for the boots W is installed. Air at a high temperature and a low humidity is blown to the boots W in both of the normal attitude and the reverse support attitude, whereby the boots W are capable of being dried in the storage part 2 in the shortest period of time.

[0037] That is, the most quickly drying chamber 21 is provided with an area where dehumidified and heated air is blown by the blowing fan 16 from an upper and lower straight air path lower part of the blowing part 3 as shown in FIGS. 4 and 5, and heated by a heating part 55 which is installed under the shelf board 51, whereby the lowermost stage of the storage part 2 is dried most quickly in the shortest period of time as compared with any other area. In this area, even the boots W are in a wet state, efficient drying may be performed.

[0038] In the heating part 55 shown in FIG. 4, a panel or block-shaped heater is placed on a bottom plate 13 as indicated by a dotted line, in which case, however, when a rod-like heater or the like, integrally installed on a shelf rail 50 is used, air inside the chamber is capable of being efficiently heated without any large occupation of a heater space or without causing inhibition of an air flow.

[0039] Further, without being limited to the above-described means, for example, a panel heater or the like may be installed on the rear side of the shelf board 51. Further, within a space path formed between the shelf part 5 and the bottom plate 13, a by-pass path 76 may be provided as indicated by the dotted line of FIG. 4 so as to selectively introduce and blow the dehumidified and heated air blown from the blowing part 3.

[0040] In this embodiment, as shown in FIG. 8, the shelf part is constructed such that a heater 3h such as a tube heater or a cord heater is installed in a pipe at the inside of the shelf rail 50 formed horizontally in each drying chamber in the same manner as in a conventional technology so as to enable local contact heating in addition to hot air heating.

[0041] Next, the reverse support structure 6 installed inside the most quickly drying chamber 21 is described by referring to FIGS. 8 to 10.

[0042] The reverse support structure 6 is constructed such that both ends of a support rail 60 comprising a rail member bent and formed in the shape of a channel are rotatably and axially supported relative to the left and right lateral rails 25, and an attitude of the support rail 60 is switchable between a support attitude where a support part 61 is projected in the most quickly drying chamber 21 as indicated by the solid line of FIGS. 9 and 10 and a storage attitude where the support part 61 is rotated and retreated upward to be stored along the lateral rail 25 as indicated by the dotted line of FIGS. 9 and 10.

[0043] Further, the auxiliary shelf part 5a corresponding to the reverse support structure 6 is designed to have a structure such that the shelf rail 50 is movable to be retreated at the switching operation of the support rail 60, whereby collision between the support part 61 and the shelf rail 50 is prevented, and an attitude change of the support rail 60 and reverse support of the boots W or the like are capable of being smoothly performed.

[0044] In other words, the auxiliary shelf part 5a shown in the figures is designed to have a structure such that both ends of the front two shelf rails 50 out of three shelf rails 50 in a normal service attitude are integrally connected by actuating members 62, and the relevant actuating members 62 are slidably inserted into and supported on a guide groove 25a formed on the lateral rail 25.

[0045] The reverse support structure 6 and the auxiliary shelf part 5a in the most quickly drying chamber 21 constructed as described above are put in a state where in the normal attitude indicated by virtual lines of FIGS. 8 and 10, the support rail 60 is stored along the lateral rail 25, the shelf rails 50 connected by the actuating members 62 are drawn to the front side and therefore, a house shoes or the like is capable of being stored in cooperation with the rear shelf rail 50. By virtue of this structure, when storing the boots W in the normal attitude where they are placed on the shelf part 5, the boots W are capable of being stored without collision of the tubular part of the boots W with the auxiliary shelf part 5a.

[0046] Further, when switching an attitude of the reverse support structure 6 to a reversed attitude as indicated by the solid line of FIGS. 8 to 10, the front two shelf rails 50 in the auxiliary shelf part 5a are first retreated by pushing them rearward to form a large spaced part at a front upper part of the shelf part 5. In

this state, when the support rail 60 is rotated to a front side while being removed from a switching member 65 against elasticity of the member, a switching operation to the support attitude is capable of being performed without collision of the support rail 60 with the auxiliary shelf part 5a.

[0047] Next, the soles of the boots W are reversed upward and the tiptoe parts thereof are laid on the auxiliary shelf part 5a. In this state, when the support part 61 of the support rail 60 is allowed to engage with the heel parts formed at rear parts of the boots W, the tiptoe parts and the heel parts of the boots W are supported in an upward attitude by the shelf rails 50 and the support rail 60.

[0048] Therefore, according to this construction, the reverse support of the boots W may be readily performed, and the tubular parts of the boots W may be widely opened in a state where they are hung downward from the shelf part 5.

[0049] Further, in the boots W reversely supported, a support device is not inserted into the boots W differently from a conventional case, so that air heated by the heating part 55 of the most quickly drying chamber 21 is allowed to flow into the tubular part of the boots W in an downward attitude, and water in the boots is allowed to drop while flowing downwards, and so that even immediately after the boots W are washed, the boots may be dried in a short period of time.

[0050] Therefore, as shown in FIG. 10, even when drying washed boots for cold weather where a cold weather member W1 such as a thick felt having a thickness of about 5 mm is stretched in the inside, or in addition, even when drying wetted ski-boots or sports shoes immediately after the use, the boots are capable of being quickly dried by use of the most quickly drying chamber 21 provided with the reverse support structure 6.

[0051] Incidentally, the switching member 65 is made of spring materials or rubber materials and has an elastically deformable stopper structure, so that the support rail 60 may be supported on the lateral rail 25 in the drying chamber.

[0052] The shelf rail 50 of the auxiliary shelf part 5a is constructed so that it can be slid in the longitudinal direction. However, the present invention is not limited to this structure, and the auxiliary shelf part 5a may be switched between the normal service attitude and the retreat attitude by rotating the shelf rail 50 in the vertical direction.

[0053] In addition, a water-draining mechanism 5b is installed under the boots W reversely supported. In this water-draining mechanism 5b, water is collected into a groove-shaped drainage trough part 57 formed on the bottom plate 13 and discharged to the outside of the apparatus.

[0054] On the occasion, when performing the reverse support drying of the boots W, the shelf board 51 may be removed.

[0055] Next, another embodiment of the shelf part 5 and the reverse support structure 6 is described by referring to FIGS. 11 to 13.

[0056] The switching member 65 of the reverse support structure 6 is provided on the shelf rail 50 of the auxiliary shelf part 5a. On the shelf board 51, a plurality of ventilation 51a are provided by piercing from the middle part of the front side of the board 51 to the front part thereof, and from the relevant ventilation 51a, hot air is blown upward in the tubular part of the boots W reversely supported to dry the boots W.

[0057] On this occasion, the shelf board 51 is bent into a valley-shape as shown in FIGS. 12 and 13, whereby water falling in droplets is collected and drained, and a ventilation space is capable of being secured between the soles of the boots W and the shelf board 51, so that the drying of the soles is accelerated.

[0058] Next, the blowing part 3 and the blowing guiding part 4 installed in the storage part 2 are described.

[0059] First, in the blowing part 3 installed on the right side of the storage part 2, a hermetically closed blowing chamber 30 is formed on the lower body 1b side by use of the internal side wall 15, the peripheral wall 13, the bottom plate 13 and an openable and closable lid part 19 on the front side, and in the inside of the chamber, a square-cylindrical-shaped blowing tube 7 is stood at a predetermined heat insulated space from the peripheral wall 13. In the inside of the hermetically closed dehumidifying chamber 31 formed on the upper body 1a side, a low temperature dehumidification-type dehumidifier 3a is installed. In a state where the lower body 1b and the upper body 1a are connected, air with high humidity which is sucked from the quickly drying chamber 22 and the normal drying chamber 23 of the upper body 1a is dehumidified through the dehumidifier 3a. The dried air dehumidified is blown from the blowing tube 7 toward the normal drying chambers 23 sides and the most quickly drying chamber 21side on the lower side of the lower body 1b. The normal drying chambers 23 on the upper side of the lower body 1b are communicated with the upper part of the blowing tube 7 so as to enable suction.

[0060] The lid part 19 is provided with an operating panel 9 for performing operation of the drying apparatus 1 and control of each device from the outside of the apparatus by automatic or manual operation. The operating panel 9 is connected to a microcomputer, various actuators and devices such as a temperature sensor or a humidity sensor (not shown), thereby enabling the operation of the drying apparatus 1 in accordance with various settings.

[0061] As shown in FIG. 4, in the blowing tube 7, a blowing fan 32 is installed on the upper end of the air path 70 formed almost in the vertical direction, an intake vent of the relevant blowing fan 32 is opened in the dehumidifier chamber 31, and a lowermost stage 'air path 71 with a width 1 which is bent toward tube most quickly drying chamber 21 side is formed on the lower end of

the air path 70. An end of the relevant lowermost stage air path 71 is connected to the blowing fan 16 attached on the internal side wall 15.

[0062] Furthermore, at the middle part of the air path 70, middle stage air paths 72 and 73 connected to the suction fan 17 and the blowing fan 16 of the normal drying chambers 23 and 23 are each branched and formed. Moreover, an air path width L which is wider than the air path width 1 of the lowermost stage air path 71 in a front view is formed between the middle stage air path 72 and the middle stage air path 73, and a heater part (heating part) 3b for heating air is installed in the inside of the air path width L.

[0063] Thus, an air path construction member is also used for the heater part 3b to form a linear air path 70, and the heater path 3b is installed at the upper stream side of the air stream in the air path 70, whereby heating efficiency in the heater part 3b is improved, heat radiation of the whole blowing tube 7 to the outside of the apparatus is prevented and improvement of insulation efficiency is attained. By virtue of this structure, air stream from each blowing fan 16 toward each drying chamber is allowed to flow almost uniformly.

[0064] Furthermore, at the branch parts of the air paths 71, 72 and 73 nearly orthogonally branched from the air path 70, air guide plates 75 with a predetermined shape and number are installed as shown in FIG. 4, whereby air stream in a nearly equal amount is allowed to flow in a rectifying state to each corresponding drying chamber.

[0065] That is, the wind guide plates 75 are installed in a plurality of stages using, as a set, a member bent and formed almost concentrically at a predetermined space from a centre of the corner at the branch part, whereby air blown from the blowing fan 32 to the air path 70 is capable of being guided in a rectifying state toward the lower stream side of each corresponding drying chamber side or the like.

[0066] Next, one embodiment of the heater part 3b is described by referring to FIGS. 4, 6 and 7. This heater part 3b is composed of a block-shaped heater 35 which internally packs a heater line, and a heat release member 36 made of a member having a high thermal conductivity such as aluminium, in which a number of fins are formed vertically around the relevant heater 35. The heater 35 is sandwiched and fixed integrally by the left and right heat release members 36, and the heater part 3b is fixed and supported on the centre part of the heater tube 33 in the manner capable of being inserted and detached, whereby a ventilation space is formed between fins and an inner periphery of the heater tube 33.

[0067] Thus, air which is blown, for example, at about 35°C by the upper blowing fan 32 is allowed to contact with a number of fins when passing through the inside of the heater tube 33, and as a result, the air is heated to about 45°C, and blown from the lower part of the blowing tube 7 to the normal drying chambers 23 and the most quickly drying chamber 21.

[0068] On this occasion, the air passes while contacting with the vertical fins indirectly heated, without directly contacting with the heater 35 heated to a higher temperature as a heat generation part, so that adhesion or deposition of dust coexisting in air is capable of being prevented and trouble such as ignition due to deposition or the like is capable of being prevented.

[0069] Further, the heater tube 33 is formed to have almost the same vertical length as that of the heater part 3b, and the air paths 70a and 70b vertically divided are connected through a flange-like fixing piece provided on upper and lower ends of the heater tube, whereby the blowing tube 7 is constructed as a series of units.

[0070] More specifically, in the blowing tube 7 constructed as described above, the upper air path 70a and the lower air path 70b are dividedly formed and connected by the heater tube 33 which internally packs the heater part 3b for serving also as an air path, so that even if the blowing tube 7 has a vertically long and complicated shape, individual air paths are capable of being readily produced and assembly operation is also capable of being readily carried out.

[0071] Further, the heater tube 33 constructed so as to be independently attached to and detached from the blowing tube 7 is capable of being assembled after the heater part 3b is previously attached as parts.

[0072] Incidentally, as shown in FIG. 6, in the heater tube 33, maintenance work such as cleaning or repair of the heater part 3b is capable of being performed from the opening formed on the end of the heater tube, so that the maintenance work is capable of being readily performed without disassembly of the blowing tube 7.

[0073] Further, the blowing tube 7 constructed as described above is downsized so that it may stored inside the lower body 1b and is designed to have such a simple structure that the air path is not complicated and the blowing resistance is reduced.

[0074] Further, the lower end of the fitting tube 74 and the upper end of the blowing tube 7 are matched or almost matched with a joint part (lower frame 34) of the upper body 1a and the lower body 1b, whereby the upper body 1a and the lower body 1b are designed to have such a structure that any other members other than the joint ends of the two bodies are not projected from the mutual joint faces to prevent deformation or breakage of the members at the time of carrying or assembling and also, assembly operation is capable of being readily performed.

[0075] Next, the dehumidifier 3a is described by referring to FIGS. 4 and 5. This dehumidifier 3a has a known low temperature dehumidification-type dehumidifying structure. In the blowing part 3 of the upper body 1a, the intake hole 37 of the dehumidifier is opposed to the quickly drying chamber 22 side and the normal drying chamber 23 side, the delivery hole 38 of dehumidified air is installed to be communicated with the blowing fan 32 side, and partitioning between the relevant intake hole 37 and delivery hole 38 sides is performed through

an appropriate partitioning member 39.

[0076] In the blowing part 3, a heat insulating member is stuck and sprayed on an internal surface of the peripheral wall 13 or the like forming an external wall of the apparatus, whereby the inside of the blowing part 3 is designed to have insulated structure to prevent heat loss.

[0077] In addition, when applying a heat insulating member along an outer periphery of the blowing tube 7 on the lower body 1b side, heat insulating work to the peripheral wall 13 or the like may be omitted.

[0078] By the above-described construction, air dehumidified by the dehumidifier 3a for dehumidifying air sucked from the upper drying chambers is heated in the blowing chamber 30 and blown to each lower drying chamber. After the dehumidification by the dehumidifier 3a, the dehumidified air is heated by the heater part 3b in the blowing tube 7 which is a heat insulating space in the blowing chamber 30 and then, the heated air is blown to the lower drying chambers. As a result, the heated and dried air carries out the drying of objects to be dried while circulating through the inside of the storage part 2 comprising the drying chambers formed in a plurality of stages, so that operation of the drying apparatus 1 by energy-saving is enabled and reduction in the running cost also is enabled.

[0079] Next, the blowing guiding part 4 is described by referring to FIG. 1. In the blowing guiding part 4, a closed hollow chamber having an openable and closable lid part is formed by almost the same construction as in the blowing part 3, and a second dehumidifier 3c is installed in this hollow chamber on the lower body 1b side. In the hollow chamber on the upper body 1a side, an ozone treatment part (ozone generator) 8 comprising, for example, an ultraviolet lamp or a discharge ozone generator for applying sterilizing or bacteriostatic treatment against miscellaneous bacteria in air, and in addition, a fragrance treatment part 8a for giving an aromatic action by a fragrance emitting device or the like to eliminate or prevent foreign odour in air, a disinfectant spray part 8b for spraying a bactericidal solution or the like are installed as an air treatment part.

[0080] Further, the ozone treatment part 8 is installed in the upper part within the hollow chamber in the blowing guiding part 4 serving as a recirculation path, so that ozone generated by the ozone generator is capable of being supplied within the hollow chamber of the upper part of the blowing guiding part 4, where no obstacles are prevent, and ultraviolet rays generated from the ozone generator are not leaked out in air from the closed blowing guiding part 4 and therefore, an adverse effect on the environment is prevented.

[0081] Out of the air purification treatment as described above, the fragrance treatment part 8a is activated after completion of the sterilizing treatment and the deodorizing treatment such as ozone treatment, to give fragrance to the purified air.

[0082] Further, the miscellaneous bacteria treatment part 8, the fragrance treatment part 8a and the disinfectant spray treatment part 8b are installed compactly and collectively in the blowing guiding part 4 in which an enough space enabling maintenance services is secured.

[0083] The second dehumidifier 3c is installed in the lower part of the blowing guiding part 4, on a diagonal line of the dehumidifier 3a in the blowing part 3. In the dehumidifier 3c, air containing moisture discharged from the most quickly drying chamber 21 side and the normal drying chamber 23 side is sucked and dehumidified. Thereafter, the dehumidified air is merged with air heading for the normal drying chamber 23 of the upper stage, and the resulting air is blown toward the normal drying chamber 23 side and the quickly drying chamber 22 side on the upper body 1a side. Air is blown into the storage part 2 of the upper body 1a side for circulation, and the drying of boots W in this part is carried out in the same manner as in the storage part 2 of the lower body 1b side, whereby totally uniform dehumidification in the storage part 2 is carried out by use of the dehumidifier 3a and the second dehumidifier 3c.

[0084] Further, by circulating air through the inside of the drying apparatus 1 as described above, dusts suspended in air in a mixing state are removed by adhering them to filters provided on the dehumidifier 3a and the second dehumidifier 3c or by mixing them in droplets generated at the dehumidification, so that purification of air in the storage part 2 is capable of being accelerated. Further, when a filter is provided on the blowing fan 16 on the upper body 1a side without being provided on the dehumidifier 3a side, capability of purifying air is capable of being improved while attaining downsizing and improvement in capability of the dehumidifier 3a.

[0085] In this embodiment, when the storage part 2 has a small capacity or the heater has sufficient performance, installation of the second dehumidifier 3c is capable of being omitted. Similarly, when capacity of the heater part 3b is increased or objects to be dried do not largely require dehumidification in air, installation of the dehumidifier 3a also may be omitted.

[0086] According to the apparatus of the present invention, the boots W stored in the normal drying chamber 23 are dried in a matter of a few hours, however, the boots W stored in the quickly drying chamber 22 are quickly dried in time shorter than a normal time because they are placed on the uppermost stage of the storage part 2 and air is forcibly blown into the boots W by the blowing fan 18.

[0087] Further, the boots W stored in the most quickly drying chamber 21 are capable of being dried in time shorter than that in the quickly drying chamber 22 in the case of stopping the blowing fan 18 because they are placed on the lowermost stage of the storage part 2, dehumidified and dried air through the dehumidifier 3a and the heater part 3b is directly blown from the lower part of the blowing tube 7, and the relevant air is reheated by the heating part 55.

[0088] Further, in the drying of the boots W as described above, when selectively actuating the miscellaneous bacteria treatment part 8, the fragrance treatment part 8a, the disinfectant spray part 8b or the like each treatment corresponding to conditions of the boots W as an object to be dried is capable of being carried out.

[0089] Further, according to the drying apparatus 1 by the above-described embodiment, when general boots W are washed and stored in the quickly drying chamber 22, the normal drying chamber 23 and the most quickly drying chamber 21 in a normal placing attitude while operating the inside of the storage part 2 at a set temperature, for example, at about 38°C, the boots W are capable of being dried to a predetermined state in nearly from 1 to 3 hours in the quickly drying chamber 22, in nearly from 2 to 4 hours in the normal drying chamber 23 and in nearly from 1 to 3 hours in the most quickly drying chamber 21, respectively.

[0090] Next, a case of drying the already described boots W for cold weather immediately after washing, where a thick felt is stretched, is described by referring to this drying operational specifications. With respect to a time required to dry the boots W to a predetermined state, it is about from 2 to 4 days in the quickly drying chamber 22 where the boots are stored in a normal attitude and similarly, it is about from 3 to 7 days in the normal drying chamber 23 and further, it is about from half day to one day and half in the most quickly drying chamber 21 where the boots are stored in a reversed attitude.

[0091] According to the above-described experiment, high drying performance in the most quickly drying chamber 21 is capable of being recognized, so that it is possible to accelerate washing and use of the boots W for cold weather, in which defects are found in view of sanitary and washing is avoided because of difficulty in drying though the boots are absolutely necessary for an operation under a cold environment such as cold district, refrigerator inside and winter.

[0092] With respect to the drying apparatus 1 according to the present invention, an embodiment for drying the boots W as an object to be dried is described. However, the object to be dried is not limited to the boots W and the drying apparatus 1 is capable of being used for, for example, clothes or other washing. When drying other belongings or goods as just described, the construction of the storage part 2 and the shelf part 5 or various types of required performance of the treatment parts, such as dehumidification, drying and others must be set according to the shapes or sized and drying specifications of the objects to be dried.

[0093] Further, in the drying apparatus 1, as shown in FIG. 14, component parts of the storage part 2 or the like are capable of being dividedly formed as a unit shape in the vertical direction in each predetermined lateral width, whereby the drying chambers each capable of storing and placing a number of objects to be dried such as boots W in the storage part 2 are capable of being simplified in the installation structure to have a low-cost construction. Further, the drying chamber 1 liable to have a large size is vertically divided to have a compact construction, so that operations such as production, transportation and setting thereof are capable of being efficiently performed.

INDUSTRIAL APPLICABILITY

[0094] The drying apparatus of this prevention is capable of being produced or used as a drying machine for drying footwear such as boots, or clothes, other washings or the like which are put on, for example, in a cooking place of large-scaled restaurants or hotels, a packing house, a handling place of fishery products or other places.

Claims

1. A drying apparatus (1), comprising:

a storage part (2) formed with plural stages of drying chambers for removably storing objects to be dried;
a blowing part (3) for blowing and circulating air in said storage part (2) laterally from one side to the other side; and
a heater part (3b) for heating the air circulated in the storage part (2);

wherein said blowing part (3) is formed as a hollow vertical blowing chamber (30) and a blowing tube (7) forming an independent tubular air path (71) for blowing the air heated by the heater part (3b) from either of the upper and lower drying chamber sides to the other drying chamber side is installed in said blowing chamber (30).

2. The drying apparatus according to claim 1, wherein the heater part (3b) is installed in the blowing tube (7).

3. The drying apparatus according to claim 1, wherein a blowing fan (32) is installed on the upstream side of the blowing tube (7).

4. The drying apparatus according to claim 1, wherein the storage part (2) and the blowing part (3) are dividedly formed on an upper body (1a) side and a lower body (1b) side, a dehumidifier (3a) is installed in the blowing chamber (30) on the upper body (1a) side, the blowing tube (7) is installed in the blowing chamber (30) on the lower body (1b) side, and the lower body (1b) and the upper body (1a) are joined to allow the blowing tube (7) to communicate with an exhaust side of the dehumidifier (3a).

5. The drying apparatus according to claim 1, wherein the blowing part (3) and a blowing guiding part (4) communicating with each drying chamber are connected onto one side and the other side of the storage part (2).

6. The drying apparatus according to claim 5, wherein in the blowing guiding part (4), an air treatment part for performing one or more treatments of sterilizing treatment, deodorizing treatment and fragrance treatment on circulating air is installed.

7. The drying apparatus according to claim 1, 2, 3, 4 or 5, wherein in a drying chamber in a specific area out of the drying chambers formed in a plurality of stages, a reverse support structure (6) is installed for supporting footwear (W) as an object to be dried in the reversed attitude, and the object to be dried is dried in the reversed attitude in said drying chamber.

8. The drying apparatus according to claim 1, 2, 3, 4 or 5, wherein in a drying chamber in a specific area out of the drying chambers formed in a plurality of stages, a reverse support structure (6) is installed for supporting footwear (W) as an object to be dried in the reversed attitude, and a water-draining mechanism (5b) for receiving water dropping from the footwear (W) and discharging the water from the storage part (2) is installed below the footwear (W) supported in the reversed attitude by said reverse support structure (6).

9. The drying apparatus according to claim 1, 2, 3, 4 or 5, wherein in a drying chamber in a specific area out of the drying chambers formed in a plurality of stages, a reverse support structure (6) is installed for supporting footwear (W) as an object to be dried in the reversed attitude, the reversed support structure (6) being installed in a drying chamber on the lowermost stage to form a most quickly drying chamber (21).

10. The drying apparatus according to claim 1, 2, 3, 4, or 5, wherein out of the drying chambers formed in a plurality of stages in the storage part (2), the drying chamber on the lowermost stage is formed as the most quickly drying chamber (21) provided with the reverse support structure (6), the drying chamber on the uppermost stage is formed as a quickly drying chamber (22) by installing a fan (18) for blowing air downward on the upper part of the drying chamber on the uppermost stage to quickly dry the object to be dried, and the other drying chambers are formed as a normal drying chamber (23) for storing the object to be dried in a normal dry state.

FIG. 1

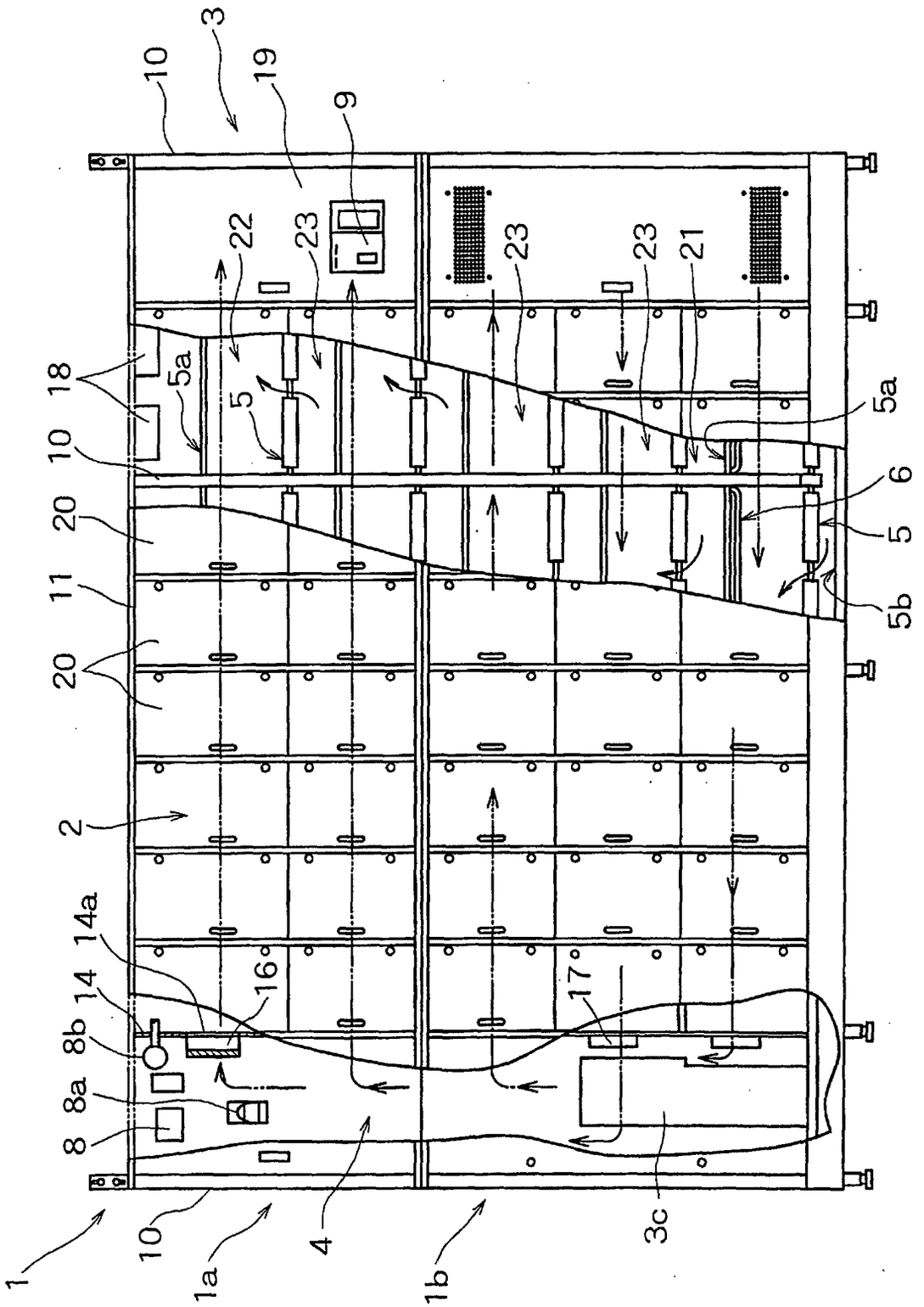

3
10
19
9
22
23
23
23
21
18
5a
5
10
20
11
20
2
14a
14
16
17
8b
8a
8
10
1
1a
4
1b
3c
5a
6
5
5b

FIG. 2

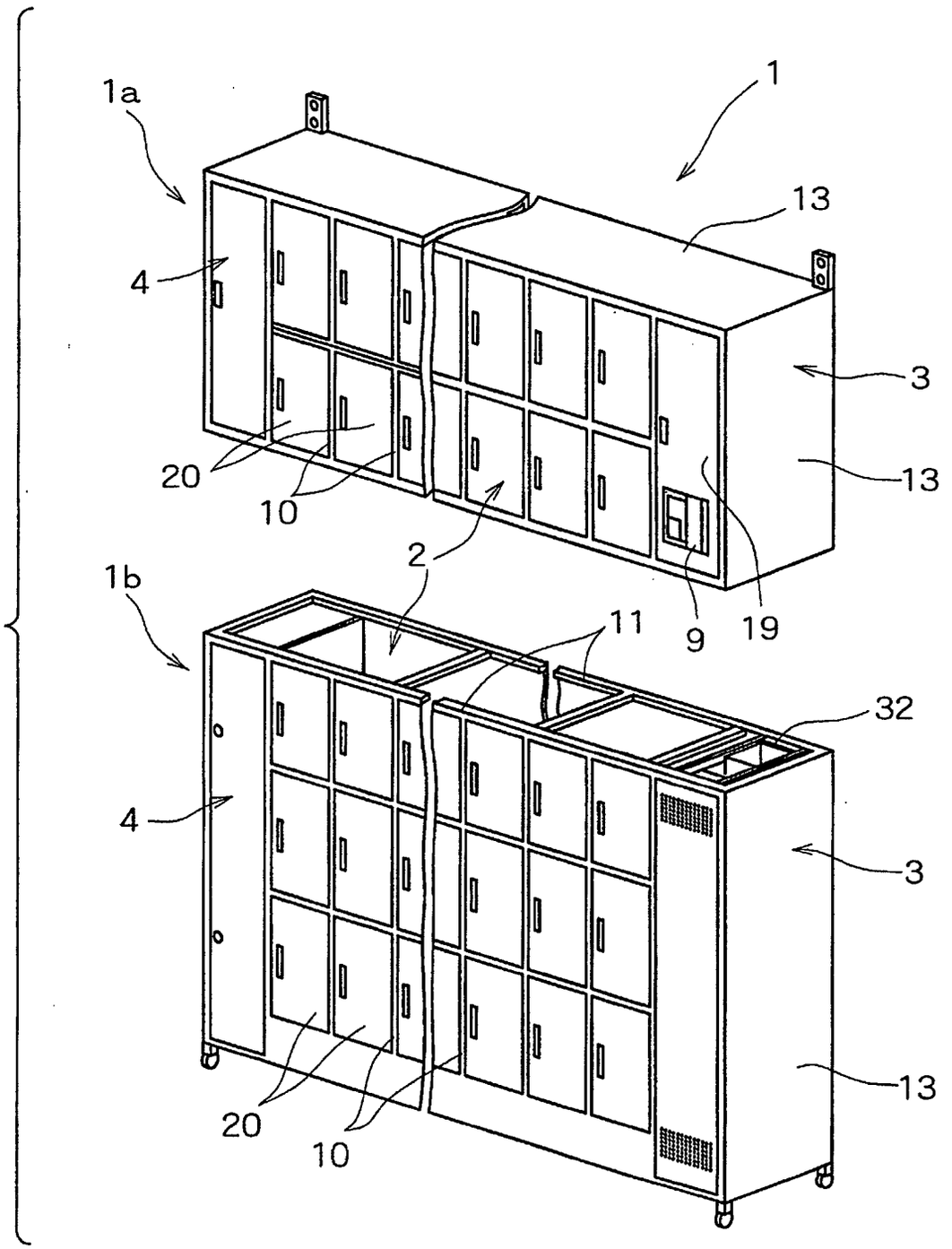


FIG. 3B

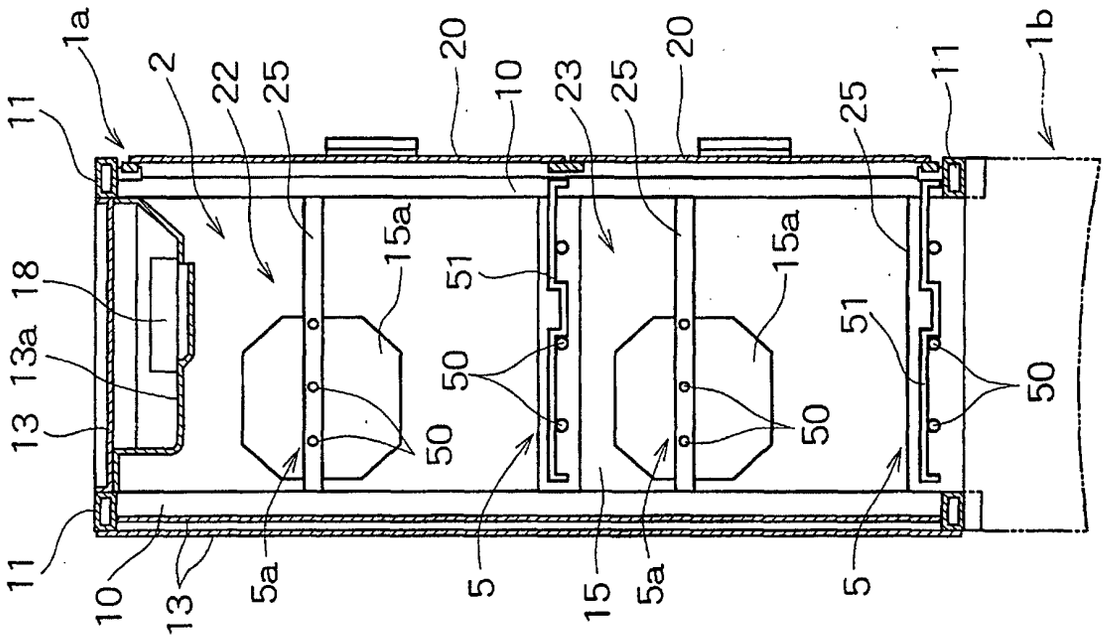

1a
2
22
25
20
10
23
25
20
25
11
1b
11
18
13a
13
15a
51
50
50
15a
51
50
50
11
10
13
5a
5
15
5a
5

FIG. 3A

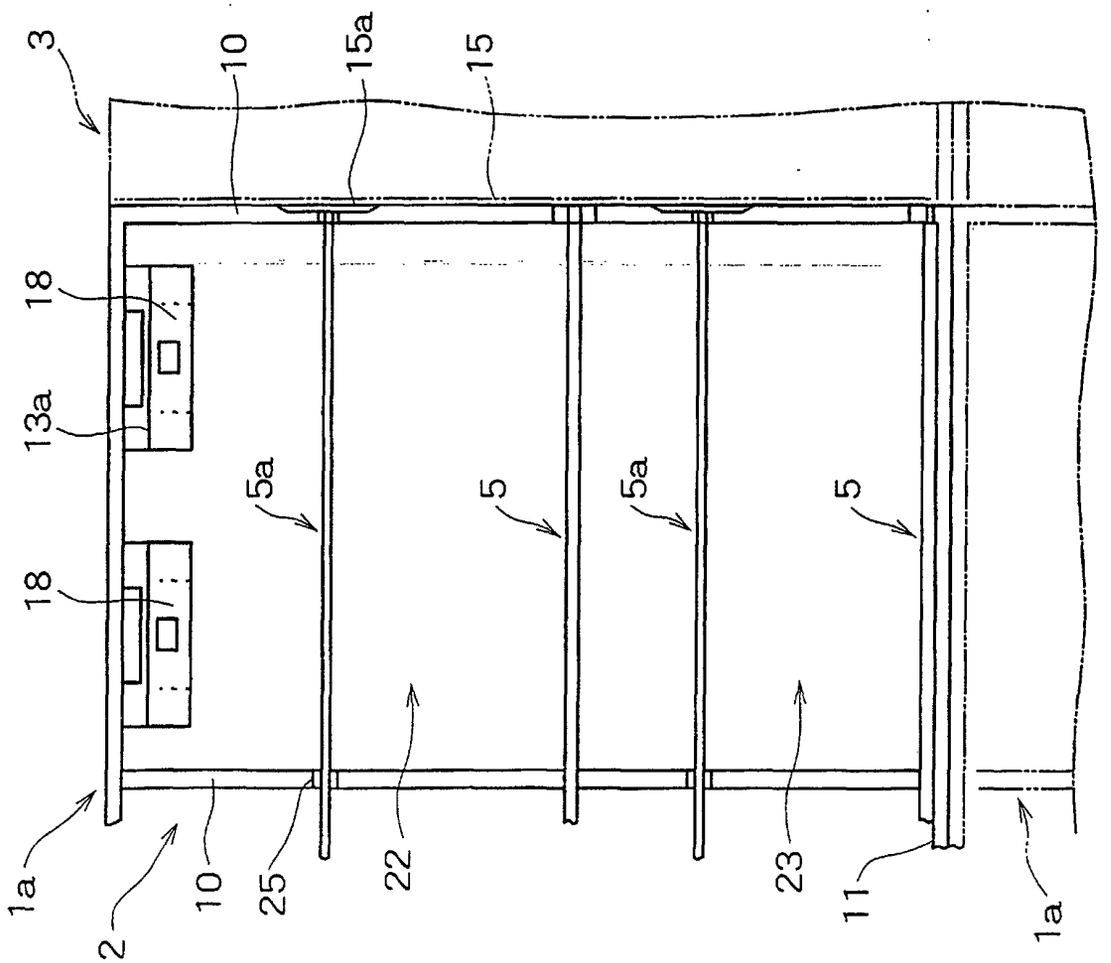

3
10
15a
15
18
13a
18
5a
5
5a
5
1a
2
10
25
22
23
11
1a

FIG. 4

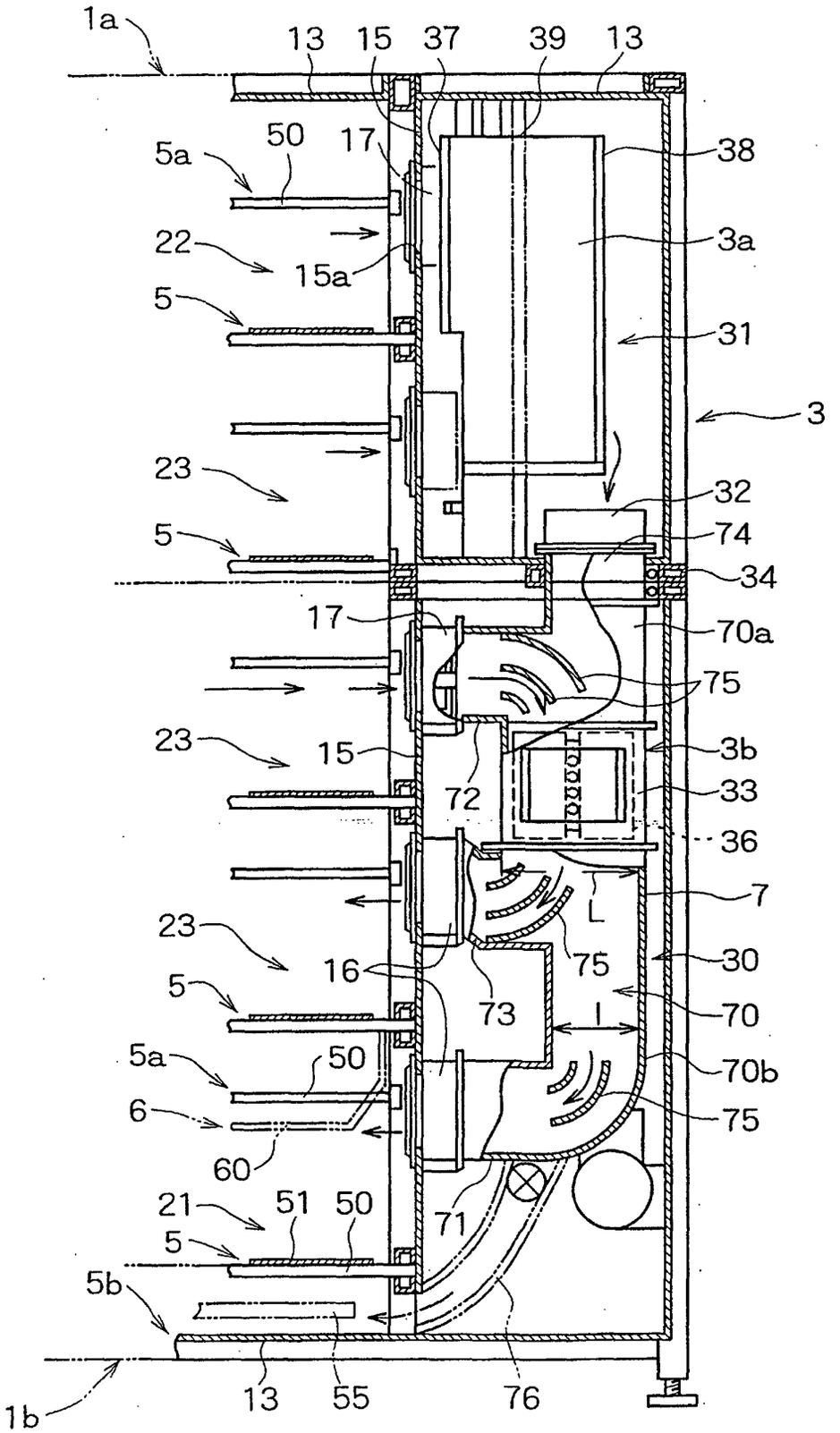

1a
13
15
37
39
13
50
17
38
5a
22
15a
3a
5
31
3
23
32
5
74
34
17
70a
75
23
15
3b
72
33
36
7
23
16
75
30
5
73
70
5a
50
70b
6
75
60
21
51
50
71
5
5b
13
55
76
1b

FIG. 5

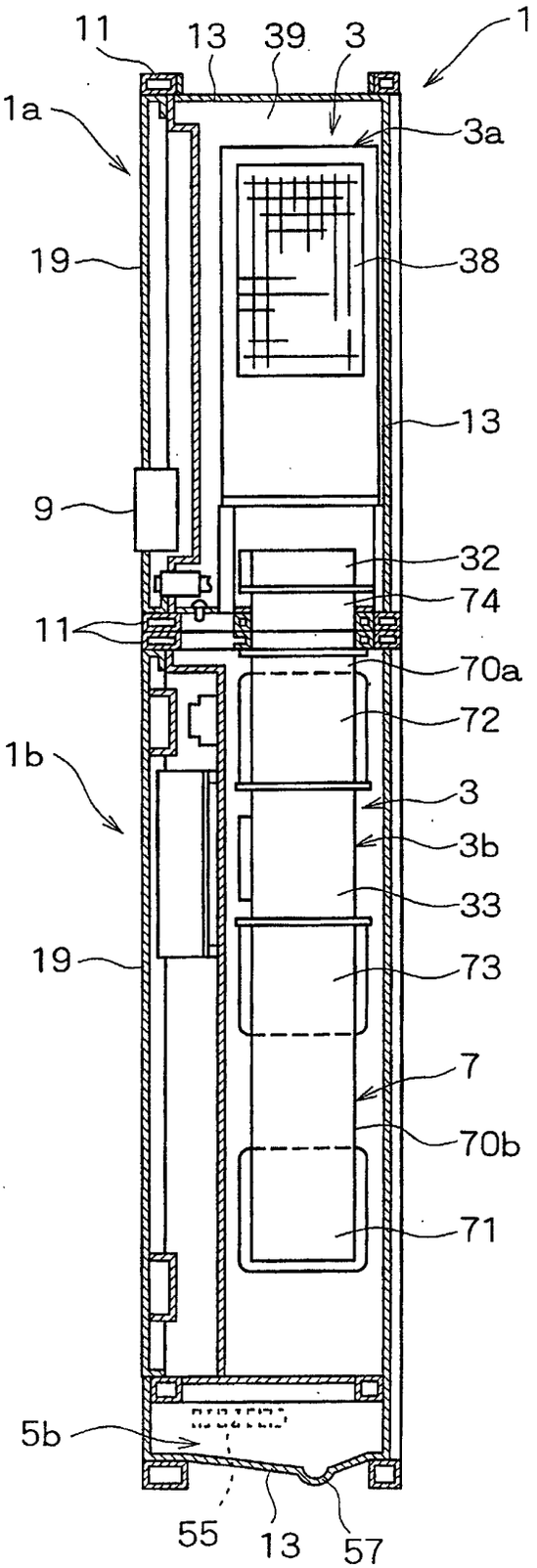

11
13
39
3
1
1a
3a
19
38
13
9
32
74
11
70a
72
1b
3
3b
33
19
73
7
70b
71
5b
55
13
57

FIG. 6

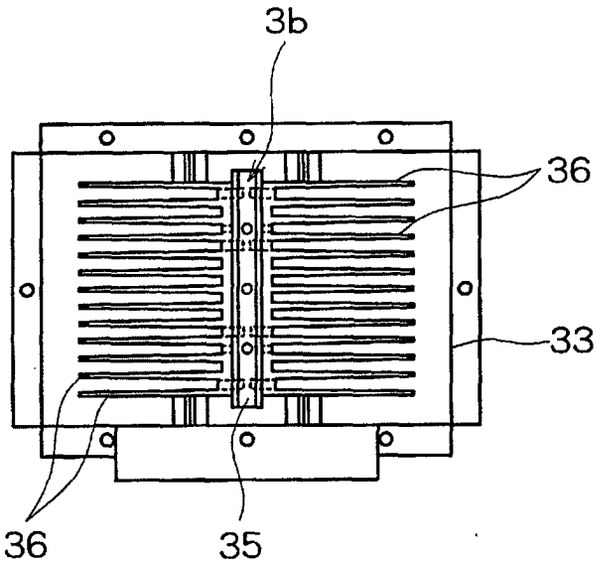


FIG. 7

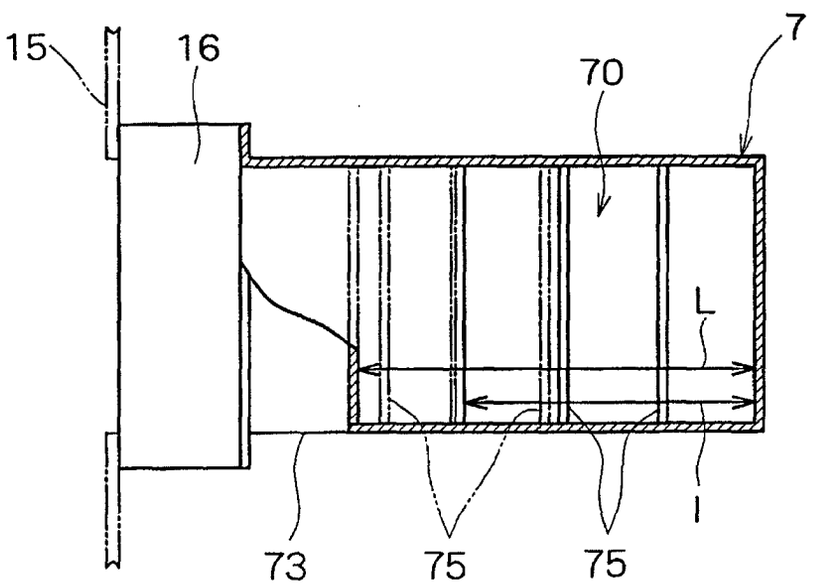


FIG. 8

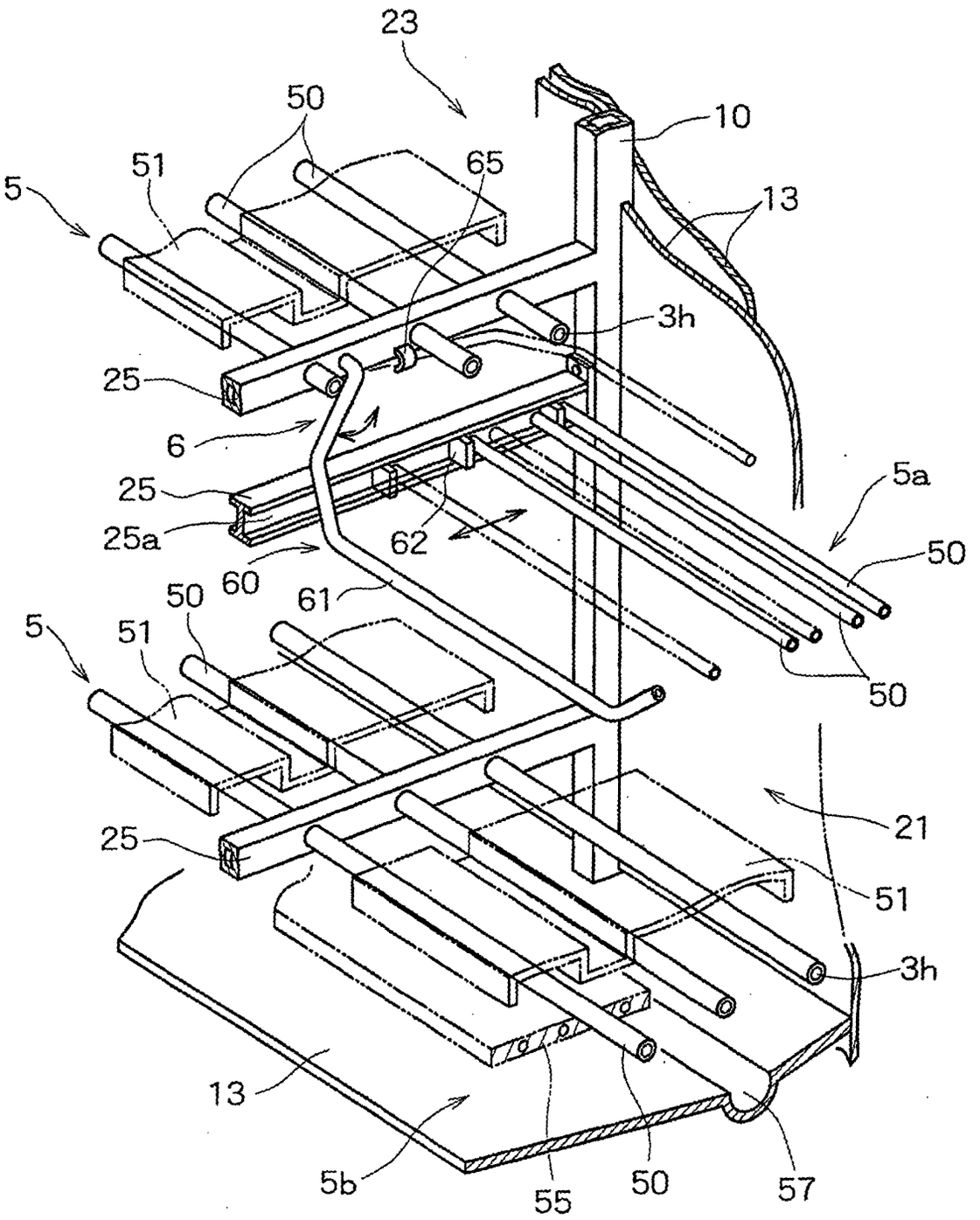

23
50
10
51
65
5
13
3h
25
6
5a
25
25a
62
50
60
61
50
5
51
50
21
25
51
3h
13
5b
55
50
57

FIG. 9

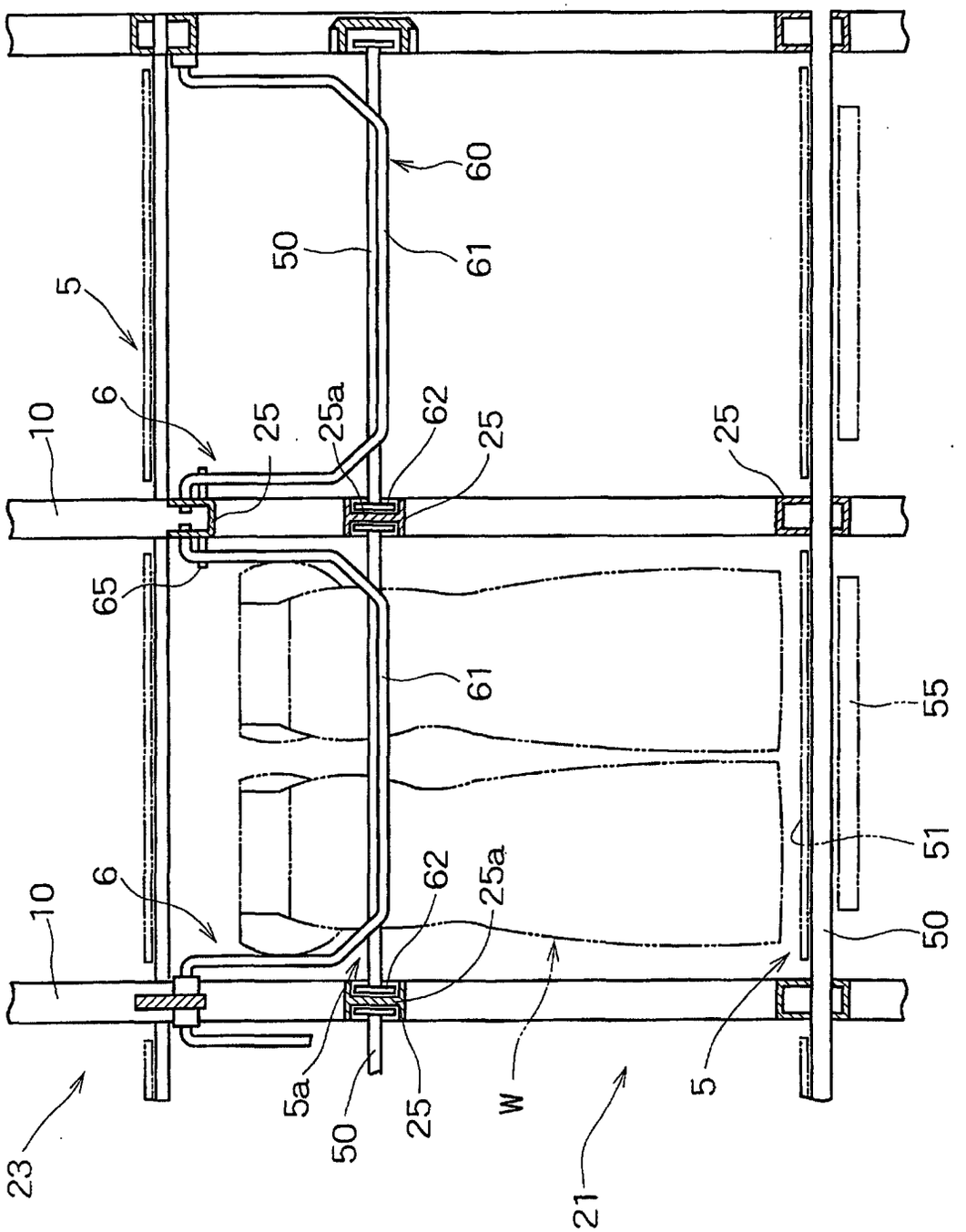

60
50
61
5
6
10
25
25a
62
25
25
65
61
55
51
6
10
62
25a
50
5a
50
25
W
5
23
21

FIG. 10

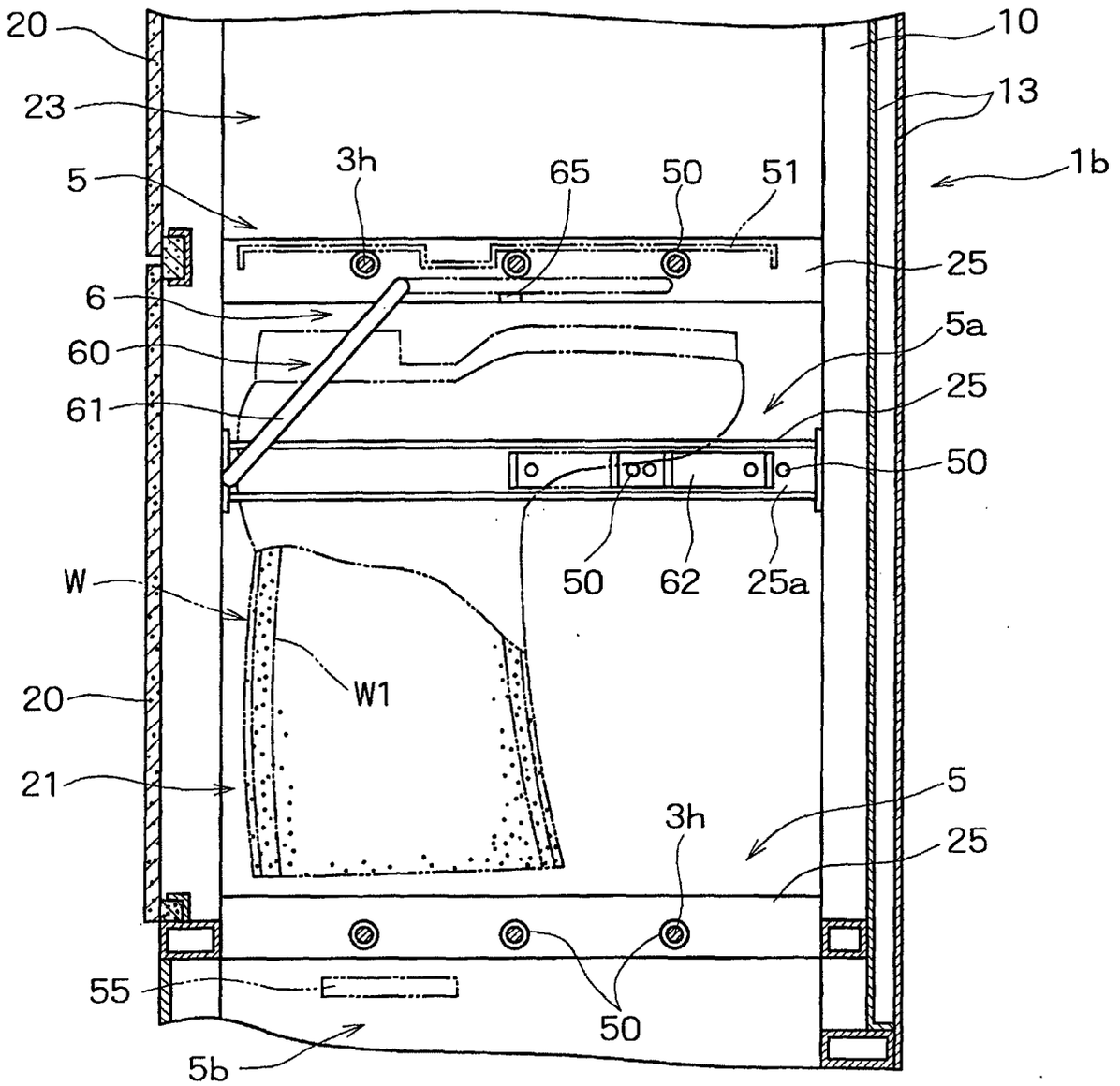

20
23
5
6
60
61
W
W1
20
21
55
5b
10
13
1b
3h
65
50
51
25
5a
25
50
50
62
25a
5
3h
25
50

FIG. 11

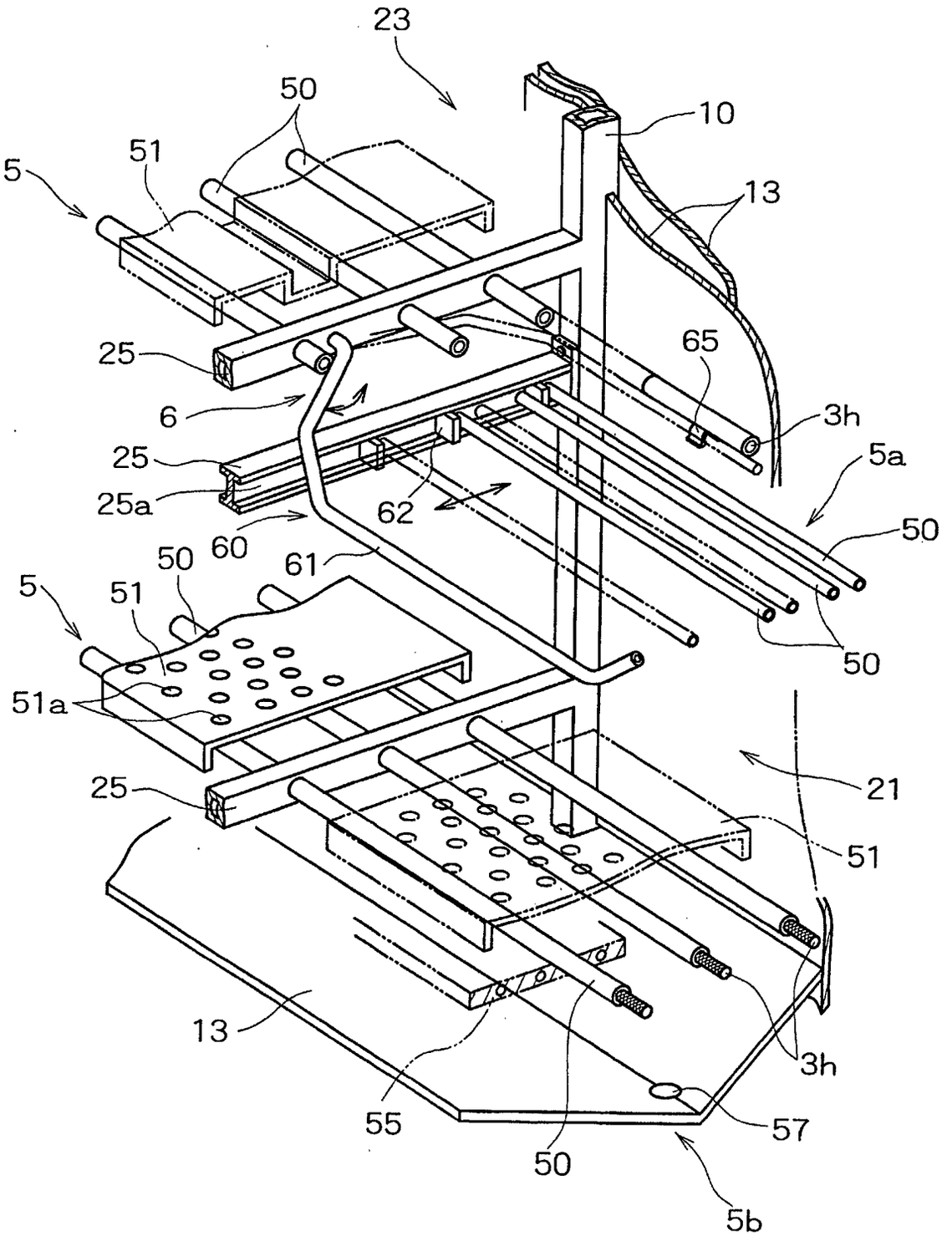

23
50
10
51
5
13
65
25
6
3h
25
5a
25a
62
50
60
61
50
5
51
50
51a
25
21
51
13
3h
55
57
50
5b

FIG. 12

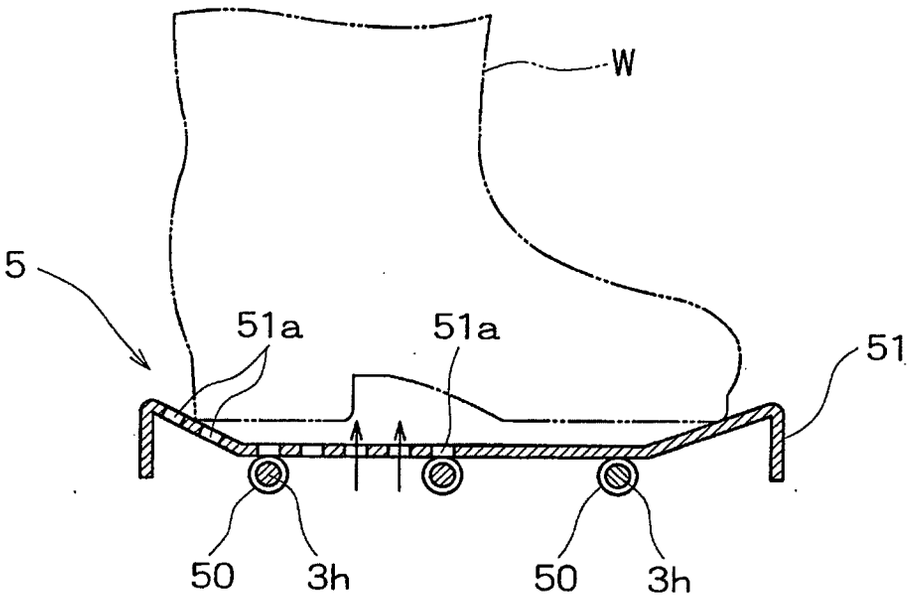


FIG. 13

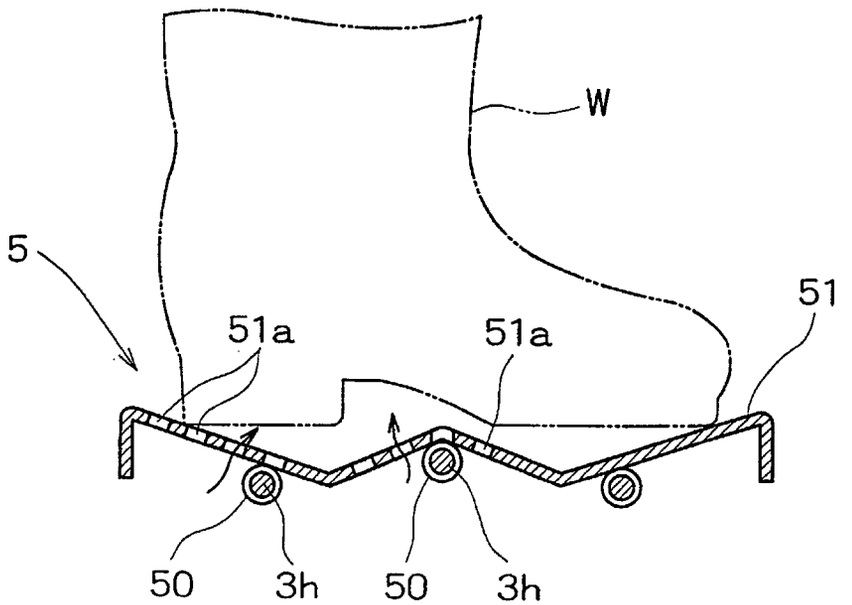
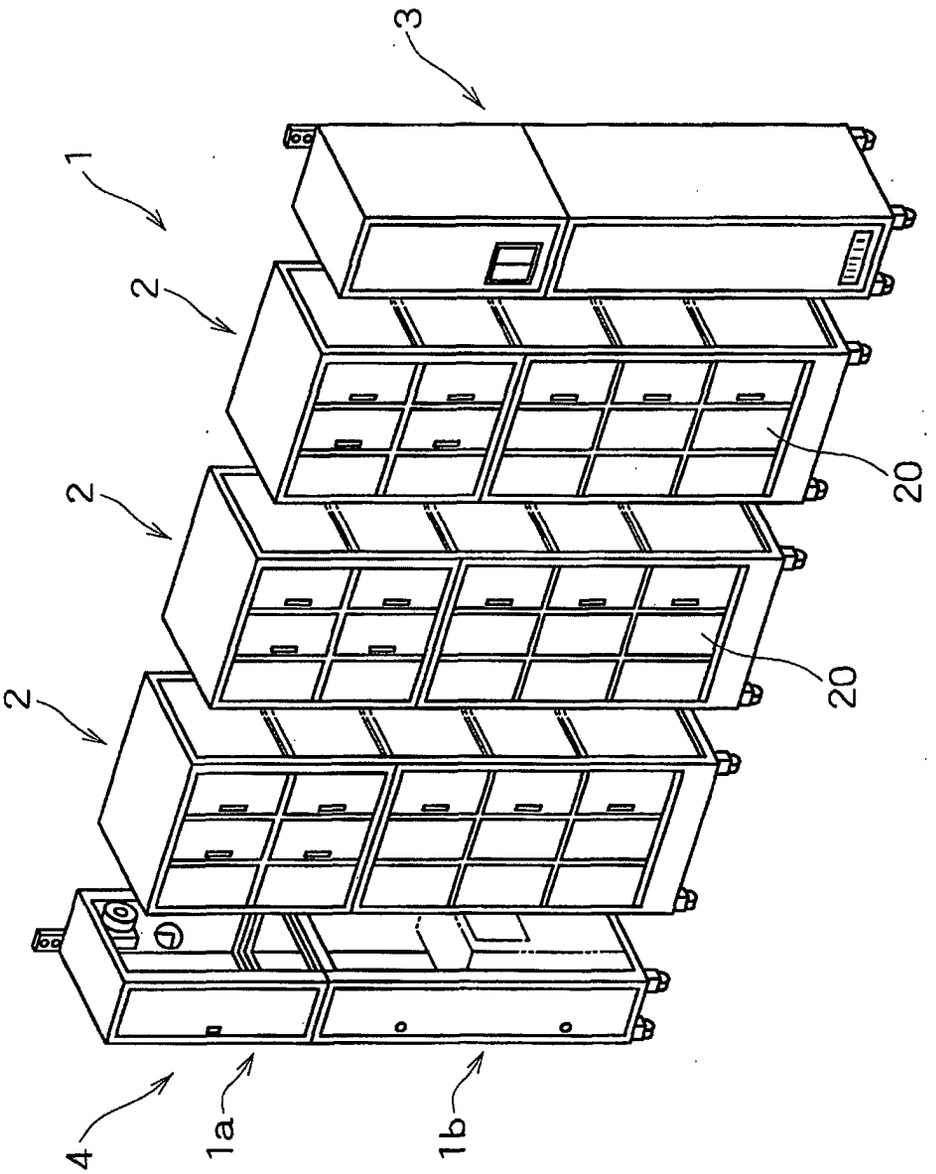


FIG.14



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/13517

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] A47L23/20, D06F58/10

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)
Int.Cl[7] A47L23/20, D06F58/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Toroku Jitsuyo Shinan Koho	1994-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Jitsuyo Shinan Toroku Koho	1996-2003

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 5-51241 U (Takayuki KIMURA), 09 July, 1993 (09.07.93), Claims (Family: none)	1-3,5,6 7-8
X Y	JP 11-30479 A (Kabushiki Kaisha Kaisanbutsu no Kimuraya), 02 February, 1999 (02.02.99), Claims (Family: none)	1-3,5,6 7-8
Y	JP 58-133222 A (Hitachi, Ltd.), 08 August, 1983 (08.08.83), Page 2, upper right column, lines 2 to 4; Fig. 3 (Family: none)	7

☒ Further documents are listed in the continuation of Box C. ☐ 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
"E" earlier document but published on or after the international filing date
"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)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 April, 2003 (10.04.03)	22 April, 2003 (22.04.03)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/13517

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 58-133221 A (Hitachi, Ltd.), 08 August, 1983 (08.08.83), Page 2, upper right column, lines 15 to 20; Figs. 2, 3 (Family: none)	8

Form PCT/ISA/210 (continuation of second sheet) (July 1998)