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

(11) Publication number: **0 406 002 A2**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **90307136.3**

(51) Int. Cl.5: **B05C 21/00**, B05B 15/04

(22) Date of filing: **29.06.90**

(30) Priority: **30.06.89 JP 170880/89**
**22.08.89 JP 216862/89**
**08.11.89 JP 291961/89**

(43) Date of publication of application:
**02.01.91 Bulletin 91/01**

(84) Designated Contracting States:
**DE FR GB IT SE**

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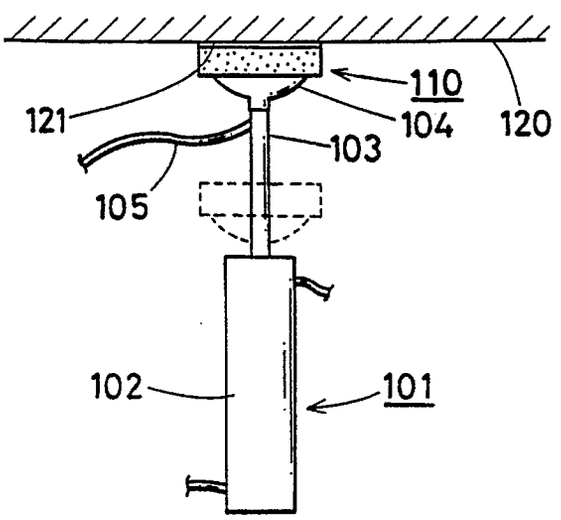
## (54) A method of surface treatment.

(57) A method for a surface treatment employing masking member(s) to protect part(s) of an article from said surface treatment is provided in the present invention.

Said method comprises sucking masking member(s) to sucker(s) to transport said masking member(s) to part(s) of an article which is(are) necessary to protect it from a surface treatment, attaching masking member(s) on(in) said part(s) of said article, removing said masking member(s) from said sucker(s), effecting said surface treatment on the surface of said article, and removing said masking member(s) from said part(s).

Fig. 1

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# A METHOD OF SURFACE TREATMENT

The present invention relates to a method of surface treatment employing masking member(s) to protect part(s) of an article such as a car body from said surface treatment such as coating, plating, vacuum evaporation, phosphatizing, and the like.

When a surface treatment is effected on the surface of an article, and if said surface of said article has (a) part(s) on which said surface treatment should not be effected for the reason that another surface treatment is effected on said part-(s) after said surface treatment, or said surface treatment spoils the appearance of said article and so on, said part(s) of said surface of said article may be covered and protected with said masking member(s).

In the case of a corrosion, sound, and vibration -proof coating for the underside of a car body, said part(s) may be part(s) on which bracket(s), frame-(s), and the like is(are) attached, and hole(s) such as water ejecting hole(s), harness hole(s) and the like. If said corrosion, sound, and vibration - proof coating by using a coating agent, such as a polyvinylchloride-sol, a tar-urethane mixture and the like is effected on(in) said part(s) or said hole-(s), in a case where said part(s) on which bracket-(s), frame(s), and the like is(are) attached, it is difficult to attach firmly said bracket(s), frame(s), and the like to said part because of the coating layer formed by said coating, and in the case of said hole(s), the surface treatment leaks from said hole(s) to waste said coating agent and further it may be a concern that said coating agent fills in said hole(s) or stains the inside of said hole(s).

In a case where the surface treatment of an article has many parts to be protected from said surface treatment such as said coating of the underside of a car body as above described, many masking members must be attached to(in) said parts (more than 200 parts for one car body) before said surface treatment and accordingly many masking members must also be removed from said parts after said surface treatment.

Further, in a case of a continuous mass-production line, said masking members should be attached to(in) said parts and removed from said parts in a short time.

Still further, in the case of the continuous mass-production line, it is desirable that said masking members are automatically attached to(in) said parts and removed from said parts.

Hitherto, a flat type masking member having an adhesive layer on one side has been provided (USP 4835026).

Said masking member is used to protect a flat surface part of an article and said masking member is attached to said flat surface part by said adhesive layer thereof by a worker's hand. After a surface treatment, said masking member is removed from said flat surface part by a worker's hands or a hook.

Further, a plug type masking member has also been proposed.

Said masking member is used to protect a hole in an article and said masking member is inserted into said hole by a worker's hands. After a surface treatment, said masking member is removed from said hole by a worker's hands or a hook the same as for said flat type masking member.

Still further, a cap type masking member having a hole has been proposed.

Said masking member is used to protect a projection of an article and said masking member is put over said projection by inserting said projection into said hole of said masking member by a worker's hands. After a surface treatment, said masking member is removed from said projection by a worker's hands or a hook the same as for said flat type and said plug type masking member.

Nevertheless, as above described, said masking members are attached on (in) said part, said hole, or said projection by a worker's hands and much labor and time have been necessary to protect said part, said hole, or said projection.

According to this invention, there is provided a method of surface treatment employing masking members to protect part(s) of an article which comprises engaging masking member(s) by sucker(s) and transporting said masking member(s) to part(s) of an article which is (are) to be protected from the surface treatment, attaching said masking member(s) to said part(s) of said article, disengaging said sucker(s) from said masking member(s) effecting said surface treatment on the surface of said article, and removing said masking member(s) from said part(s).

With the present invention it is possible to save labor and time in the case of the attaching of said masking members, and the attaching method of said masking members is suitable for automatic operation. The method of surface treatment may be suitable for a continuous mass-production line.

The invention will be better understood from the following description which is given by wav of example only with reference to the accompanying drawings in which:

Fig.1 to Fig.7 relate to a first embodiment of the present invention.

Fig.1 is a partial side sectional view showing the attaching of said masking member by a attach-

ing tool.

Fig.2 is a partial side sectional view of said sucker part of said attaching tool.

Fig.3 is a perspective view of said masking member used in said first embodiment.

Fig.4 is a partial side sectional view after the surface treatment.

Fig.5 is a partial side sectional view showing the removal of said masking member.

Fig.6 is a side view showing a conveyer system in which said attaching tool is used.

Fig.7 is a side sectional view showing a cylinder system in which said attaching tool is used.

Fig.8 to Fig.11 relate to a second embodiment of the present invention.

Fig.8 is a perspective view of a masking member used in said second embodiment.

Fig.9 is a partial side sectional view showing the attaching of said masking member by a sucker.

Fig.10 is a side view showing a slide system in which said attaching tool is used.

Fig.11 is a cross sectional view of said slide.

Fig.12 and Fig.13 relate to a third embodiment of the present invention.

Fig.12 is a perspective view of a masking member used in said third embodiment.

Fig.13 is a partial side sectional view showing the attaching of a masking member by a sucker.

Fig.14 and Fig.15 relate to a fourth embodiment of the present invention.

Fig.14 is a perspective view of a masking member used in said fourth embodiment.

Fig.15 is a partial side sectional view showing the attaching of a masking member by a sucker.

Fig.16 and Fig.17 relate to a fifth embodiment of the present invention.

Fig.16 is a perspective view of a masking member used in said fifth embodiment.

Fig.17 is a partial side sectional view showing the attaching of a masking member by a sucker.

Fig.18 and Fig.19 relate to a sixth embodiment of the present invention.

Fig.18 is a perspective view of a masking member used in said sixth embodiment.

Fig.19 is a partial side sectional view showing the attaching of a masking member by a sucker.

Fig.20 and Fig.21 relate to a seventh embodiment of the present invention.

Fig.20 is a perspective view of a masking member used in said seventh embodiment.

Fig.21 is a partial side sectional view showing the attaching of a masking member by a sucker.

Fig.22 and Fig.23 relate to a eighth embodiment of the present invention.

Fig.22 is a partial side sectional view of a sucker part of an attaching tool.

Fig.23 is a partial side sectional view showing that the masking member is held by said sucker.

Fig.24 is a perspective view showing that the masking member is held by a part of attaching tools.

Fig.25 to Fig.30 relate to a ninth embodiment of the present invention.

Fig.25 is a partial side sectional view showing the attaching of said masking members by suckers.

Fig.26 is a partial side sectional view of said sucker part of said attaching tool.

Fig.27 is a partial side sectional view after the surface treatment.

Fig.28 is a partial side sectional view showing the removal of said masking members.

Fig.29 is a side view showing a conveyer system in which said attaching tool is used.

Fig.30 is a side sectional view showing a cylinder system in which said attaching tool is used.

Fig.31 and Fig.32 relate to a tenth embodiment of the present invention.

Fig.31 is a partial side sectional view showing the attaching of said masking members by said attaching tool.

Fig.32 is a side view showing a slide system in which said attaching tool is used.

Fig.33 relates to a eleventh embodiment of the present invention and is a partial side sectional view showing the attaching of said masking members by suckers.

Fig.34 relates to a twelfth embodiment of the present invention.

Fig.35 relates to a thirteenth embodiment of the present invention.

Fig.36 relate to a fourteenth embodiment of the present invention.

Fig.37 relates to a fifteenth embodiment of the present invention.

Fig.38 is a perspective view showing that the masking member is held by a pair of suckers of said attaching tool.

## DETAILED DESCRIPTION

Fig.1 to Fig.7 relate to a first embodiment of the present invention. In this invention, a part having a flat surface of an article is protected by a masking member.

Referring now to Fig.1 to Fig.7, a sucking tool (101) comprises an oil pressure cylinder (102) having a piston rod (103) consisting of a pipe to which a vacuum-ventilation tube (105) connect, and a sucker (104) attached at the end of said piston rod (103). Said sucker (104) is made of a rubber, plastic, a metal, and the like.

As shown in Fig.3, a flat type masking member

(110) consists of a flat body (111) and an adhesive layer (112) formed on a side of said flat body (111).

To attach said masking member (110 ) to a part (121) having a flat surface of an article (120), said sucker(104) of said sucking tool (101) contact to the upper side of said masking member (110) to suck up by operation of a vacuum pump connecting to said tube (105) of said sucking tool (101), and then said masking member (110) held by said sucker (104 ) is transported right below said part (121) of said article (120) by a robot with which said sucking tool (101) is equipped. Said piston rod (103) is pushed from a dotted line position to a solid line position by the oil pressure to attach said masking member (110) to said part (121) of said article (120) by said adhesive layer (112) thereof as shown in Fig.1. Said masking member (110) is separated from said sucker (104) of said attaching tool (101) by opening said piston rod (103) to the atmosphere or by putting air into said piston rod (103).

As above described, said masking member (110) is attached to said part (121) of said article (120) by said adhesive layer (112), and after this, a paint such as a polyvinylchloride-sol, a urethane resin, an asphalt, a rubber-asphalt mixture, a tar-urethane mixture and the like is coated on the surface of said article to form a coating layer (130) as shown in Fig.4. After said coating, said masking member (110) is removed from said part (121) by using said sucking tool (101) or a hook equipped with a robot as shown in Fig.5.

In above described coating process, a plural number of said masking member (110) may be transported by a conveyer (140) to a direction shown by an arrow in Fig.6, and said masking member (110) may be sucked up one by one at one end of said conveyer (140) by said sucking tool (101) to attach said masking members (110) to said parts (121) of said article (120) or a plural number of said masking member (110) are placed one upon another to form an accumulation of masking members (110) wherein said masking members (110) are mutually adhered by said adhesive layer (112) thereof. Said accumulation of masking members (110) may be put into a cylinder (141) equipping a piston (142) and then said accumulation of masking members (110) may be pushed up by said piston (142) to suck up said masking members (110) one by one at the upper end of said accumulation of masking members (110) by said sucking tool (101) to attach said masking members (110) to said parts (121) of said article (120).

Fig.8 to Fig.11 relate to a second embodiment of the present invention. In this invention, a hole in an article is protected by a masking member.

Referring now to Fig.8 to Fig.11, a plug type masking member (110)A consists of an inserting part (111)A and a flange part (112)A. Said masking member (110)A is inserted into a hole (121)A in an article (120)A by using said sucking the upper surface of said flange part (112)A of said masking member (110)A as shown in Fig.9. After a surface treatment, said masking member (110)A is removed from said hole (121)A of said article (120)A by using said sucking tool (101) or a hook.

In above described surface treatment process, a plural number of said masking members (110)A may be supplied to said sucking tool (101) by a slide (143). In said slide system, said masking members (110)A may be respectively put in a guide groove (144) of said slide (143) as shown in Fig.10 and Fig.11. Said conveyer system or said cylinder system may be also applicable to supply said masking member (110)A to said sucking tool (101).

Fig.12 and Fig.13 relate to a third embodiment of the present invention. In this embodiment, a projection of an article is protected by a masking member.

Referring now to Fig.12 and Fig.13, a cap type masking member (110)B consists of a cylindrical body (111)B having and inserting hole (112)B and said masking member (110)B is attached over a projection (121)B of an article (120)B by using said sucking tool (101) of said first embodiment by sucking the upper surface of said cylindrical body (111)B of said masking member (110)B as shown in Fig.13.

After a surface treatment, said masking member (110)B is removed from said projection (121)B of said article (120)B by using said sucking tool (101) or a hook.

In above described surface treatment, said conveyer system or said cylinder system in said first embodiment or said slide system in second embodiment may be also applicable to supply said masking member (110)B to said sucking tool (101).

Fig.14 and Fig.15 relate to a fourth embodiment. In this embodiment, a flat part of an article is protected by a masking member.

Referring now to Fig.14 and Fig.15, a clip type masking member (110)C consists of a rectangular parallel piped body (111)C having a inserting ditch (112)C and said masking member (110)C is attached onto a flat part (121)C of an article (120)C by using said sucking tool (101) of said first embodiment by sucking one side of said masking member (110)C as shown in Fig.15.

After a surface treatment, said masking member (110)C is removed from said flat part (121)C of said article (120)C by using said sucking tool (101) or a hook.

In above described surface treatment, said

conveyer system or said cylinder system in said first embodiment or said slide system in said second embodiment may be also applicable to supply said masking member (110)C to said sucking tool (101).

Fig.16 and Fig.17 relate to a fifth embodiment of the present invention. In this embodiment, a part having a flat surface of an article is protected by a masking member.

Referring now to Fig.16 and Fig.17, a masking member (110)D consists of a vessel type body (111)D having a flange (112)D extending from the upper end of said vessel type body (111)D and an adhesive layer (113)D formed on the upper surface of said flange (112)D. Said masking member (110)-D is attached to a part (121)D having a flat surface of an article (120)D by said adhesive layer (113)D by using said masking tool (101) of said first embodiment by sucking the under side of the bottom of said masking member (110)D as shown in Fig.17.

After a surface treatment, said masking member (110)D is removed from said flat part (121)D of said article (120)D by using said sucking tool (101) or a hook.

In above described surface treatment, said conveyer system or said cylinder system in said first embodiment or said slide system in second embodiment may be also applicable to supply said masking member (110)D to said sucking tool (101).

Fig.18 and Fig.19 relate to a sixth embodiment of the present invention. In this embodiment, a part having a flat surface or an article is also protected by a masking member.

Referring now to Fig.18 and Fig.19, a masking member (110)E consists of a vessel type body (111)E having a flange (112)E extending from the upper end of said vessel type under side of the bottom of said vessel type body (111)E. Said masking member (110)E is attached to a part (121)E having a flat surface of an article (120)E by said adhesive layer (113)E by using said masking tool (101) of said first embodiment by sucking the upper side of the bottom of said masking member (110)E as shown in Fig.19.

After a surface treatment, said masking member (110)E is removed from said flat part (121)E of said article (120)E by using said sucking tool (101) or a hook.

In above described surface treatment, said conveyer system or said cylinder system ind said first embodiment or said slide system in said second embodiment may be also applicable to supply said masking member (110)E to said sucking tool (101).

Fig.20 and Fig.21 relate to a seventh embodiment of the present invention. In this embodiment, a hole in an article is protected by a masking member.

Referring now to Fig.20 and Fig.21, a masking member (110)F consists of a vessel type inserting part (111)F having a flange (112)F extending from the upper end of said inserting part (111)F and said masking member (110)F is inserted into a hole (121)F in an article (120)F by using said sucking tool (101) of the first embodiment by sucking the upper side of the bottom of said masking member (110)F as shown in Fig.21.

After a surface treatment, said masking member (110)F is removed from said hole (121)F of said article (120)F by using said sucking tool (101) or a hook.

In above described surface treatment, said conveyer system or said cylinder system in said first embodiment or said slide system in said second embodiment may be also applicable to supply said masking member (110)F to said sucking tool (101).

Fig.22 and Fig.23 relate to a eighth embodiment of the present invention. In this embodiment, a masking member is held to a sucker of a sucking tool with its needles.

Referring now to Fig.22 and Fig.23, a sucker (104)A of said sucking tool (101) has needles (106)A inside of said sucker (104)A. When the upper side of said masking member (110) is sucked by said sucker (104)A, said masking member (110) is pierced with said needles (106)A of said sucker (104)A to be held more firmly by said sucker (104)A.

In the first embodiment, in the case that said masking member (110) having a big volume is used, said masking member (110) may be unstably held by only one sucking tool (101). Therefore, it is desirable that said masking member (110) is held by a pair of said sucking tool (101) as shown in Fig.24.

Fig.25 to Fig.30 relate to a ninth embodiment of the present invention. In this embodiment, a plural number of said masking member (110) of the first embodiment are attached by a sucking tool (101)A.

Referring now to Fig.25 to Fig.30, said sucking tool (101)A comprises a vacuum pipe (103)A connected to a vacuum pump (102)A, a plural number of branch pipes (105)A connected to said vacuum pipe (103)A, a plural number of suckers (104)A connected respectively to the end of said branch pipes (105)A, and a pair of valves (106)A, (107)A arranged at both ends of said vacuum pipe (103)A.

To attach a plural number of said masking members (110) to said plural numbers of said parts (121) of said article (120), a plural number of said masking members (110) are respectively sucked up by a plural number of said suckers (104)A of said sucking tool (101)A as shown in Fig.25. To

suck a plural number of said masking members (110) as above described, said valve (106)A is shut and said valve (107)A is opened and said vacuum pump (102)A is operated. Further, to suck a plural number of said masking members (110), a pair of said valves (106)A, (107)A is opened and said vacuum pump (102)A is operated, thus air passes through said vacuum pipe (103)A and a plural number of said masking members (110)A are also sucked up by a plural number of said suckers (104)A. After a plural number of said masking members (110) are attached to said parts (121) of said article (120), said masking members (110) are respectively separated from said sucking tool (101)A. To separate a plural number of said masking members (110) from said sucking tool (101)A, said valve (106)A is opened. If desired, said valve (107)A is shut and/or said vacuum pump (102)A is stopped.

After said masking members (110) are respectively attached to said parts (121) as above described, a surface treatment such as a coating is effected on the surface of said article (120) to form a coating layer (130) as shown in Fig.27, and then said masking members(110) are removed by such as said sucking tool (101)A as shown in Fig.28, or a hook and the like.

In above described coating process, a plural number of said masking members(110) may be transported by a conveyer (140) to a direction shown by an arrow in Fig.29, and said masking members (110) may be sucked up at the corner of said conveyer (140) by said sucking tool (101) to attach said masking members (110) to said parts (121) of said article (120) or a plural number of said masking members (110) are placed one upon another to form an accumulation of masking members (110) wherein said masking members (110) are mutually adhered by said adhesive layer (112) thereof. Said accumulation of masking members (110) may be put into a cylinder (141) equipping a piston (142), and then said accumulation of masking members (110) may be pushed up by said piston (142) to suck up said masking members (110) one by one at the upper end of said accumulation of masking members (110) by said sucking tool (101)A to attach said masking members (110) to said parts (121) of said article (120) as shown in Fig.30.

Fig.31 and Fig.32 relate to a tenth embodiment of the present invention. In this embodiment, a plural number of said masking members (110)A are inserted in a plural number of said holes (121)A in said article (120)A by said sucking tool (101)A as shown in Fig.31.

After a surface treatment, said masking members (110)A are respectively removed from said holes (121)A by such as said sucking tool (101)A, a hook, and the like.

In above described surface treatment process, a plural number of said masking members (110)A may be supplied to said sucking tool (101)A by a slide (143) as shown in Fig.32, the same as in the second embodiment. The conveyer system and the cylinder system suggested in the first embodiment may be also applicable to supply said masking members (110)A to said sucking tool (101)A.

Fig.33 relates to a eleventh embodiment of the present invention. In this embodiment, a plural number of said masking members (110)B are attached over a plural number of said projections (121)B of said article (120)B by said sucking tool (101)A as shown in Fig.33.

After a surface treatment, said masking members (110)A are respectively removed from said projections (121)B by said sucking tool (101)A, or a hook.

In above described surface treatment process, said conveyer system, said cylinder system and said slide system may be applicable to supply a plural number of said masking members (110)B to said sucking tool (101)A.

Fig.34 relates to a twelfth embodiment of the present invention. In this embodiment, a plural number of said masking members (110)C are attached onto said parts (121)C on said article (120)C by said sucking tool (101)A as shown in Fig.34.

After a surface treatment, said masking members (110)C are respectively removed from said parts (121)C by said sucking tool (101)A, or a hook.

In above described surface treatment process, said conveyer system, said cylinder system and said slide system may be applicable to supply a plural number of said masking members (110)C to said sucking tool (101)A.

Fig.35 relates to a thirteenth embodiment of the present invention. In this embodiment, a plural number of said masking members (110)D are attached to a plural number of said flat parts (121)D of said article (120)D by said sucking tool (101)A as shown in Fig.35.

After a surface treatment, said masking members (110)D are respectively removed from said parts (121)D by said sucking tool (101)A, or a hook.

In above described surface treatment process, said conveyer system, said cylinder system and said slide system may be applicable to supply a plural number of said masking members (110)D to said sucking tool (101)A.

Fig.36 relates to a fourteenth embodiment of the present invention. In this invention, a plural number of said masking members (110)E are attached to a plural number of said flat parts (121)E of said article (120)E by said sucking tool (101)A as shown in Fig.36.

After a surface treatment, said masking mem-

bers (110)E are respectively removed from said parts (121)E by said sucking tool (101)A, or a hook.

In above described surface treatment process, said conveyer system, said cylinder system and said slide system may be applicable to supply a plural number of said masking members (110)E to said sucking tool (101)A.

Fig.37 relates to a fifteenth embodiment of the present invention. In this embodinent, a plural number of said masking members (110)F are inserted in a plural number of said holes (121)F in said article (120)F by said sucking tool (101)A as shown in Fig.37

After a surface treatment, said masking members (110)F are respectively removed from said holes (121)F by said sucking tool (101)A, or a hook.

In above described surface treatment process, said conveyer system, said cylinder system and said slide system may be applicable to supply a plural number of said masking members (110)F to said sucking tool (101)A.

In said ninth embodiment, in the case that said masking member (110) having a big volume is used, said masking member (110) may be unstably held by only one sucker (104)A of said sucking tool (101)A. Therefore, it is desirable to held said masking member (110) by a pair of suckers (104)A of said sucking tool (101)A which are next each other as shown in Fig.38.

In the present invention, said masking member (110), (110)A, (110)B, (110)C, (110)D, (110)E, (110)F are made of a material, such as a plastic or a rubber such as polystyrene, polyethylene, polypropylene, ethylene-propylene copolymer, polyvinylchloride, polyvinylidene chloride, polymethacrylate, styrene-butadiene copolymer, acrylonitrile-butadiene copolymer, polybutadine polyisoprene, polyisobutylene, polychloroprene, isoprene-isobutylene copolymer, natural rubber, polyurethane, melamine resin, urea resin, phenol resin, epoxy resin and the like; foams of said plastic or said rubber' a mixture of said plastic or said rubber with a filler such as calcium carbonate, talc, bentonite, flyash, blast furnace slag, and the like; a fiber material such as thermoplastic uesin - impregnated fiber; a thermosetting resin - impregnated fiber, wooden material such as wood, hardboard, plywood and the like; metal material and the like; composite material consisting of a plural number of materials selected from the group of said materials.

## Claims

1. A method of surface treatment employing masking members to protect part(s) of an article which comprises engaging masking member(s) by sucker(s) and transporting said masking member(s) to part(s) of an article which is (are) to be protected from the surface treatment, attaching said masking member(s) to said part(s) of said article, disengaging said sucker(s) from said masking member(s) effecting said surface treatment on the surface of said article, and removing said masking member(s) from said part(s).

2. A method for a surface treatment in accordance with claim 1, wherein a plural number of said masking members are attached by a plural number of said suckers on (in) a plural number of said parts of said article at one time.

3. A method for a surface treatment in accordance with claim 1 or 2 wherein at least some of said masking members are of flat type and said parts to be protected by said masking members are flat surfaces.

4. A method for a surface treatment in accordance with claim 1, 2 or 3 wherein at least some of said masking members are of plug type and said parts to be protected by said masking members are holes.

5. A method for a surface treatment in accordance with claim 1, 2, 3 or 4 wherein at least some of said masking members are of cap type and said parts to be protected by said masking members are projections.

6. A method for a surface treatment in accordance with claim 1, 2, 3, 4 or 5 wherein at least some of said masking members are of clip type and said parts to be protected by said masking members are flat parts.

7. A method according to any preceding claim wherein the masking members are removed by the suckers.

8. A method according to any one of claims 1 to 6 wherein the masking members are removed by hooks.

9. A method according to any preceding claim wherein there are pins in the suckers to additionally engage the masking members.

10. A member according to any preceding claim wherein at least some masking members are engaged by a plurality of suckers.

Fig. 1

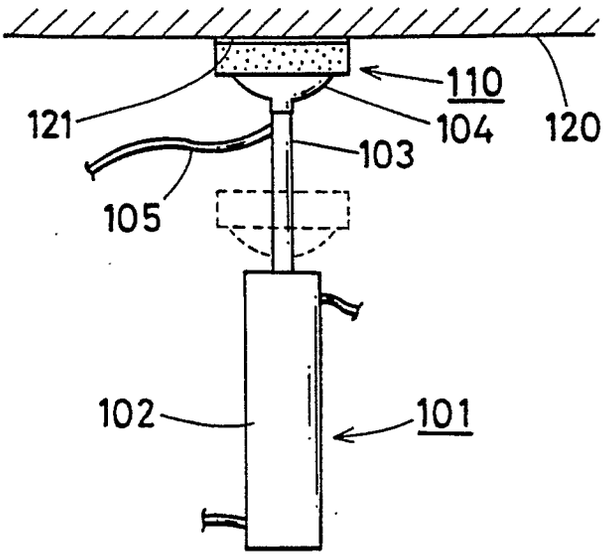



Fig. 2

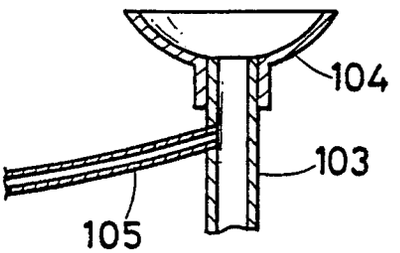



Fig. 3

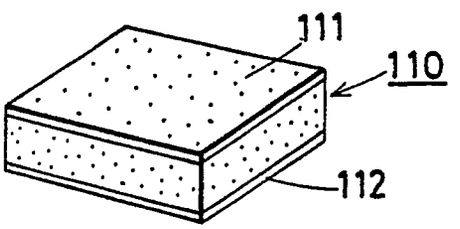


Fig. 4

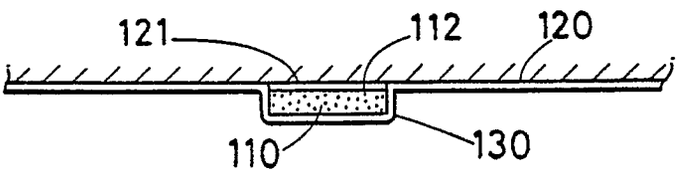



Fig. 5

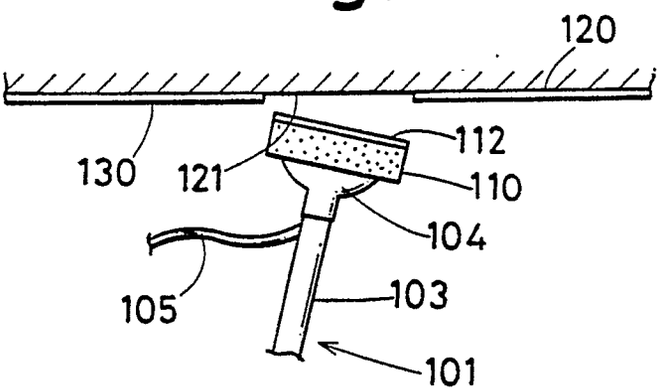


Fig. 6

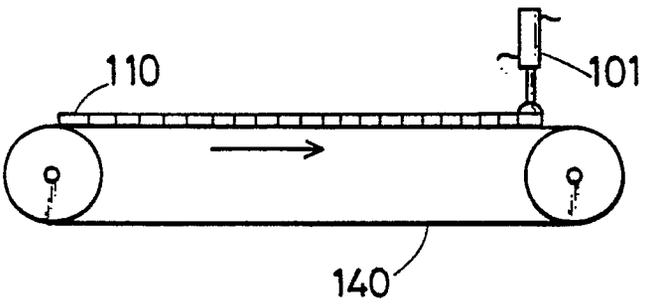



Fig. 7

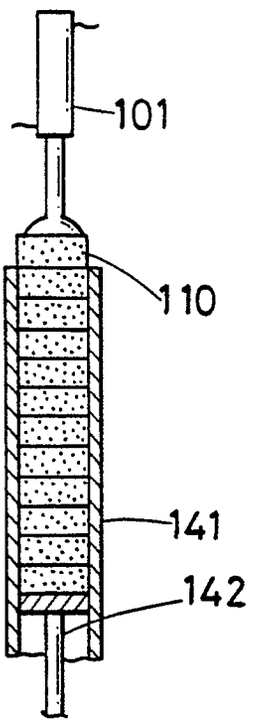


Fig. 8

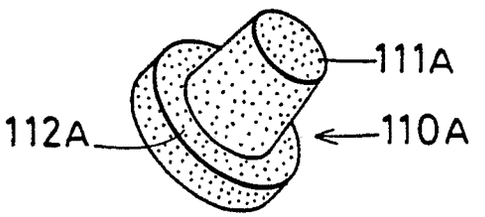



Fig. 9

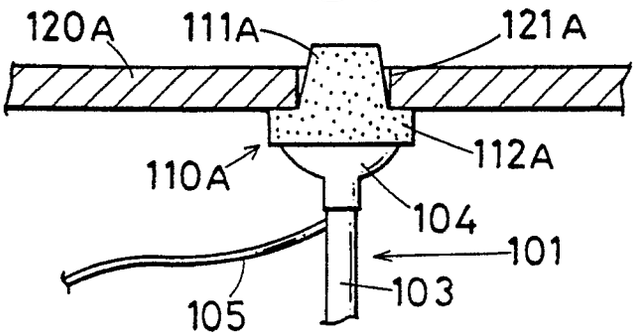



Fig. 10

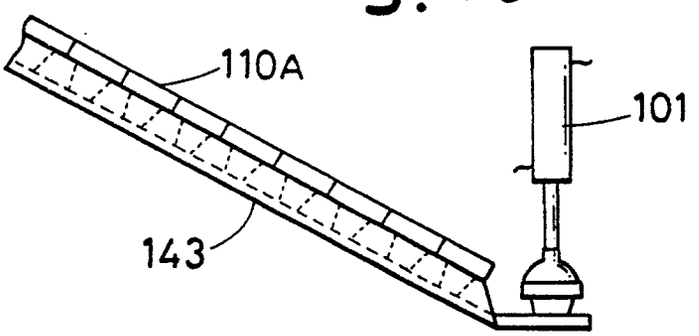



Fig. 11

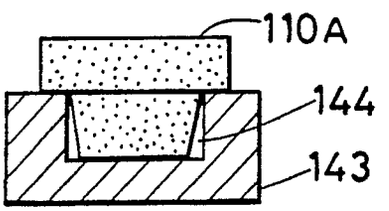


Fig.12

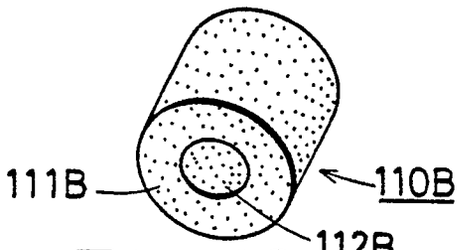



Fig.13

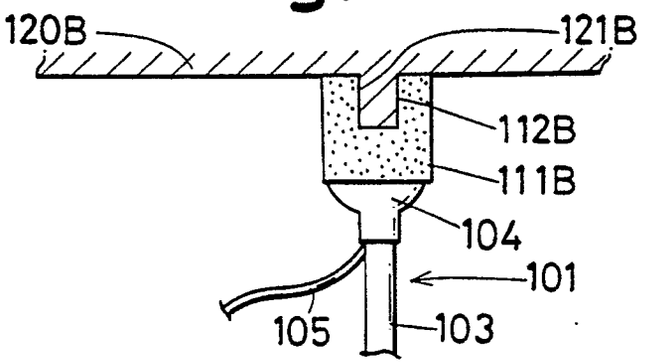



Fig.14

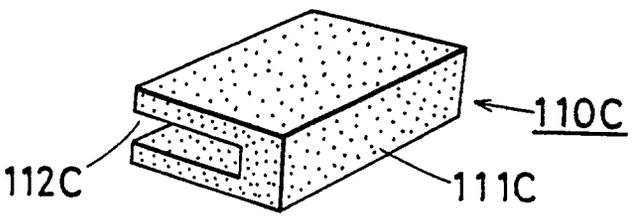



Fig.15

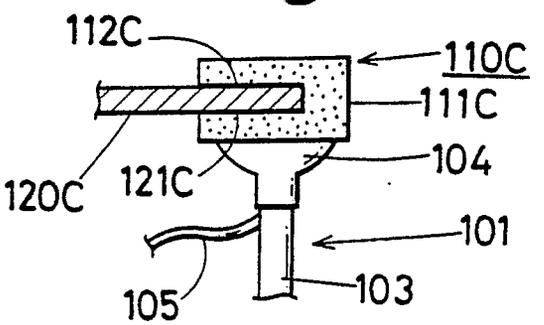


Fig.16

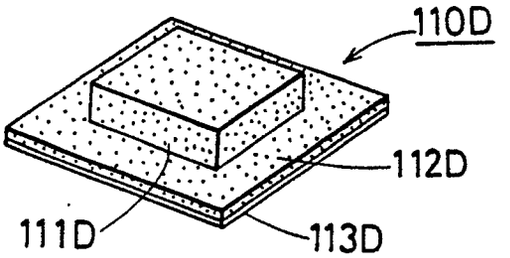



Fig.17

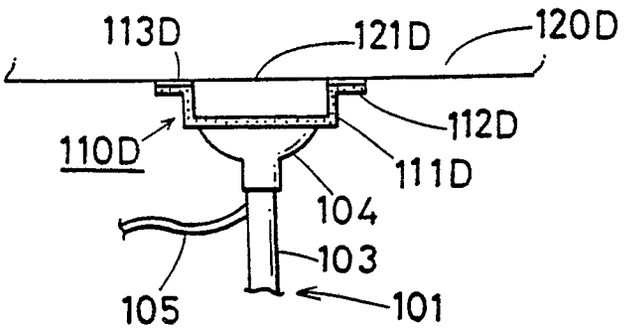



Fig.18

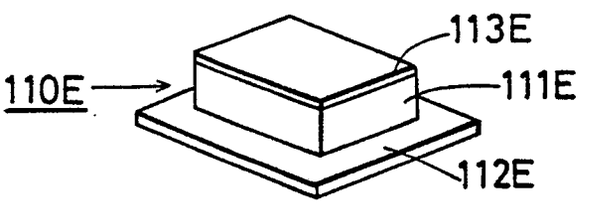


Fig.19

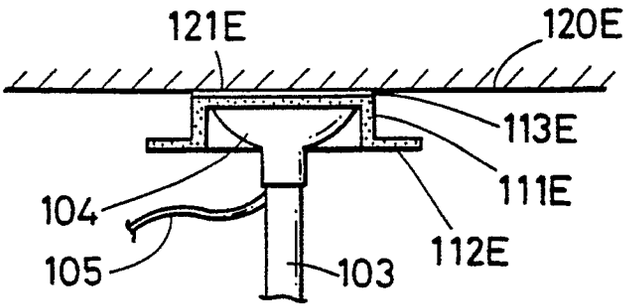



Fig.20

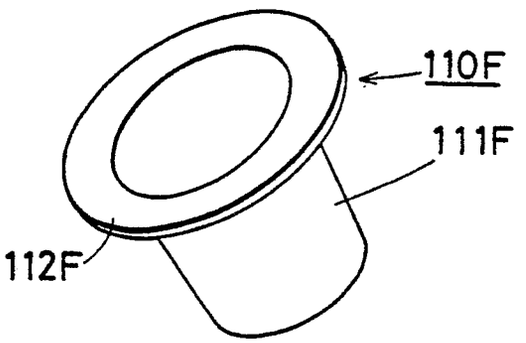



Fig.21

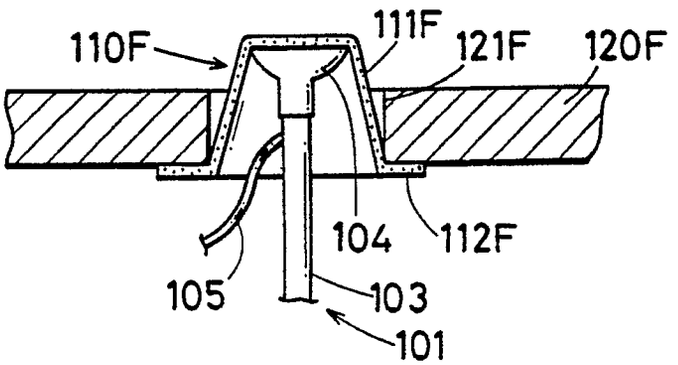


Fig. 22

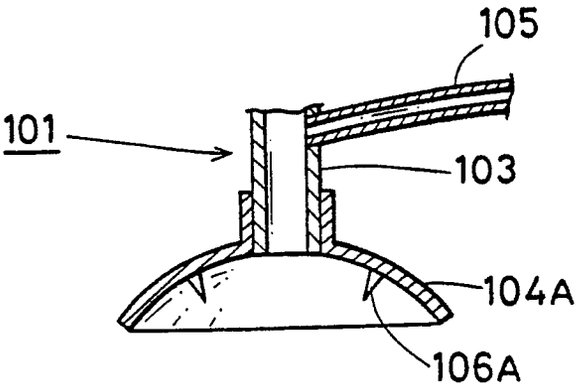



Fig. 23

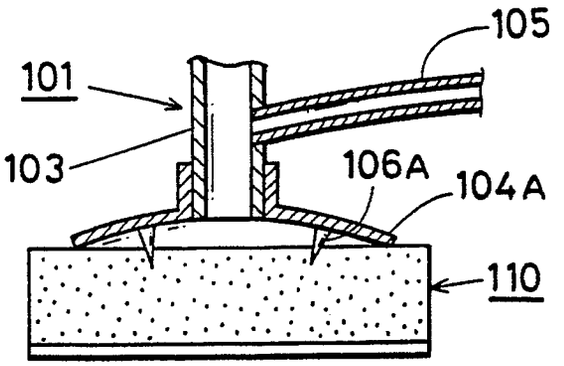


Fig. 24

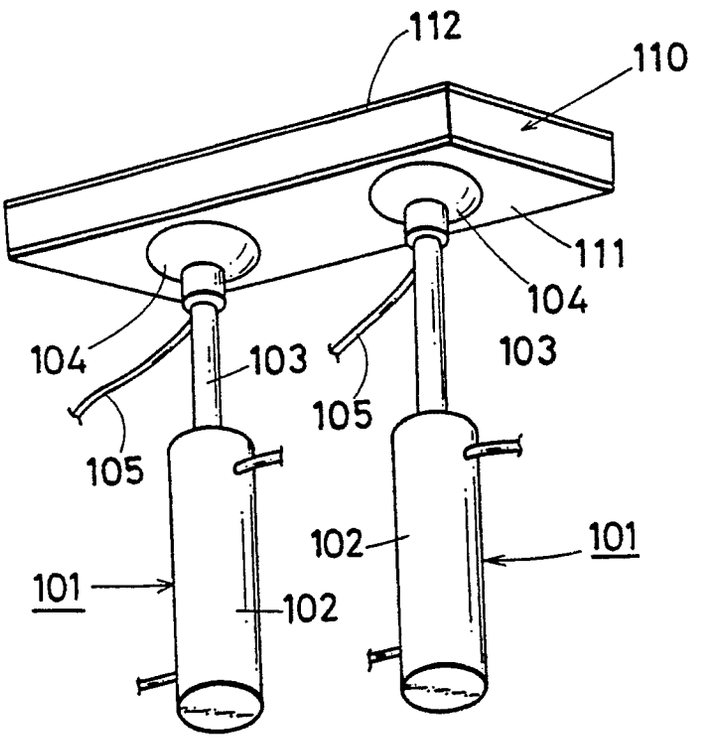
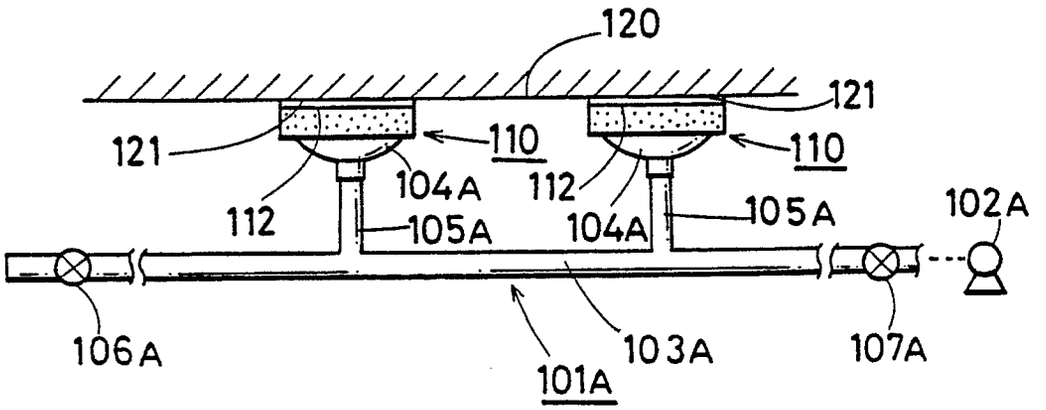


Fig. 25


120
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121
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110
112
104A
112
105A
104A
105A
102A
106A
103A
107A
101A

Fig. 26

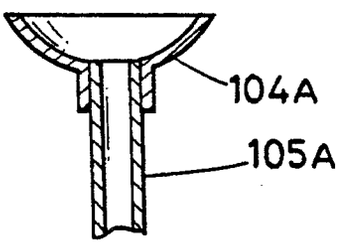
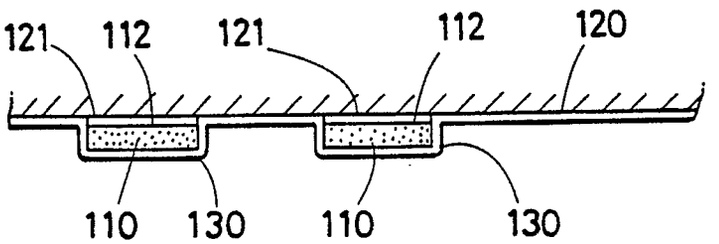

104A
105A

Fig. 27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112
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120
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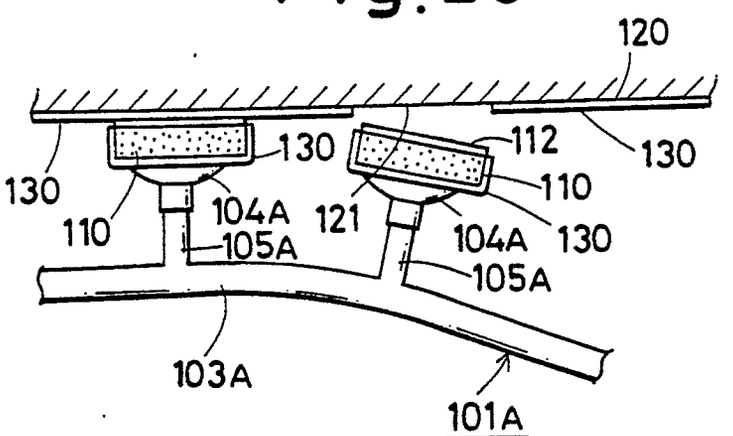
130
110
130

Fig. 28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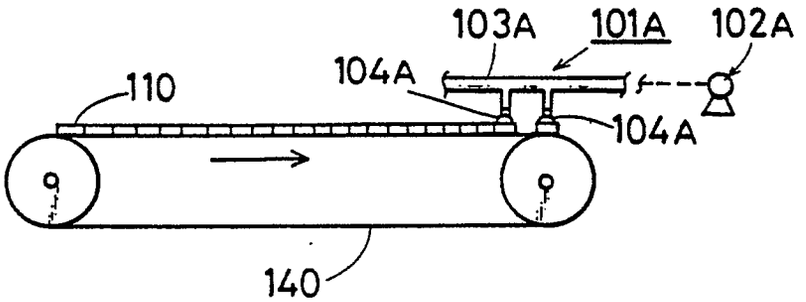
105A
104A
130
105A
103A
101A

Fig. 29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104A
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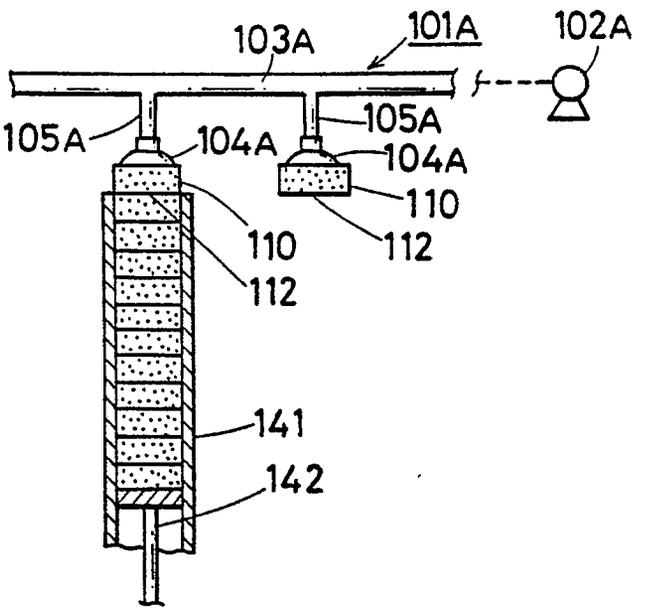
104A
140

Fig. 30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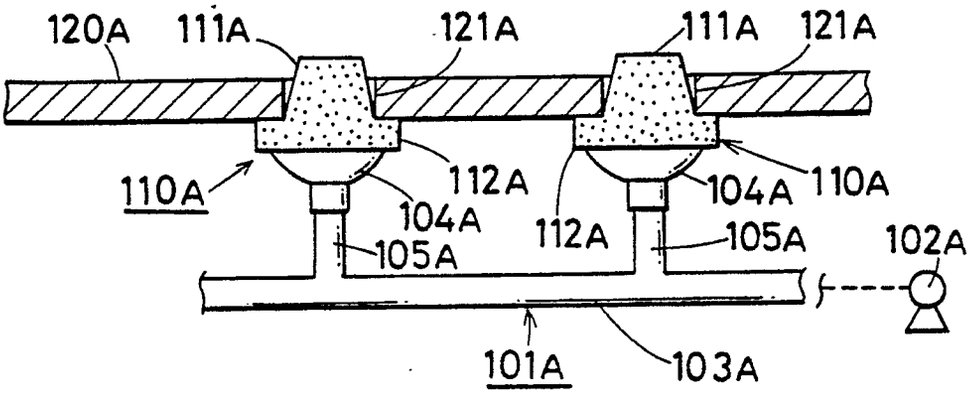
110
112
112
141
142

Fig.31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110A
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105A
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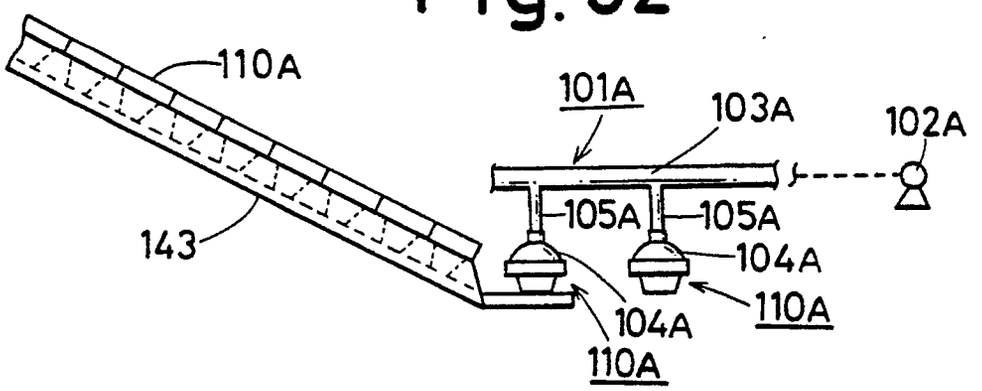
102A
101A
103A

Fig.32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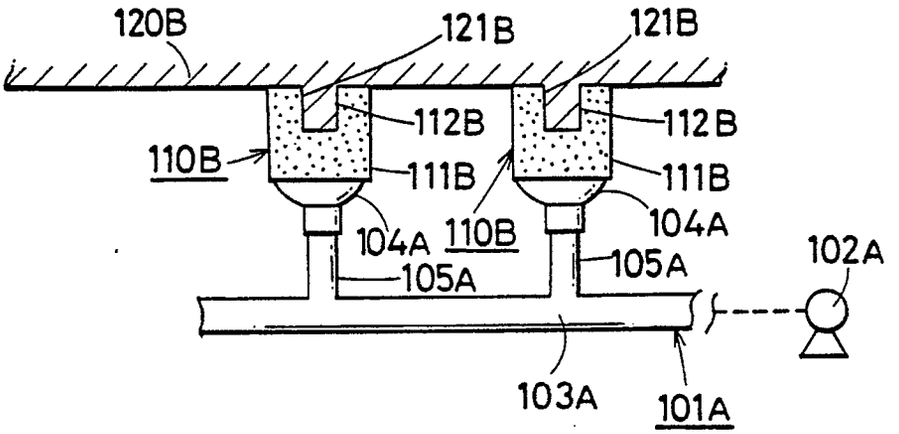
110A
110A

Fig. 33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110B
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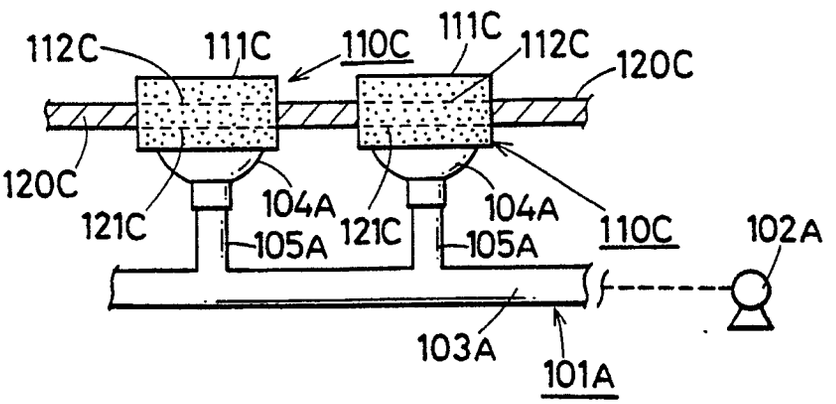
103A
101A

Fig. 34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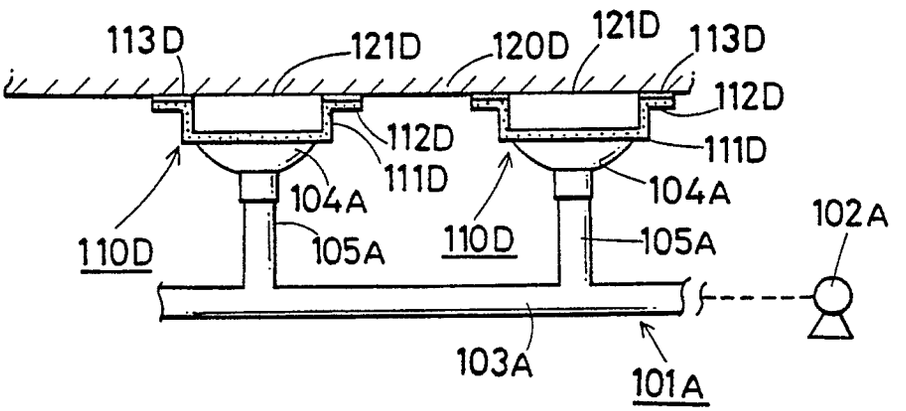
105A
103A
101A

Fig.35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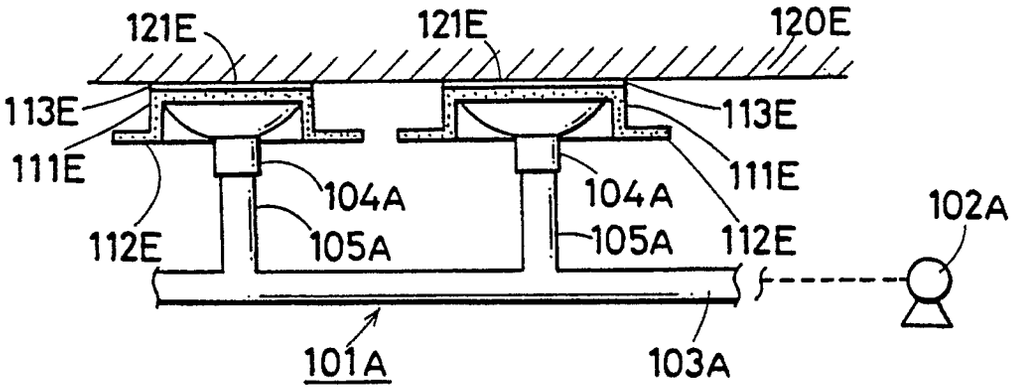
103A
101A

Fig.36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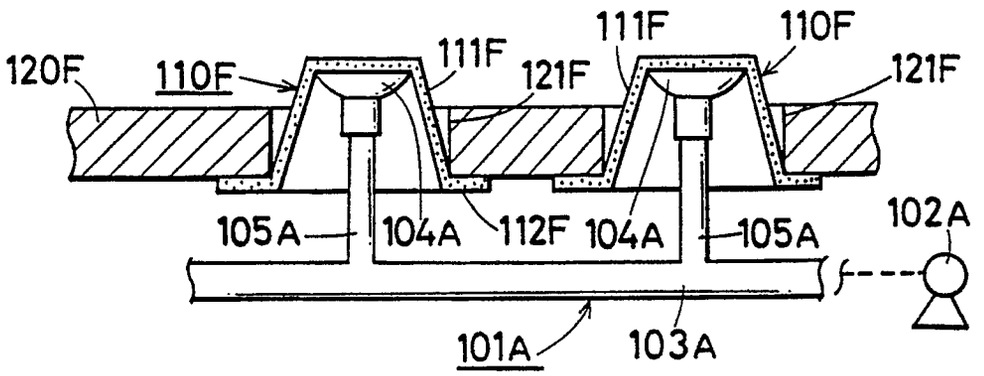
101A
103A

Fig.37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102A
101A
103A

Fig.38