

[72] Inventor **Zoltan Csenyi**
Bahnhofstrasse 161, 8902 Urdorf,
Switzerland
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[56]

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Primary Examiner—Andrew R. Juhasz
Assistant Examiner—Donald D. Evenson
Attorney—Karl Ross

[54] **DEVICE FOR HOLDING FITTINGS ON CONCRETE FORMWORK**
17 Claims, 5 Drawing Figs.

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248/206 R, 248/362
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206 R; 269/21, 47

ABSTRACT: A system for mounting cup-shaped holders for fittings to be built into concrete bodies along the internal surface of concrete formwork. The device comprises an opening in the mounting shell in which a valve body is frictionally received, the valve body being thrust in place by a plunger and tappet on a device applied over the opening. The device may be connected with a suction pump by a hose or the like or may employ a piston pump for operating the tappet and providing suction.

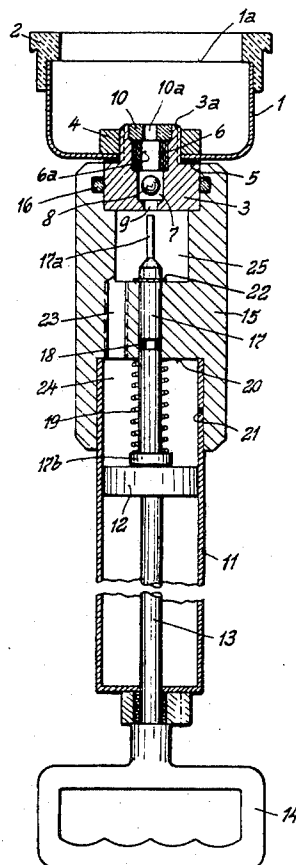


Fig. 1

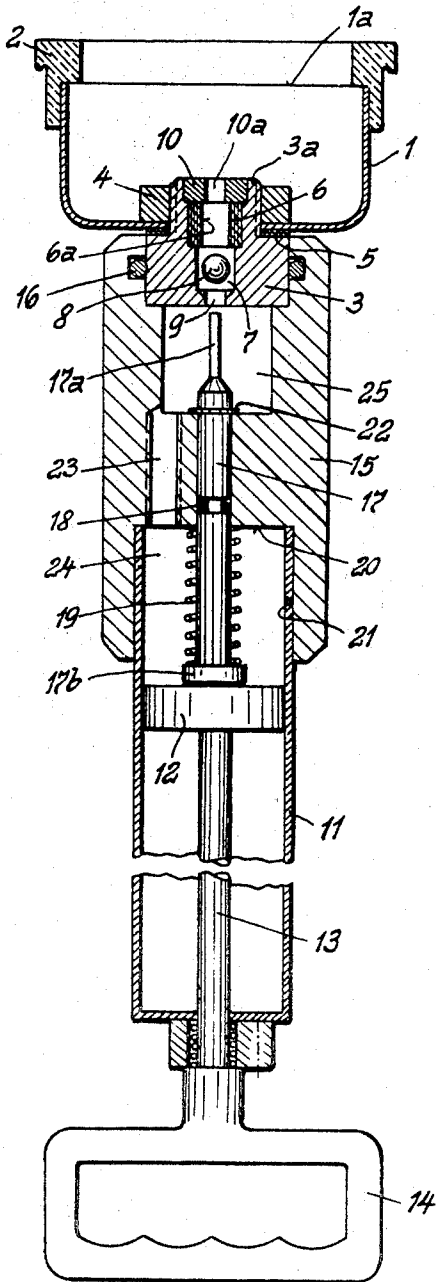
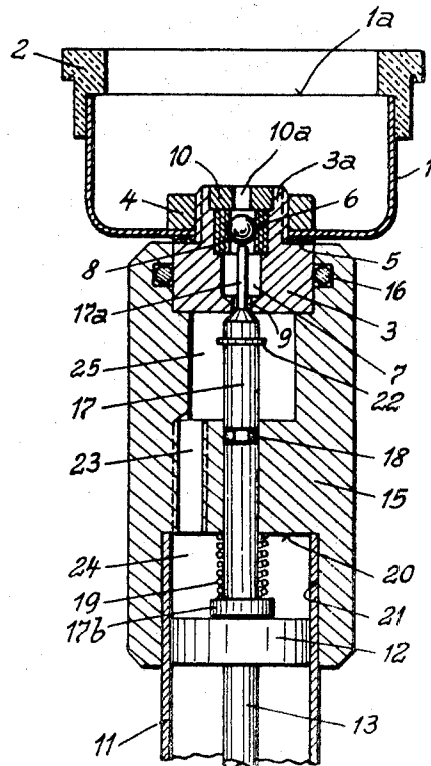


Fig. 2

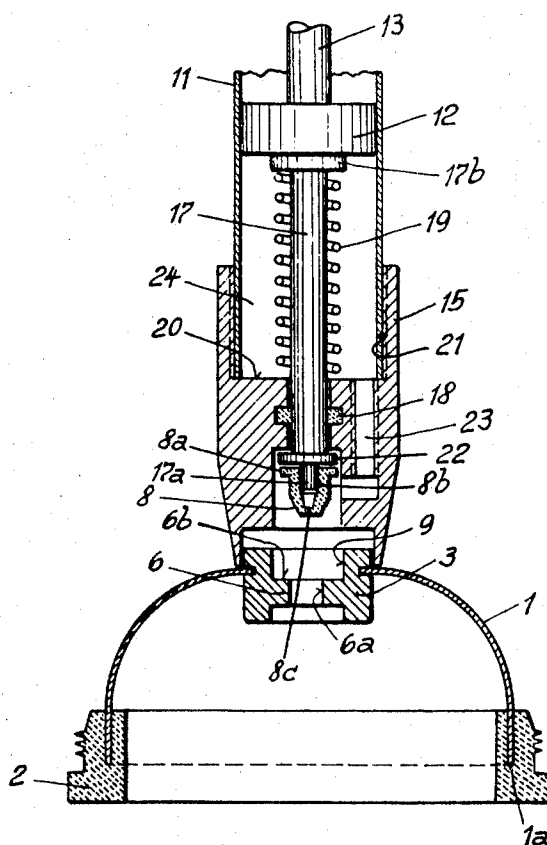


Zoltan CSÉNYI
INVENTOR.

BY

Karl F. Ross
ATTORNEY

Fig. 3

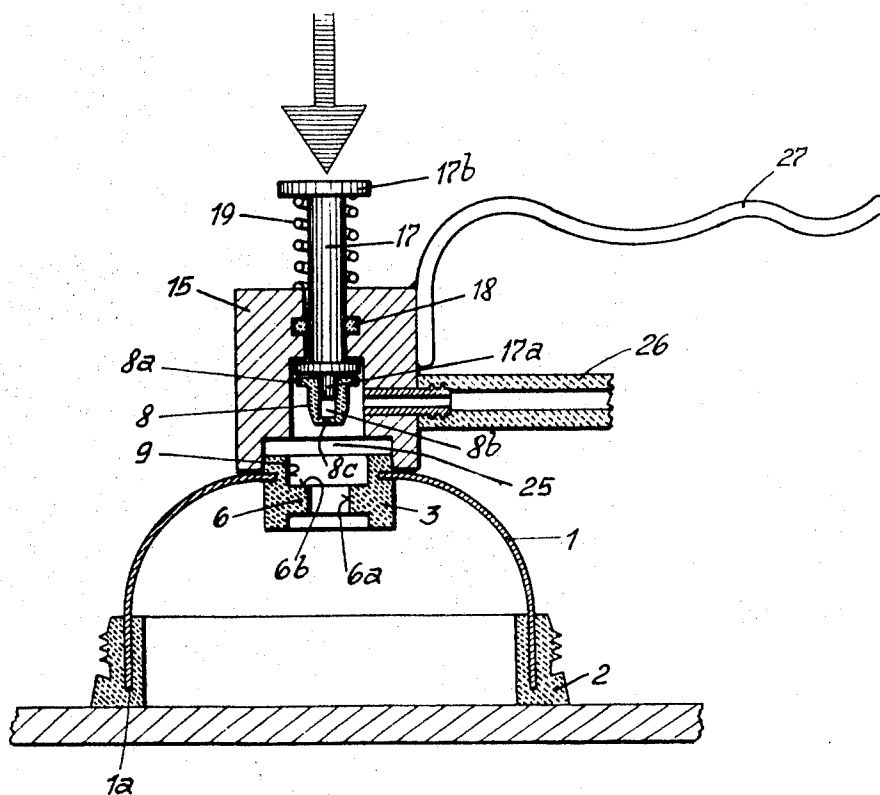
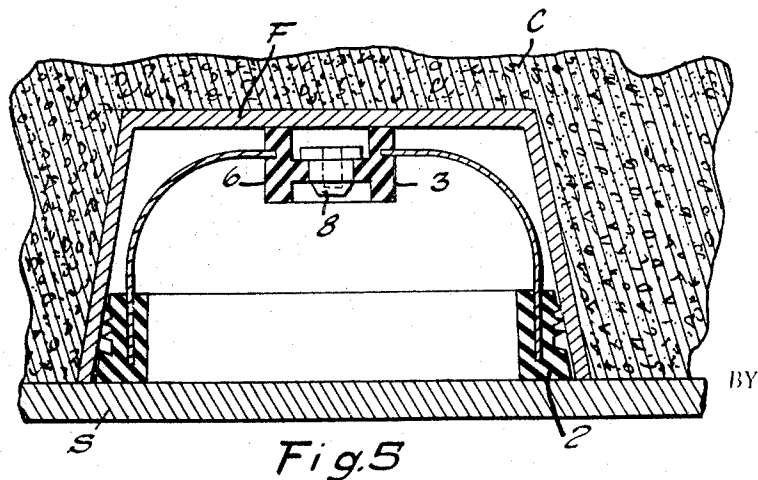


Zoltan CSÉNYI
INVENTOR.

BY

Karl G. Ross
ATTORNEY

Fig. 4



Zoltan CSÉNYI
INVENTOR.

BY
Paul J. J.
ATTORNEY

DEVICE FOR HOLDING FITTINGS ON CONCRETE FORMWORK

This invention relates to a device for holding built-in fittings on shuttering or formwork used for the erection of concrete buildings or parts thereof, having a vacuum adhesion box in the form of a capsule or bell which is provided with an air evacuation valve and with means adapted to generate a vacuum in the adhesion box applied to the shuttering.

Vacuum adhesion boxes of this kind and for this purpose are known. After being placed on the shuttering, they are evacuated with the aid of a vacuum pump so that they adhere for a considerable period and at least till the concrete behind the shuttering has hardened. Installation parts which are to be concreted in, such as electric switchboxes, shaped cores or bodies, equipment boxes or wooden inset boxes, are pushed on to these vacuum adhesion boxes. They then remain bedded in the concrete, while the vacuum adhesion boxes can be taken out for further use upon removal of the shuttering.

None of the vacuum adhesion boxes known heretofore, however, have so far given complete satisfaction. When concrete is vibrated, very great acceleration forces are produced and act on the adhesion boxes, and as the customary spring-loaded vacuum valves of the adhesion boxes are not able to follow the accelerations, air can enter the vacuum adhesion boxes. This shortcoming cannot be overcome simply by using stronger valve springs capable of standing up to the acceleration forces, since the evacuation of the adhesion boxes would then be impaired.

According to the invention this disadvantage is overcome by providing the air evacuation valve of the adhesion box—, which is nondeformable and equipped with a sealing ring, with a valve nozzle and a closing body that can be pressed friction tight into the nozzle, while the air evacuation valve is equipped with a connecting piece which can be fixed thereon airtight, this connecting piece communicating with a vacuum source and having supported in it an axially displaceable tappet coaxial with the valve nozzle, the arrangement being such that when the piston moves beyond the normal inner end of its stroke the tappet strikes against the closing body and pushes same into the valve nozzle.

The accompanying drawing shows by way of example three embodiments incorporating the invention.

FIG. 1 shows an axial section of a vacuum adhesion box with a piston-type vacuum pump attached, the piston being in the inner limiting position of the normal piston stroke;

FIG. 2 is an axial section corresponding to FIG. 1 but with the piston of the vacuum pump in a position beyond the normal inner end of the stroke;

FIG. 3 illustrates a second embodiment, likewise in axial section;

FIG. 4 is an axial section of the device according to the third embodiment; and

FIG. 5 is an axial section through the vacuum adhesion box or shell and a utility housing fitted thereover and embedded in the concrete body prior to removal of the formwork.

Referring to FIGS. 1 and 2, numeral 1 designates a bell-shaped nondeformable vacuum adhesion box upon whose rim 1a an elastic sealing ring 2 is removably or interchangeably fitted. 3 denotes a valve body that has threaded stud 3a passing through the bottom of adhesion box 1. Valve body 3 is fixed in place by means of a nut 4 screwed onto threaded stud 3a. A sealing disc 5 interposed between valve body 3 and the bottom of the box ensures an airtight joint between the valve body and the box. In an axial bore of valve body 3 there is a bush 6 of elastically deformable material which serves as a valve nozzle, and which may be made for instance from a piece of hose. Adjacent the bush 6 and coaxial therewith is a chamber 7 which contains a closing body in the form of a ball 8, for instance a steel ball, whose diameter is greater than the bore 6a of the sealing bush 6. Numeral 9 designates a bore coaxial with chamber 7 and bush 6 through which bore chamber 7 and ball 8 are accessible from the outside. Sealing

bush 6 is secured in place by an insert 10 fitted in the threaded stud 3a and provided with an axial bore 10a.

Reference character 11 designates the cylinder of a piston-type vacuum pump with piston 12, piston rod 13 and handle 14 attached to the latter. At the end opposite the handle the cylinder 11 fits into a connecting piece 15 whose forward end, fitted with an internal sealing ring 16, can be pushed onto the valve body 3 of the adhesion box. A tappet 17 is fitted in an axial bore of connecting piece 15 so as to be axially displaceable and is rendered airtight in the bore by a sealing ring 18. The end 17a of said tappet facing the mouth of connecting piece 15 is designed as a stem of reduced diameter which can enter the bore 9 of valve body 3. At the other end tappet 17 is provided with a head 17b against which one end of a compression spring 19 abuts, while the other end thereof engages the bottom 20 of the bore 21 surrounding the inner end of the pump cylinder. A circlip 22 inserted in groove of tappet 17 serves as a stop for the tappet. A bore 23 provided in connecting piece 15, accommodating a nonreturn valve (not shown), connects the suction space 24 with a recess 25 in connecting piece 15.

For assembly purposes, the valve body of the adhesion box is pushed into the mouth of connecting piece 15 of the vacuum pump. Adhesion box and vacuum pump are now bodily placed at the desired point on one of the inner walls of the shuttering, whereupon piston 12 is pulled back by means of the handle. At this point the nonreturn valve fitted in bore 23 of connecting piece 15 opens, and air is extracted from the box through bores 9, 10a, chamber 7 and bush bore 6a, so that the box is firmly sucked to the shuttering or, in other words, the pressure of the outside atmosphere presses it firmly against the shuttering. At the end of the piston suction stroke the nonreturn valve located in bore 23 closes. During the subsequent inward movement of piston 12 towards connecting piece 15 the air extracted from box 1 and now contained in cylinder space 24 is expelled through a discharge valve (not shown) located in piston 12. If piston 12 is now moved beyond the inner end of its stroke shown in FIG. 1, to the position shown in FIG. 2, the stem 17a passes through bore 9 of valve body 3 and pushes ball 8 into bore 6a of bush 6, which is expanded in the process, so that adhesion box 1 is then closed airtight on the valve side also. The vacuum pump can now be removed from valve body 3. If necessary the suction stroke of the pump may be repeated several times.

The bore 9 is of irregular shape at the end opening into chamber 7, being provided with notches for instance so that the bore cannot be closed by ball 8 during the suction stroke of the pump.

To prevent ball 8 being pushed into the bush unintentionally in the course of several suction strokes of the piston before the desired degree of evacuation is reached, an adjustable stop can be provided to prevent piston 12 from being moved beyond its normal inner end position.

Upon removal of the shuttering, adhesion box 1, sealing ring 2 and valve body 3 can be taken out of the concreted-in fitting. With the aid of an object such as a nail or a fine screwdriver introduced into bore 10a, the ball 8 can be pushed back into chamber 7. While the box with the valve body may be reused as often as desired, it is advisable to change the sealing ring 2 fitted on the rim of the box from time to time. By suitable choice of the hardness of the elastic material used for bush 6 and of the difference of diameter between the ball 8 and the bush bore 6a, it is possible to vary the static friction between ball and bush in wide limits and to keep it in all cases in a range that will resist the forces of acceleration produced when the concrete is vibrated.

It is advantageous to provide an additional chamber, corresponding to chamber 7, between bush 6 and insert 10. This makes it possible to push ball 8 out of bush 6, for instance by means of a nail introduced through bore 9, and thus to render the evacuation of the adhesion box ineffective should the box have been fitted in the wrong position on the shuttering.

The aforescribed vacuum adhesion box is not only a suitable holder for electric switchboxes and the like, but may also be used for fixing in situ shuttering components or door and window frames that are to be concreted in.

Built-in fittings of such large size naturally require the use of several adhesion boxes for absolutely satisfactory fixation. The boxes do not necessarily have to be of round section. It is quite conceivable to adapt the adhesion boxes to the form of the built-in fittings and to make them, say, triangular if door or window frames are to be held fast at their corner.

In the form of embodiment shown in FIG. 3, numeral 1 again designates the nondeformable vacuum adhesion box, 2 the sealing ring fitted on the rim 1a of the adhesion box, 3 the valve body with the valve nozzle 6 and the nozzle bore 6a, 8 the closing body, 11 the pump cylinder, 12 the piston, 13 the piston rod, 15 the connecting piece, 17 the tappet with the inner stem 17a and head 17b, 18 the tappet seal, 19 the compression spring, 20 the bottom of bore 21, 22 the stop of the tappet, 23 the bore taking the nonreturn valve (not shown), and 24 the pump suction space.

In contrast to the embodiment as in FIGS. 1 and 2, in the form shown in FIG. 3 the closing member 8 is designed as a cylindrical plug and provided with an outer collar 8a which comes up against the shoulder 6b of valve body bore 9 upon insertion of the plug in valve nozzle bore 6a. As can be seen, the closing plug 8 is provided with a central blind bore 8b by means of which the plug can be pushed onto the closing stem 17a of tappet 17 with a push-fit. The blind bore 8b of plug 8, which is made of elastically deformable material, goes so deep that only a comparatively thin bridge of material remains, and this can be pierced with a thin, sharp object.

Before connecting piece 15 is fitted on valve body 3 of the adhesion box, piston 12 is pushed wholly into pump cylinder 11 so that tappet 17 emerges from connecting piece 15, and the closing plug 8 is then pushed onto the closing stem 17a. Evacuation of the adhesion box 1 takes place in the same way as described with reference to FIGS. 1 and 2. With evacuation completed, piston 12 of the suction pump is pushed beyond the normal inner end of the stroke, with the result that tappet 17 pushed closing plug 8 into nozzle bore 6a. Since the nozzle bore 6a is once more smaller than the outside diameter of closing plug 8, the latter undergoes elastic deformation so that a considerable frictional force is produced between closing plug and nozzle bore and prevents the closing plug from being loosened in the nozzle under the influence of the acceleration forces produced during the vibration of the concrete.

From FIG. 5 it will be apparent that, once the vacuum adhesion box 1 with its seal 2 engages the formwork or shuttering S, a utility housing or the like can be thrust thereover as indicated at F and concrete C filled in behind the formwork. Removal of the form S and the adhesion box 1 with it exposes the closure member 8 which can be pierced as indicated earlier to permit equalization between the pressure within the box and the external pressure. The box can then be removed and the process repeated. The system illustrated in FIG. 5, of course, results also when the arrangements of FIGS. 1-3 are used.

Should the vacuum adhesion box have been fitted by mistake in a wrong position, the thin bottom 8c of the closing plug can be pierced, as already mentioned, with a sharp object, so that air enters the adhesion box and this is released from the shuttering.

As visible from the drawing, this embodiment of the invention permits the valve body 3 projecting out of the adhesion box 1 to be kept very low, and the closing plug 8 to be sunk completely in the valve body, i.e. in its bore 9. Such a low design is a particularly big advantage in prefabricated buildings in which, as is well known, the built-in fittings are bounded by shuttering surfaces on both sides and have a little height or depth.

In the form shown in FIG. 4, numeral 1 again designates the vacuum adhesion box with the sealing ring 2 fitted on its rim 1a, 3 is the valve body, 6 the valve nozzle with nozzle bore 6a,

8 the closing plug of elastically deformable material with its outer collar 8a, blind bore 8b and material bridge 8c adjacent it, 9 is the outer bore of the valve body with the shoulder 6b formed by it, 15 is the connecting piece, 17 the tappet axially movable therein with its thinner closing stem 17a and head 17b, 18 is the tappet seal and 19 the compression spring acting on the tappet.

The connecting piece 15 is not combined with a suction pump as in the two aforescribed forms. Instead the suction space 25 of connecting piece 15 is connected by a flexible pipe 26 to a vacuum source, say, a motor-driven vacuum pump. Apart from the suction pump, the handling and action of the device shown in FIG. 4 are the same as for the embodiment illustrated in FIG. 3. The form according to FIG. 4 permits the construction of a particularly low and flat closing device, so that the adhesion box may also be fitted at places particularly difficult of access where hand pumps as described in connection with FIGS. 1 to 3 cannot be used. In the pipe 26 leading from connecting piece 15 to the vacuum source it is preferable to fit a multiway cock which enables the pipe to be shut off as desired and the suction space 25 of connecting piece 15 connected to the atmosphere for the purpose of facilitating removal of the connecting piece from the valve body. It is also possible, however, to run an electric control lead in parallel to pipe 26 to a relay acting upon the multiway cock, in which case an electric switch would have to be fitted on handle 27.

To facilitate the removal of the connecting piece from the valve body in the forms shown in FIGS. 1-3 also, communication of suction space 25 with the atmosphere may again be provided for through a valve actuated from the outside.

What I claim is:

1. A device for holding built-in fittings on shuttering used for the erection of concrete buildings or parts thereof, said device comprising a capsule or bell-shaped vacuum adhesion box provided with an air evacuation valve and means for generating a vacuum in the adhesion box applied to the shuttering, said valve including a nozzle and a closing member capable of being pressed friction tight thereinto and having allocated to it a connecting piece fixable thereon airtight, a plunger reciprocable relative to said adhesion box and a tappet coaxial with said nozzle and supported axially displaceable and airtight in said connecting piece for introducing said closing member frictionally into said nozzle upon advance of said plunger.
2. The device defined in claim 1 wherein the valve nozzle is made of elastically deformable material.
3. The device defined in claim 1 wherein the closing member is made of elastically deformable material.
4. The device defined in claim 1 wherein the valve nozzle is formed by an elastically deformable bush adjoining which is formed a chamber accessible through a bore provided in said bush from the outside and containing the closing member.
5. The device defined in claim 4 wherein the closing member is a ball.
6. The device defined in claim 4 wherein the bush has the configuration of a piece of hose.
7. The device defined in claim 1, further comprising a suction pump assembled with said connecting piece.
8. The device defined in claim 1 wherein the tappet has an annular groove and a sealing ring received therein, said connecting piece being provided with a central bearing bore receiving said tappet and sealingly engaged by said ring.
9. The device defined in claim 1 wherein the tappet is tapered to a thinner stem at one end and at the other end has a head against which abuts one end of a compression spring whose other end engages the bottom of a bore surrounding a pump cylinder slidably receiving said plunges, said plunges being constituted as a pump piston.
10. The device defined in claim 1 wherein the closing member is provided with a blind bore open towards said plunger and coaxial with said tappet, by means of which bore the closing member can be pushed onto a thin stem of the tappet with a push-fit.

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11. The device defined in claim 10, wherein the closing member is made of elastically deformable material, the blind hole provided therein going so deep that the bridge of material left can be pierced with a stiff, sharp object.

12. The device defined in claim 1 wherein said connecting piece is connected by a flexible pipe with a vacuum source, the head of the tappet projecting from the connecting piece and forming said plunger so as to permit actuation by hand.

13. The device defined in claim 12, wherein a shutoff member is fitted in the flexible pipe.

14. The device defined in claim 13 wherein the shutoff member is a multiway cock by means of which the flexible pipe can be closed at will and the connecting piece can be

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connected to the atmosphere for the purpose of admitting air to a suction space formed in said connecting piece.

15. The device defined in claim 12, wherein the connecting piece is provided with a handle.

16. The device defined in claim 15, wherein an electric control cable is run parallel to the flexible pipe to a relay acting upon the shutoff member, a switch fitted in said cable being attached to the handle.

17. The device defined in claim 1, further comprising a valve that can be actuated from the outside and fitted in the connecting piece to permit the addition of air to said box.

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