Sept. 3, 1940. D. M. DOW ET AL 2,213,792

VACUUM CLEANER

Filed March 8, 1935 2 Sheets-Sheet 1

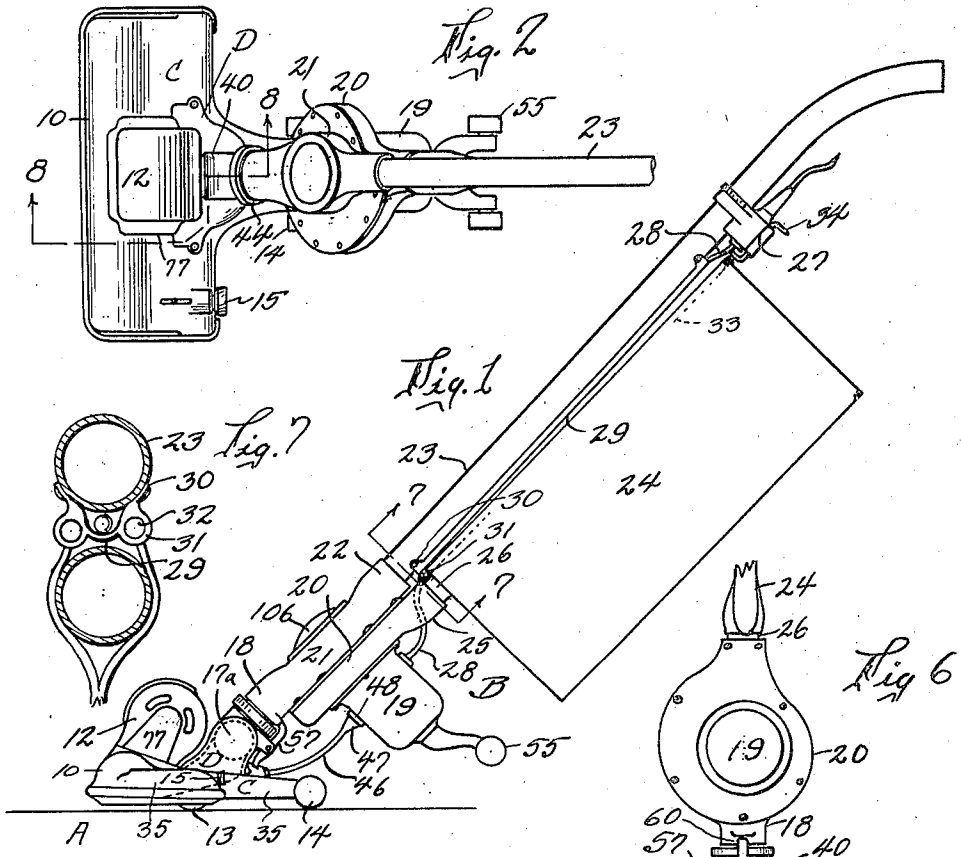

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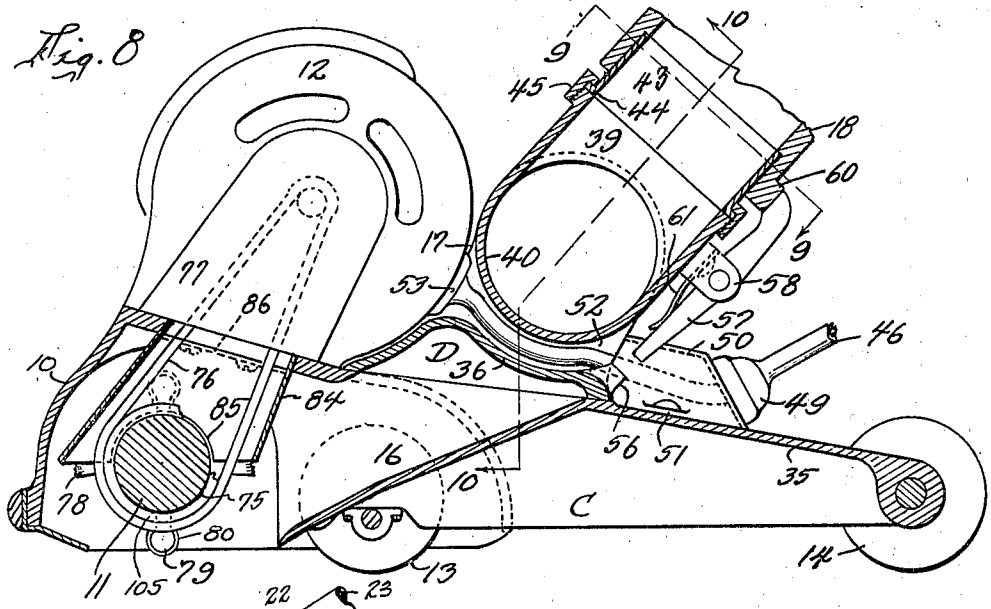
Fig. 8



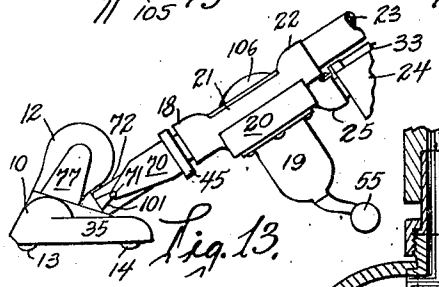


Fig. 13.

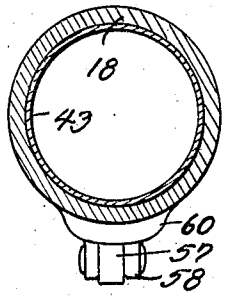


Fig. 9

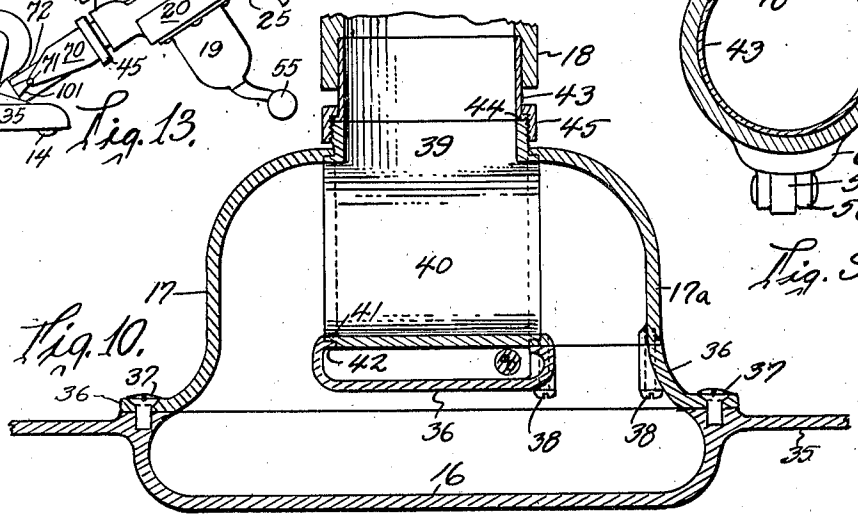


Fig. 10.

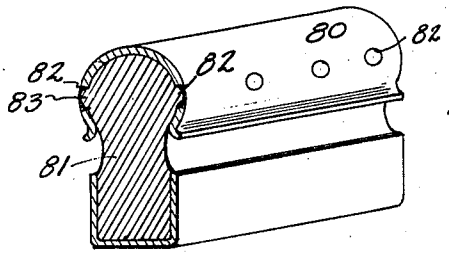


Fig 11

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2,213,792

VACUUM CLEANER

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4 Claims. (Cl. 15—6)

This invention relates to vacuum cleaners and has for its object generally to provide a cleaner having a floor tool adapted to travel on forward and rear wheels over a floor covering with its suction chamber at a fixed height thereabove irrespective of the position of the handle of the cleaner, in combination with a hollow suction handle and suction producing means, together forming a rigid unit which is pivotally connected to the floor tool.

Particularly, the invention aims to provide a practical and successfully operative combination of the foregoing features in a vacuum cleaner wherein the suction chamber, overhanging the forward floor tool supporting wheels and spaced above the floor covering, carries an auxiliary motor for driving a rotary agitator therein, said auxiliary motor being independent of the fan motor and mounted directly on top of the nozzle. To this end, the invention contemplates an arrangement wherein the weight of the auxiliary motor which, being preferably located forwardly of the axis of the forward wheels, would otherwise tend to tip the nozzle forward, is balanced by the weight of the handle and suction unit, applied to the floor tool intermediate the forward and rear wheels thereof.

Another object is to provide a vacuum cleaner including a floor tool adapted to travel over a floor covering so as to follow any irregularities in the surface thereof and a handle, suction unit and bag assembly pivotally connected to the floor tool in such a manner as to not interfere with the following of the floor surface contour and yet capable of also travelling on the floor so as to relieve the operator of supporting its weight, whereby the operator need only exert a horizontal pushing action in order to move the cleaner about over a floor with the nozzle constantly following the contour thereof and maintaining the correct position above the floor covering.

Another object is to provide such a cleaner in which a hollow duct connection is so constructed as to offer minimum resistance to the flow of air and foreign material carried in the air stream so as to avoid clogging and to distribute the suction uniformly in the suction chamber.

Another object is to provide such a cleaner in which the connection between the floor tool and handle unit includes a pivotal connection on a horizontal axis for allowing the handle of the cleaner to be raised and lowered and a swivel connection on an axis parallel or substantially parallel to that of the handle so as to allow the handle to be rotated around substantially its own axis relative to the floor tool. More specifically, the present invention contemplates the provision of a vacuum cleaner in which a minimum height floor tool is adapted to be moved under a piece of furniture and in which the handle and suction producing unit are adapted to be rotated to an intermediate position from which they may be lowered to a substantially horizontal position which they are incapable of assuming unless first rotated to the intermediate position.

The invention aims to embody the foregoing features of multiple pivotal movement an an arrangement in which the handle is capable of imparting steering movement to the floor tool, i. e., the connection between the handle unit and floor tool is rigid as far as any substantial movement of the handle laterally relative to the floor tool is concerned.

Another object of the invention is to provide means for preventing the handle and suction producing unit from being lowered beyond a predetermined upwardly and rearwardly inclined position except when rotated to the aforementioned intermediate position.

Another object of the invention is to provide in combination with a motor for driving the suction fan an auxiliary motor on the floor tool for driving a rotary agitator, an improved arrangement of a conductor extending from the first motor to the auxiliary motor for supplying the latter with current.

Another object is to provide a floor tool and pivotal suction conduit construction of such character as to make it possible to construct the same of die castings.

Another object of the invention is to provide a device for preventing dirt, dust, lint, etc., from following the agitator drive belt from the suction chamber into the belt housing of the auxiliary motor.

Another object is to improve upon the construction of resilient agitators.

Another object is to provide improvements in floating or self-adjusting rotary agitators.

Other objects of the invention will appear in the following detailed description of the invention, illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation of a vacuum cleaner embodying our invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a plan view of the floor tool casting.

Fig. 4 is a rear elevation of the same.

Fig. 5 is an inverted plan view of the pivotal suction conduit casting.

Fig. 6 is a rear elevation of the cleaner with a handle and suction unit standing in a vertical position.

Fig. 7 is a detail sectional view taken on the line 7—7 in Fig. 1.

Fig. 8 is a transverse sectional view through the floor tool taken on the line 8—8 of Fig. 2.

Fig. 9 is a detail sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is a sectional view taken longitudinally through the pivotal suction conduit as indicated by the line 10—10 of Fig. 8.

Fig. 11 is a detail perspective sectional view of one of the beater elements of a rotary agitator.

Fig. 12 is a sectional view taken similar to Fig. 8 of a modification thereof.

Fig. 13 shows another modification.

Referring now to Figs. 1–11 inclusive, the form of invention shown therein comprises a floor tool A and a handle and suction unit assembly B.

The floor tool has a suction chamber 10, a rotary agitator 11 mounted therein, an auxiliary electric motor 12 for driving the agitator 11, forward and rear supporting rollers 13 and 14 respectively upon which the suction chamber 10 travels at any of several fixed elevations relative to the carpet depending upon the position of adjustment of the wheels 13, controlled by adjusting mechanism 15, and suction duct mechanism 16—17 to which the suction neck 18 of the handle suction unit assembly is pivotally connected.

The handle suction unit assembly B comprises a primary motor 19 secured to a fan case 20 which is in turn secured to a valve housing 21 formed integrally with the suction neck 18. Opposite the suction neck 18 is a corresponding suction neck 22 to which is attached the hollow suction handle 23 aligned with the suction neck 18.

A dust collecting bag 24 is hung below the handle 23 and spaced therefrom. The discharge outlet 25 of the fan case 20 is connected by a coupling 26 to the neck of the bag 24.

A switch assembly 27 is secured to the handle 23 near its upper end, and a motor cord 28 extends from the switch assembly to the motor 19 in a sheath 29 of stamped sheet metal or the like secured to the lower side of the handle 23. Formed on the lower end of the sheath 29 are the ears 30 by means of which it is secured to the handle and also the ears 31 which have openings 32 to receive the ends of rods 33 stiffening the upper edges of the bag 24 and forming between them an openable mouth. The upper ends of the rods 33 are secured by retractible latch elements 34 mounted in the switch assembly. The sheath 29 lies in the space between the bag 24 and the handle 23.

The floor tool, in the form under discussion, is formed of two castings C and D. The casting C includes the suction chamber 10, the inclined throat 16 extending from top to bottom of the casting C in a downwardly and fowardly inclined direction, opening at its lower forward end into the suction chamber 10 and at its upper rear end through the top wall of the truck portion 35 of the casting C, the latter having a central rearwardly extending leg to which the rear wheels 14 are secured.

The casting D comprises a central lower portion 36 completely covering the top opening of the throat 16 and secured to the wall 35 by screws 37, and the upwardly projecting spaced elbows 17—17*a* respectively, to which is pivoted the T-union 40 forming a connection between the elbows 17—17*a* and the suction neck 18.

The connection 40 has flanges 41 which are rotatably seated in flanges 42 on the elbows 17—17*a*.

The elbow 17*a* is detachably secured as at 38 to the bottom portion 36 of the casting D so as to allow assembly of the T-union 40.

To the central arm 39 of the T-union 40 the suction neck 18 is attached by means of a short steel tube nipple 43 having a flange 44 held in swivelling engagement with the end of the arm 39 by a retaining nut 45 threaded to the arm 39.

Electrical connection between the motor 19 and the auxiliary motor 12 is effected by means of a flexible conduit 46 one end of which has a male connection 47 plugged into a socket 48 in the wall of the motor 19, the socket 48 in turn being electrically connected to the motor cord 28, preferably the terminals thereof where they attach to the motor brushes. The flexible conduit 46 is provided, intermediate its ends with a strain relief washer 49 which is secured in a stamped sheet metal box 50 secured at 51 to the wall 35. The box 50 is in the shape of an inverted channel, and the cord 46 extends through the same and thence through the space 52 between the base portion 36 of the casting D and the T-union 40. It is thence attached to the motor 12 at 53. The foregoing arrangement makes it practically impossible for the conduit 46 to become caught against objects during cleaning operations, and makes it possible to employ a minimum amount of slack in the conduit wall allowing the rotative movements which will hereinafter be described. This is true because the point of attachment of the conduit to the floor tool is quite close to both the axis of vertical hinging of the handle and the axis of rotation of the handle.

It will now be noted that the handle 23 may be raised or lowered while the floor tool A remains in the same position relative to the floor. If desired, the entire weight of the entire cleaner may be supported on the floor so that the operator need not lift the motor, fan, handle, bag 24 and the contents of the latter. The only effort required is that of horizontal propulsion of the cleaner. This is accomplished by allowing the suction unit supporting wheels 55 to ride against the floor. The floor tool will follow any irregularities in the surface of the floor so as to at all times maintain its proper adjustment and the suction unit and handle assembly will also follow the contour of the floor, any irregularities being compensated for by a slight pivotal movement around the horizontal axis of the elbows 17—17*a*.

It may also be noted that under certain preferred conditions of design, the weight of the auxiliary motor 12, centered forwardly of the wheels 13, would, if the floor tool were disconnected from the suction producing unit, or if the pivotal attachment of the latter were over the wheels 13 or as far forward as the axis of the agitator drive motor (which is common in conventional type cleaners where the agitator is driven by the fan motor) tend to tip the nozzle forwardly and downwardly around the wheels 13. The present invention however obviates this difficulty by locating the axis of pivotal attachment of the handle unit rearwardly of the wheels 13, i. e., intermediate the axis of the wheels 13 and 14, so that the weight of the handle assembly, or the forward portion thereof if the

wheels 55 are being allowed to ride against the floor, will be sufficient to maintain the floor tool in proper balance. In this connection, it may be stated that the weight of the suction producing unit, which is located entirely forwardly of the wheels 55 is greater than the weight of the dust collecting bag 24 even when filled with refuse, so that there is at all times a balance of weight forwardly of the wheels 55 producing some downward pressure on the pivotal connection.

The invention, however, provides that when the cleaner is picked up bodily, the floor tool A, of which the forward portion is much heavier than the rear, will not flop downwardly substantially beyond its normal horizontal position. This is important since the operator will often wish to lift the floor tool over slight projections such as door treads, etc., and when again placing the floor tool in contact with the floor it is desirable that it maintain a horizontal position. This is assured by the employment of a stop 56 formed on the duct casting D and a finger 57 pivoted to a bracket 58 on the T-union 40. When the handle suction unit assembly is in position where the wheels 55 engage the floor, the finger 57 will likewise engage the stop 56 and limit the rearward movement of the floor tool around the axis of the elbows 17—17a. The weight of the forward region of the floor tool will maintain the stop 56 in engagement with the finger 57 so as to assure the floor tool remaining in horizontal position as long as the handle is held in the correct position.

It is desirable however that the arrangement be such that the handle 23 may upon occasion be lowered to a substantially horizontal position without tipping up the floor tool. For example, in going under low furniture, it is desirable to lower the handle assembly. The invention provides for this by allowing the handle and suction unit assembly to be rotated around the axis of the handle so as to bring the motor 19 and wheels 55 around to one side of the handle, a position in which they do not interfere with lowering of the handle. When the handle has thus been rotated, the finger 57, which has previously been held in operative position by means of a cam 60 on the suction neck 18, is now moved to an inoperative position by a spring 61 secured to the bracket 58. When thus in inoperative position, the end of the finger 57 simply slides beneath the stop 56 and allows the T-connection to rotate on below the limit at which it has hitherto been stopped.

In the modified form of the floor tool shown in Fig. 12, the castings C and D are combined in a single integral casting and the lower wall of the duct 16 is formed by a stamped sheet metal plate 16a secured as at 16b to the casting.

It may now be noted that we have provided a double pivotal connection such as to allow up and down movement of the handle relative to the floor tool and/or swivelling movement of the handle substantially around its own axis, yet a connection in which the axis of the handle is, in the preferred form rigidly positioned in a vertical plane bi-secting the floor tool perpendicular to the longitudinal axis thereof. To state it in another manner, the handle, while being capable of swivelling and up and down hinging relative to the floor tool, nevertheless is so connected to the floor tool that it cannot be moved substantially laterally relative to the floor tool. Accordingly, the normal function of steering the floor tool by the handle is as fully present as it is in any conventional cleaner in spite of the several pivotal movements of which it is capable. It will be understood that in the accompanying claims, the word "flexible" referring to the conduit connecting the throat 16 and the fan case inlet 18, refers to either the inherent wall flexibility of the tube 72, or to the pivoting flexibility of the pivoted sections 17 and 40 of the form shown in Fig. 10.

The rotary agitator comprises a hub 75 extending from end to end of the nozzle and journalled therein at its ends. In the preferred form shown in Figs. 1–12, the mounting may be similar to that disclosed in United States Patent 2,102,221, issued December 21, 1937. The belt drive 76, belt housing 77 and construction of the auxiliary motor 12 in the preferred form are also substantially as shown in that patent. Brush elements 78 and resiliently mounted agitators 79 are mounted in the hub and arranged preferably in a manner similar to that shown in said patent.

We have provided an improvement over the specific construction of the beater element covered by the aforesaid patent, wherein the carpet contacting channel 80, instead of being bonded to the rubber strip mounting 81, is clinched into clamping engagement with the side faces of the somewhat narrowed waist region of said rubber strip. The channel 80 is provided with a series of openings 82 into which the rubber is extruded under the squeezing pressure of the channel. These extruded lugs 83 serve to give additional retention to prevent the channel from becoming disengaged from the rubber strip and serve as the primary means for preventing the channel slipping endwise from the channel strip.

In order to prevent lint, dust, etc., being thrown and carried up into the belt housing 77, we provide a guard housing 84 of sheet metal, the upper end of which is inserted in the belt opening in the top wall of the suction chamber 10 and the lower end of which embraces the upper half of the cross section of the hub 75, its side walls being semi-circularly cut away as at 85 for this purpose. An ear 86 formed by bending the upper region of one of the side walls laterally, is secured to the lower side of the top wall of the suction chamber 10 and serves to hold the guard housing in place.

We find that the use of this open ended housing, encircling the two reaches of the belt, entirely eliminates the serious difficulty of clogging of the belt housing which was previously experienced.

In the form shown in Fig. 13, the rollers 13 are positioned at the ends of the suction chamber 10, which is not of the overhanging type. The pivot 71 connecting the fork 70 to the floor tool, is located on an axis intermediate the axes of the wheels 13 and 14, intermediate the ends of the flexible tube air conduit 72, and intersecting the latter. It is attached to ears 101 formed on the floor tool. The fork 70 is connected, through the swivel joint 45, to the neck 18.

The belt guard 84 is just wide enough between its side walls to just clear the belt pulley 105.

A valve 106 operates in the valve housing 21 to direct the suction either to the hollow handle 23 or to the floor tool.

We claim:

1. In a vacuum cleaner, a floor tool including a suction chamber, forward and rear wheels supporting the same for following the contour of a

supporting surface, a rotary agitator therein, a motor carried on the floor tool and operatively connected to said agitator for driving the same, and a throat extending rearwardly from the suction chamber, a handle assembly including a handle and suction producing unit rigidly attached together, a connecting member having a swivelled connection with the suction inlet neck of said suction producing unit, substantially aligned with the axis of said handle, and having a pivotal connection with the floor tool on a horizontal axis parallel to the axes of said wheels and thereby connecting said neck to said floor tool for transferring propelling movement from one to the other, a flexible air conduit connection the upper extremity of which comprises said swivel connection and the lower extremity of which communicates with said throat, and means, rendered inoperative when said handle is rotated around the axis of said swivel, for normally limiting the possible downward swinging movement of the forward region of the floor tool when the cleaner is lifted by means of the handle.

2. In a vacuum cleaner, a floor tool including a suction chamber, a rotary agitator therein and an auxiliary motor mounted on the floor tool and operatively connected to the agitator, a handle assembly including a handle and a suction producing unit, rigidly attached together, said unit being attached to the floor tool, and including a primary motor for driving the fan thereof, an auxiliary conductor connected at one end to said primary motor and at its other end to said auxiliary motor, a pivotal air conduit connection between said suction producing unit and the floor tool, including a T-union having a horizontal portion spaced above a portion of the floor tool behind said auxiliary motor, said auxiliary conductor passing through the space between said T-union and the floor tool, and an anchoring member attached to the floor tool on the opposite side of said T-union from the auxiliary motor, said auxiliary conductor being anchored in said anchoring device.

3. In a suction cleaner, a floor tool including a suction chamber beginning with a carpet engaging mouth and terminating in a discharge throat, a handle assembly including a handle and a suction producing unit rigidly attached thereto, connecting means having a swivelled connection with the inlet of said suction producing unit, substantially aligned with the axis of said handle, and having a pivotal connection with the floor tool on a horizontal axis transverse to the direction of movement of the cleaner, and thereby connecting said suction producing unit to said floor tool for transferring propelling movement from one to the other, and means, rendered inoperative when said handle is rotated around the axis of said swivel, for normally limiting the possible downward swinging movement of the forward region of the floor tool when the cleaner is lifted by means of the handle.

4. In a suction cleaner, a floor tool, a discharge throat for said floor tool, a handle carrying a filter and suction unit assembly, means connecting said discharge throat and said assembly including a swivel connection, said swivel connection enabling a swinging of the handle in a vertical plane, means supported on said swivel connection adapted to enable said handle to rotate on its own axis and a locking means pivotally connected to said swivel connection and adapted in one position thereof to limit the swinging movement of the handle and in another position of the locking means it is adapted to prevent a rotation of said handle.

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