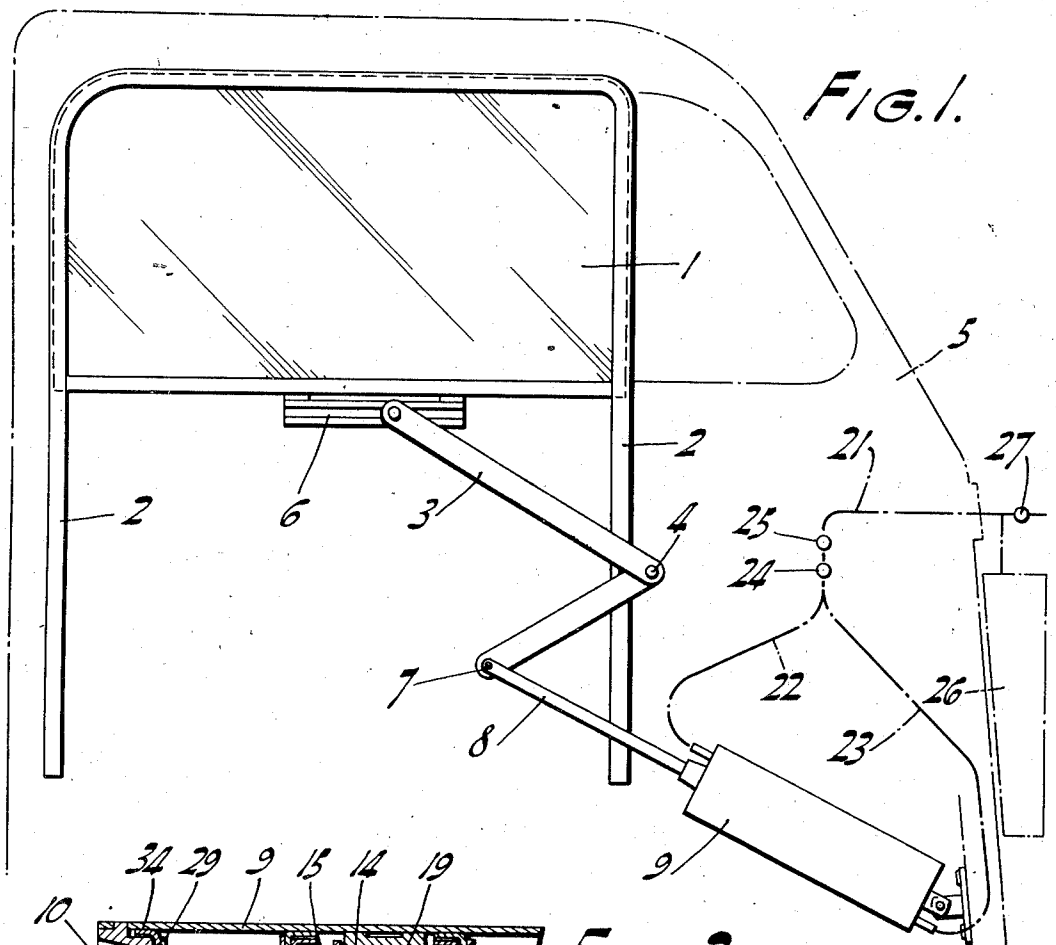
July 20, 1943. A. RAPPL ET AL 2,324,724

WINDOW OPERATOR

Filed Dec. 18, 1940

FIG. 1.



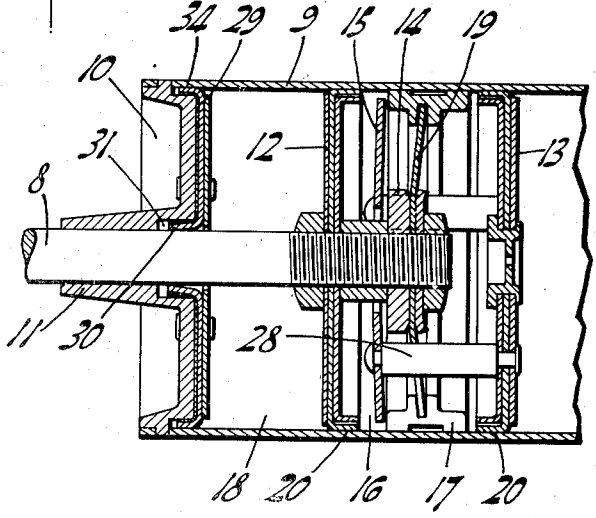


FIG. 2.

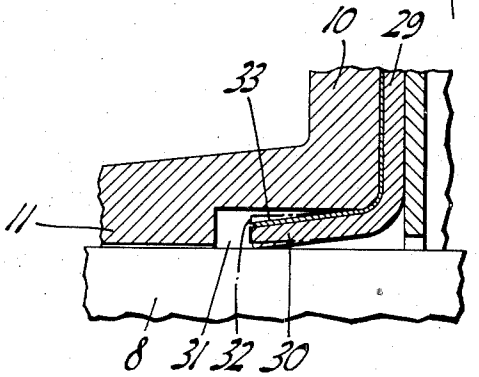


FIG. 3.

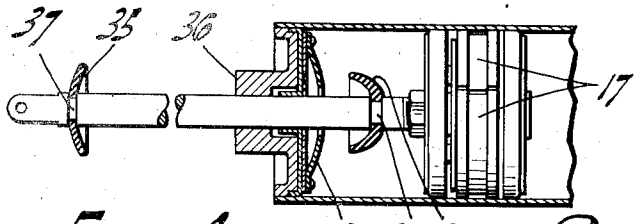


FIG. 4.

INVENTORS
ANTON RAPPL AND
ERWIN C. HORTON
BY
Beau, Brooks, Buckley & Beau.
ATTORNEYS

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WINDOW OPERATOR

Anton Rappl, Buffalo, and Erwin C. Horton, Hamburg, N. Y., assignors to Trico Products Corporation, Buffalo, N. Y.

Application December 18, 1940, Serial No. 370,686

5 Claims. (Cl. 268—125)

This invention relates to window operating mechanism and especially to a construction of this character which is particularly adapted for operation from a source of fluid pressure, such as the intake manifold in the power plant of a motor vehicle. It has heretofore been proposed to operate a piston in a cylinder by suction maintaining in the intake manifold of the vehicle engine, and in order to avoid leakage from the piston chamber a stuffing box has been provided around the piston rod. The stuffing box easily becomes worn and consequently needs frequent adjustment, as by means of a nut which tends to subject the motor to additional labor, and where the available pressure differential required for the operation of the motor is restricted, as in the suction operated type, the efficiency is thereby materially impaired.

The object of the present invention is to provied an improved window actuating mechanism which eliminates the stuffing box with its disadvantages and at the same time increases the operative efficiency of the fluid motor. A further object of the invention is to provide a mechanism of this nature in which the piston may be practically maintained in a balanced state between zones of subatmospheric pressure in the motor for immediate response in either direction of movement to an unbalanced situation resulting from a controlled venting of a selected zone to the atmosphere.

In the drawing

Fig. 1 is a phantom view of a motor vehicle window equipped with the present invention;

Fig. 2 is an enlarged longitudinal section through the fluid motor of the window operating mechanism disclosed in Fig. 1;

Fig. 3 is an enlarged sectional view through the fluid seal of the motor; and

Fig. 4 is a longitudinal sectional view through a modified form of the invention.

Referring more particularly to the drawing, the numeral 1 designates a motor vehicle window herein depicted as being mounted in channeled guideways 2 for closing in an upward direction. A bell crank lever 3 is pivoted at 4 on the door body 5 and has one end operatively connected to a bracket 6 on the bottom edge of the window and its opposite end pivotally connected at 7 to a piston rod 8 of the fluid motor. The motor comprises a housing or cylinder 9 permanently closed at one end and having its opposite end receiving a removable head 10. This head is provided with a bearing 11 which slidably receives and gives support to the rod 8.

The piston comprises a fixed section 12 rigidly carried by the piston rod 8 and a floating section 13 movable relative thereto and mechanically connected therewith by a suitable lost motion construction comprising the head 14 on the rod and the coupling plate 15 on the floating section. In the chamber 16 between the two piston sections is a braking arrangement herein disclosed as consisting of an expansible brake having shoes 17 supported lightly against the side wall of the cylinder chamber 18 by a toggle support 19 on the rod. An inward push on the rod 8, such as would result from an attempt to pry open the window, will tend to spread the toggle support and apply the brake more firmly. The glass may, however, be manually lifted without brake resistance since the shoes will merely drag idly along. Each piston section is provided with a packing having a sealing flange 20 extending toward the companion piston section and yieldable from the cylinder wall to permit fluid at a higher pressure passing into the brake chamber 16 for providing a working pressure differential on such companion piston section.

A suction supply hose or conduit 21 leading to a suitable source of suction, such as the intake manifold of the internal combustion engine of the vehicle, is connected by branch conduits 22 and 23 to the piston chamber at opposite sides of the piston. Control valves 24 and 25 are interposed in the suction line and are selectively operable to subject the piston to a working pressure differential, as by opening the cylinder chamber at one side of the piston to the atmosphere while the other side is connected to the source of low pressure influence. Normally, the chamber at the opposite sides of the piston may be opened, either to the atmosphere and selectively connectible to the source of suction, or to the source of suction and selectively vented to the atmosphere, to provide the working pressure differential. The latter arrangement is preferred because it has been found that the motor is quicker in its response, and for ease of description it will be assumed herein that both sides of the piston chamber are normally open to the source of suction and, therefore, the piston is balanced by reason of the low presure on opposite sides thereof. A suction storage tank 26 may be interposed in the suction line between a check valve 27 and the motor chamber 18, the check valve closing toward the engine when the manifold suction is deficient. Consequently, the balancing pressure at opposite sides of the piston will be extremely low even though the engine throttle may be wide

open. Therefore, when it is desired to lower the window the valve 25 will be opened to interrupt the suction communication at the left side of the piston, as viewed in Figs. 1 and 2, and vent such side of the chamber to the atmosphere. This causes a pressure differential on the floating piston section 13 to rock the bell crank lever in a counterclockwise direction and pull the window down, the brake shoes 17 being initially withdrawn from the chamber wall by reason of the play connection provided by the head 14 and coupling plate 15. The latter is fixed to the floating piston section by spaced studs 28. When it is desired to close the window the valve 24 is operated to open the right side of the piston chamber to the atmosphere which results in a pressure differential being built up on the fixed piston section. This general piston construction is more clearly set forth in our copending application Serial No. 365,060.

Since the opening movement of the window is effected by atmospheric pressure on the left side of the piston, and since the piston, when at rest, is normally balanced by suction on both sides it is obvious that any leakage of air through the rod bearing 11 will create a pressure differential tending to lower or open the window. It is, therefore, the object of the present invention to avoid this undesirable condition, while at the same time to increase the efficiency of the motor.

This is accomplished herein by providing a packing member 29 with an annular breathing lip or flange 30 extending into chamber 31 in the cylinder head 10 and about the piston rod 8. The flange chamber 31 is sufficiently large to permit the flange 30 yielding away from the piston rod for exhaling action, as indicated at 32. If desired, a light spring 33 may be provided to urge the lip 30 lightly toward the piston rod. The packing member 29 may also be provided with a packing flange 34 to seal the space between the periphery of the head 10 and the side wall of the cylinder chamber.

In operation this expansible breathing lip 30 will effectively seal the chamber against leakage of air along the piston rod. When the left side of the chamber is in communication with the suction source not only will the sealing flange 20 of the fixed piston section be acted upon by a pressure differential but the breathing lip 30 will likewise hug the piston rod 8 and consequently air leakage through the bearing 11 will be prevented. The lubricant in the bearing will therefore remain therein against being drawn into the cylinder chamber. Should it be desired to manually lift the window by grasping the upper edge of the glass, as when the engine has been turned off, the movement of the piston in the cylinder to the left would ordinarily tend to build up a pressure faster than the hose connection can relieve it, but in the present construction the breathing lip will exhale the piston driven air and thereby considerably ease the manual lifting action. The lip 30 yields outwardly for a more ready escape of air in front of the piston and consequently the manual operation is facilitated. The breathing lip is preferably of elastic material but may be of other suitable stock for effectively sealing the bearing 11 against air leakage during window closing operation of the motor and yet at the same time will function to relieve an objectionable build-up in pressure in front of the piston during the manual movement of the window.

The window will be in a fully closed position for the major portion of the life of the vehicle, and in a fully opened position for a lesser time interval and, therefore, to relieve somewhat the burden of the breather lip to seal the bearing 11 in the extreme positions of piston movement, the present invention also comprehends auxiliary means to supplement, if not fully relieve, the breather lip of this burden. Such auxiliary sealing means are depicted in Fig. 4 wherein the piston rod 8 is equipped exteriorly of the motor with a flexible disk or ring 35 which is adapted to engage a seat 36 at the outer end of the bearing 11 to close the clearance between it and the piston rod. The sealing ring may be securely fastened to the rod in a fluid tight manner, as by providing the rod with an annular groove 37 to snugly receive the inner edge of the sealing ring 35. A sealing disk or ring 38 is similarly mounted in a groove 39 on the rod 8 within the piston chamber and this sealing ring is adapted to engage a flexible seat 40 carried in a fluid tight manner on the inner face of the cylinder head 10. Therefore, as the piston moves further into the chamber 18 and approaches its extreme limit position the sealing ring 35 will engage the seat 36 and close off any leakage tendency through the bearing 11. As the piston approaches its outer limit of movement the sealing disc 38 will engage the more flexible seat 40 in sealing engagement against the leakage of air into the piston chamber. The sealing ring 35 may be of soft rubber or like material while the ring 38 may be of a more rigid character since its seat 40 will be acted upon by any pressure differential to draw it firmly against the ring 38.

Consequently, the extreme inner limit of piston movement will dispose the sealing disc 35 in a position to effectively relieve the breather lip 30, and since this limit position is maintained when the window is closed, the breather lip will be relieved of this additional burden for a substantial portion of the useful life of the vehicle. In a fully opened position the flexible seat 40 and its cooperating sealing ring 38 will serve in an additive capacity to supplement the breather lip 30 in sealing the motor chamber against air leakage.

While the foregoing description has been given in detail, it is obvious that the inventive principles set forth may be incorporated in other physical embodiments without departing from the spirit or scope of the invention defined in the appended claims. For example, the sealing parts may be reversed for the adaptation of the invention for operation by superatmospheric pressure, the breather lip 30 being extended in a reverse direction and functioning to freely admit atmospheric air into the chamber behind the piston during manual movement of the window. Furthermore, the breather lip may be replaced by other valve means elsewhere in the head 10 to expedite the evacuation of the fluid in advance of the piston on the window closing stroke of the latter.

What is claimed is:

1. A window operating mechanism comprising a window, a suction operated motor having a chamber and a piston therein with a rod extending from the piston through a bearing in a wall of the chamber, the bearing being lubricated and giving sliding support to the rod, means for normally fluid balancing the piston and adapted to vent the chamber at either side to create a motivating pressure differential, means operatively connecting the rod to the window for moving

the latter, an annular lip at the innerside of the bearing acting under fluid pressure differential to seal the chamber against air leakage along the rod and adapted to exhale air from the chamber, and auxiliary sealing means for the bearing consisting of a flexible surface carried by the rod exteriorly of the bearing and seating thereon about the rod to seal the clearance against air leakage when the window is closed and thereby relieve the lip from the full force of the pressure differential.

2. A window operating mechanism comprising a window, a suction operated motor having a chamber and a piston therein with a rod extending from the piston through a bearing in a wall of the chamber, the bearing being lubricated and giving sliding support to the rod, means for normally fluid balancing the piston and adapted to vent the chamber at either side to create a motivating pressure differential, means operatively connecting the rod to the window for moving the latter, an annular lip at the inner side of the bearing acting under fluid pressure differential to seal the chamber against air leakage along the rod and adapted to exhale air from the chamber, and auxiliary sealing means carried by the rod at spaced points and at opposite sides of the bearing for alternate sealing engagement with the latter at the opposite ends of the piston stroke and thereby cooperate with the lip in maintaining the fluid balance on the piston when the window is in fully opened and closed positions to relieve the lip in part at least from the action of the pressure differential when at rest in such positions.

3. In a window operating mechanism, a fluid pressure motor connected to the window for operating the same and having a chamber and a piston therein, the piston being adapted for window imparted movement relative to the chamber and having a rod slidable in a bearing through an end wall of the chamber, a packing member secured to the wall and having a breathing lip extending along the rod in sealing embrace therewith, and means for normally fluid balancing the piston and adapted to vent the chamber at either side of the piston to create a motivating pressure differential thereon, said piston having contact with the side walls of the chamber which is sealed against the slippage of fluid from one side to the other side of the piston during such window imparted movement, said breathing lip being flexible to permit pressure equalizing fluid flow between the chamber and the outside atmosphere over and above the capacity of the adjacent passage for facilitating the window imparted movement.

4. A window operating mechanism comprising in combination with a window movable to and from a closed position, a suction operated fluid motor comprising a chamber and a piston movable therein with a piston rod extending through a bearing in the chamber wall and operably connected to the window for actuating the same, said window adapted for manual movement in one direction and said piston rod adapted to move the piston along with the window during such manual movement, a breathing sealing lip carried by the chamber wall and extending outwardly about the rod for sealing contact therewith under the action of a fluid pressure differential during fluid operation of the piston in a window opening direction, and means normally subjecting the chamber at both sides of the piston constantly to suction and operable to selectively vent either side for effecting such operating pressure differential, said lip being expansible from the rod when the piston is moved by window imparted action in a window closing direction to permit air passage through the bearing and thereby relieve air resistance to piston movement.

5. A window operating mechanism comprising in combination with a window movable to and from a closed position, a suction operated fluid motor comprising a chamber and a piston movable therein with a piston rod extending through a bearing in the chamber wall and operably connected to the window for actuating the same, said window adapted for manual movement in one direction and said piston rod adapted to move the piston along with the window during such manual movement, a breathing sealing lip carried by the chamber wall and extending outwardly about the rod for sealing contact therewith under the action of a fluid pressure differential during fluid operation of the piston in a window opening direction, and means normally subjecting the chamber at both sides of the piston constantly to suction and operable to selectively vent either side for effecting such operating pressure differential, said breathing sealing lip being elastic for expanding away from the rod to relieve a superatmospheric building up of pressure in the adjacent chamber portion during the window imparted action of the piston, and said bearing being provided with a counterbore into which the lip freely extends, the surrounding wall of the counterbore acting to restrict the elastic sealing lip in its expanding action away from the rod during its breathing function.

ANTON RAPPL.
ERWIN C. HORTON.