March 1, 1927. 1,619,677

E. F. PIERCE

WINDSHIELD CLEANER

Filed Dec. 29, 1921 2 Sheets-Sheet 1

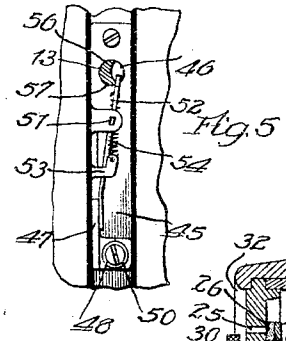


Fig. 5

Fig. 1

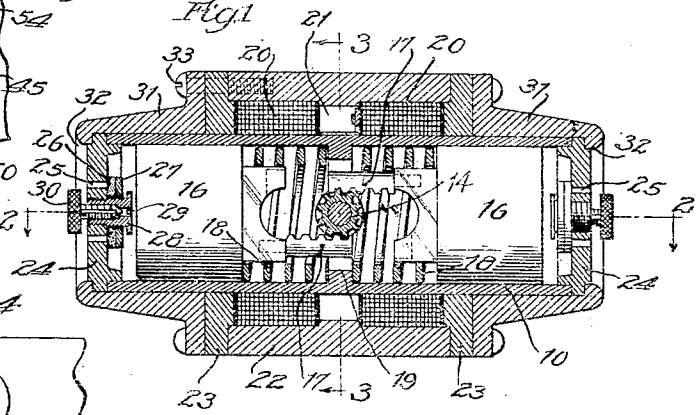


Fig. 4

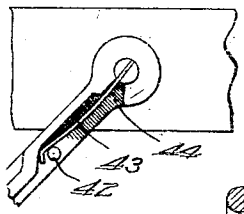


Fig. 2

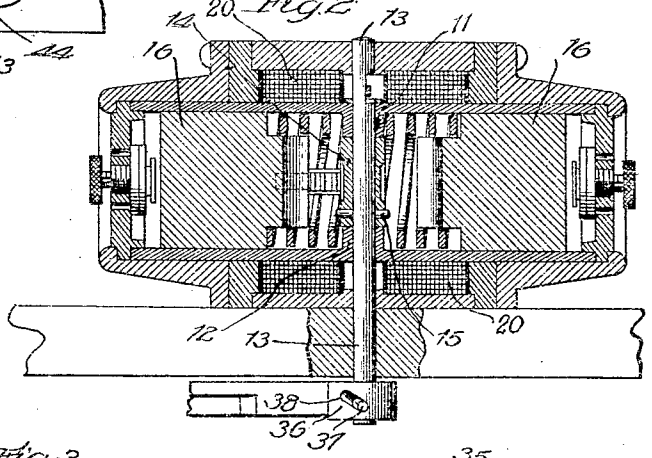


Fig. 3

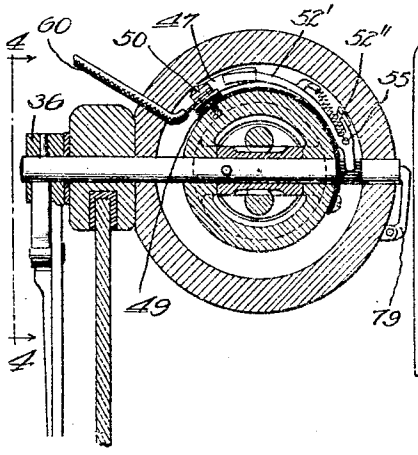
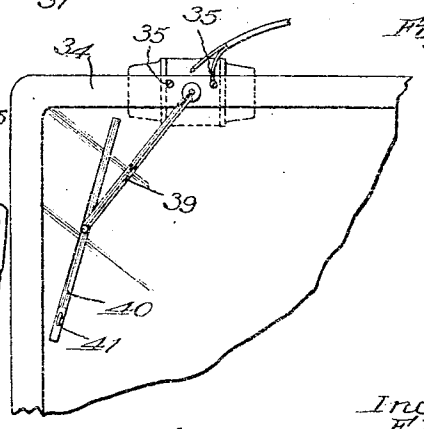


Fig. 6



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Filed Dec. 29, 1921 2 Sheets-Sheet 2

Fig. 7

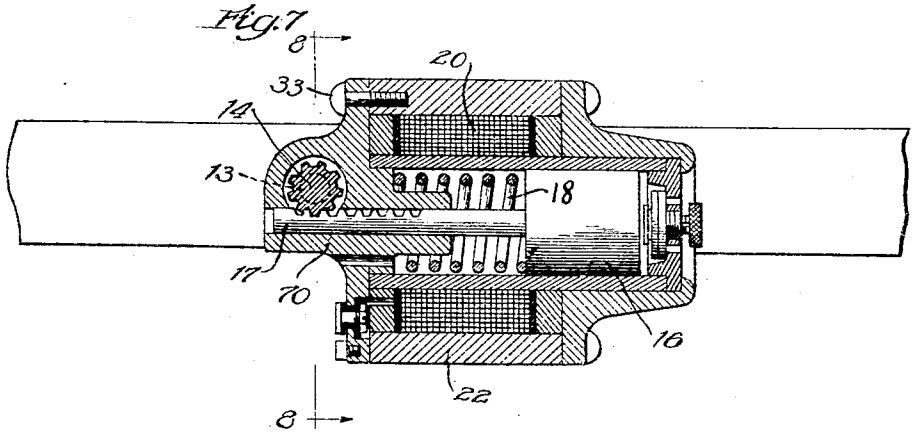


Fig. 8

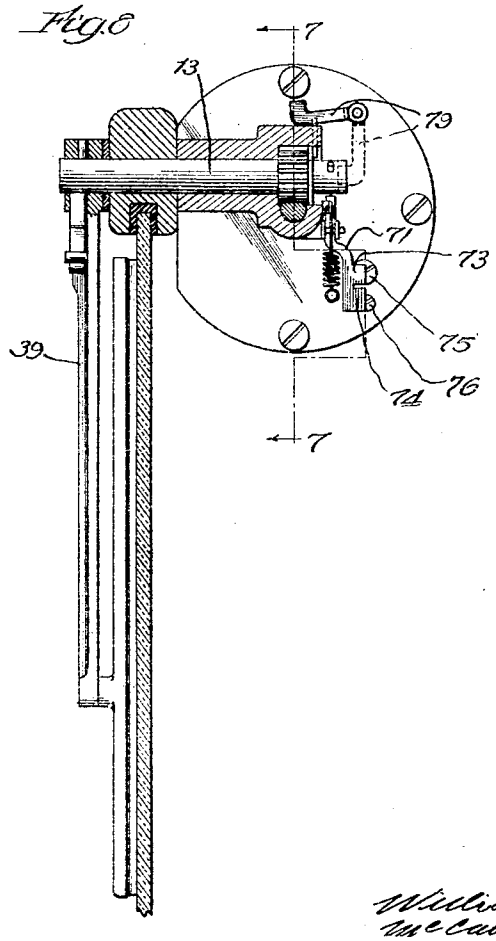
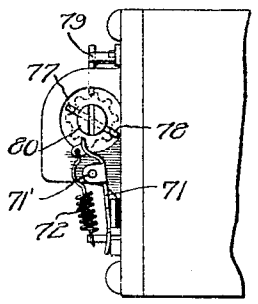


Fig. 9



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Patented Mar. 1, 1927. 1,619,677

UNITED STATES PATENT OFFICE.

EARL F. PIERCE, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TRICO PRODUCTS CORPORATION, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

WINDSHIELD CLEANER.

Application filed December 29, 1921. Serial No. 525,632.

My invention relates to improvements in windshield cleaners, and is particularly concerned with, though not limited to, improvements in windshield cleaners adapted to be actuated by electricity supplied from a storage battery, or other source, carried by the vehicle to which the windshield cleaner is attached.

The objects of my invention are:

First: To provide a windshield cleaner which will require a minimum amount of energy for its operation;

Second: To provide a windshield cleaner comprising a cleaner member adapted to contact with the windshield, a compressible element, means for placing the compressible element under compression, and means actuated by the expansion of the compressible element for operating the cleaner member;

Third: To provide a windshield cleaner such as described comprising means for controlling the rate at which the compressible element is permitted to expand;

Fourth: To provide a windshield cleaner comprising a cleaner member and means for alternately actuating said cleaner member in opposite directions, alternate strokes of said cleaner member being idle strokes;

Fifth: To provide a windshield cleaner comprising but a single solenoid of just sufficient strength to operate the cleaner member through a single stroke; and

Sixth: To provide a windshield cleaner which is simple in construction, rugged and economical to manufacture.

Other objects will appear as this description progresses, reference being had to the accompanying drawings, in which—

Figure 1 is a central longitudinal section through one embodiment of my improved windshield cleaner;

Figure 2 is a view similar to Figure 1, but taken at right angles to the section in Figure 1;

Figure 3 is a transverse section taken on line 3—3 of Figure 1;

Figure 4 is a fragmentary elevation showing more particularly the connection between the cleaner arm and the rocker shaft;

Figure 5 is a plan view of the switch for controlling the supply of current to my improved windshield cleaner;

Figure 6 is a side elevation showing my improved windshield cleaner attached to the frame of a windshield;

Figure 7 is a central longitudinal section showing a modified form of my invention;

Figure 8 is a transverse section taken on line 8—8 of Figure 7; and

Figure 9 is a side elevation showing certain details of the switch mechanism, portions of the cleaner being broken away.

Throughout the several figures of the drawings, similar reference characters will be used for referring to similar parts, and the several sections are taken looking in the direction of the small arrows.

Referring to the drawings, and for the time being to Figures 1 to 6, inclusive, my improved windshield cleaner comprises a cylinder 10, which is preferably formed of brass or some other metal or material without magnetic properties. Two aligned bearings 11 and 12 project inwardly from the central portions of the walls of the cylinder 10 in which the shaft 13 is journaled. A pinion 14 is secured to the shaft 13 by the pin 15, the pinion being positioned between the two bearings 11 and 12.

A plunger 16 is slidably mounted in each end of the cylinder 10. Each plunger carries a rack 17, racks of the respective plungers engaging the pinion 14 upon opposite sides. A spring 18 is confined between each plunger and the annular flange 19 which extends inwardly from the central portion of the cylinder 10, so that as the plungers 16 move inwardly, the springs 18 are compressed. At the same time, the shaft 13 is rotated through the action of the rack 17 upon the pinion 14.

A solenoid 20 surrounds the cylinder 10 on either side of and adjacent the shaft 13, there being a space 21 between the two solenoids to permit the passage of the shaft 13 and for another purpose to be referred to later on. The two solenoids 20 are wound in the proper direction to set up a magnetic field tending to cause the two plungers 16 to approach each other. In order to produce as strong a magnetic field as possible by com-

paratively small solenoids, I prefer to enclose the solenoids by a housing consisting of the iron cylinder 22, the ends of which are partially closed by the annular iron rings 23.

The ends of the cylinder 10 are provided with the disc closures 24 in each of which are formed a plurality of inlet ports 25. These ports are provided for the purpose of permitting the free ingress of air to the space between each disc 24 and the adjacent plunger 16, so as to permit the plunger 16 freely to move forward under the influence of its solenoid without producing a vacuum in its end of the cylinder. To prevent the too free escape of air from the cylinder as the plungers 16 move outwardly towards the discs 24 under the influence of the spring 18, I provide a valve comprising the leather disc 26 and the metal follower disc 27 for closing ports 25. These discs are centrally apertured and slidably mounted upon the screw 28 which projects inwardly from the disc 24. Each screw 28 is provided with a central bore 29 for permitting the gradual escape of air from the cylinder during the outward stroke of the adjacent plunger 16. The rate at which the air escapes from each end of the cylinder can be controlled by a needle valve 30.

The cylinder 10, the iron cylinder 22, the rings 23 and the ends 24 of the cylinder are held in assembled relation by means of the annular caps 31 which are provided with inwardly extending flanges 32 for clamping the discs 24 to the ends of the cylinder 10. The caps 31 are secured to the cylinder 22 by means of screws 33 which pass through the outer edges of the rings 23. One side of the cylinder 22 and the rings 23 and the flanges of the caps 31 is flattened to permit it to be more readily attached to the sash 34 of the windshield by means of screws 35 (see Figure 6). The ends of the shaft 13 project outwardly through suitable bearings formed in the ring 22 and the end 13′ which projects through the sash has a collar 36 slidably mounted thereon and retained in place by means of the pin 37 which is secured to the outer end of the shaft 13 and which operates in the slot 38 formed in the collar 36 and inclined to the axis of the shaft 13, as shown in Figure 2.

The cleaner arm 39 is secured to the collar 36 and carries at its outer end the usual squeegee formed of the channel-shaped metal strip 40 and the rubber strip 41. A pin 42 projects outwardly from the cleaner arm 39, and is engaged by one end of the leaf spring 43, the opposite end of this spring being secured in a slot formed in the outer end of the shaft 13. One side of the collar 36 is cut away, as shown at 44, to permit movement of the spring 43 relatively to the collar 36.

For the purpose of controlling the supply of current to the solenoids, I provide a switch which comprises a metal base plate 45, one end of which is provided with an opening 46 through which the shaft 13 projects, and the other end of which carries a contact 47 which is secured to the base 45 by means of the screw 48, the contact 47 being insulated from the base and the screw by suitable insulation 49 and 50. A lug extends outwardly from the base 45 and is bent over in substantial parallelism therewith to form the bearing 51 in which, and an aligned bearing in the base 45, is mounted the metal lever 52, one end of which contacts with the shaft 13 and the other end of which is adapted to engage contact 47. The lever 52 is bifurcated throughout a portion of its length, the portion 52^1, which engages the contact 47, forming one of the bifurcations, and the portion 52^2, which is journaled in the bearing 51, forming the other bifurcation. A second lug projects outwardly from the base 45, and is turned inwardly to form the abutment 53 for one end of the tension spring 54. The other end of this spring is connected with the lever 52 at a point 55 on the opposite side of the pivot point of the lever. The mechanism just described comprises one form of a well-known type of snap switch, and the shaft 13 is cut away at the point where the one end of the lever 52 engages it to provide the two annularly spaced edges 56 and 57 which are adapted to alternately engage the adjacent end of the lever 52 and cause it to alternately move to the open and closed positions of the switch.

Having thus described the first embodiment of my invention, I shall now describe its mode of operation. The two solenoids 20, as stated above, are to be so connected with the source of current that they will produce a magnetic field tending to cause the plungers 16 to approach each other, these plungers being made of magnetic material, such as soft cast iron, which does not tend to become permanently magnetized. For this purpose, the two solenoids 20 may be connected either in parallel or in series. One end of the solenoids 20 can then be connected with a suitable source of current, such as the storage batteries carried by an auto vehicle, and the other end can be grounded upon the metal base 45 of the switch mechanism. If then the contact 47 is connected with a suitable source of current, as, for instance, by means of the conductor 60, current will pass through the solenoid 20 when the lever 52 engages the contact 47, the current passing from the base up through the lug 51 and from thence through the lever 52 to the contact 47. This will cause the solenoid 20 to be energized, whereupon the plungers 16 will move towards each other and the springs 18 will be

compressed. At the same time, the shaft 13 will be rotated in a counter-clockwise direction (Figure 1) by the pinion 14 and the racks 17. Upon the initial movement of the shaft 13 in the counter-clockwise direction, the pin 37, bearing on the outer side of the slot 38, will cause the collar 36 to move outwardly upon the shaft. This will result in the cleaner arm 39 and the cleaner member 40 being moved away from the windshield so that when the pin 37 engages the inner end of the slot (see Figure 2), the cleaner member will be practically out of contact with the windshield, or, at least, will be resting upon it so lightly that it will offer practically no resistance to rotation. When the pin 37 engages the inner end of the slot 38 and continues to rotate in a counter-clockwise direction, it will carry the arm 39 and the cleaner member with it to the limit of its stroke in the opposite direction. Since, during this stroke, the cleaner member is practically out of engagement with the windshield, the solenoids 20 need but little more energy than that required to compress the springs 18.

Just before the cleaner arm 39 completes the non-working stroke described above, the edge 56, formed on the shaft 13, will have engaged the adjacent end of the lever 52 and caused it to rotate to a position to destroy its engagement with the contact 47, thereby opening the circuit of the solenoids and de-energizing the same. Upon the de-energization of the solenoids, the springs 18 will start to expand and return the plunger toward the outer ends of the cylinder 10. This movement will, however, quickly be checked by the compression of the air in the spaces between the plungers and the adjacent ends of the cylinder. It will, of course, be understood that this compression is caused by the closing of the ports 25 by the valves 26 at the first outward movement of the plungers 16, thus confining the air in the ends of the chambers. The bores 29 in the screws 28 will, however, afford a restricted outlet for the air compressed in the cylinder ends, thus permitting the plungers 16 to move slowly outwardly under the tension of the springs. As the plungers 16 move outwardly, the racks 17 secured thereto will cause the pinion 14, and, consequently, the shaft 13, to rotate in a direction opposite to this previous rotation. Upon the initial rotation in the opposite direction, the pin 37 will be moved to the outer end of the slot 38, thus forcing the collar 36 inwardly. The collar 36 will carry with it the cleaner arm 39 and the cleaner member 40, so that the latter will now have cleaning contact with the windshield. Continued rotation of the shaft 13, by reason of the pin 37 engaged in the end of the slot 38, will cause the cleaner arm 39 to rotate to the limit of its movement in the opposite direction. Since, during this stroke, the cleaner member is in contact with the windshield, it will clean the same. This is, therefore, the working stroke of the cleaner. Just before the working stroke is completed, the edge 57, formed on the shaft 13, will engage the end of the lever 52 and cause this lever to move to its closed position, whereupon the coils will again be energized and the non-working stroke previously described will again be repeated.

During the initial portion of the working stroke, when the pin 37 is moving from one end of the slot 38 to the other, the spring 43 will assist the pin in moving the cleaner member into cleaning contact with the windshield.

The pin and slot connection between the shaft 13 and the collar 36, not only provides means for bringing the cleaner member into and out of contact with the windshield, but it also performs another function. While the plungers 16 are making the initial portion of their outward movements, the air in the cylinder ends will not be compressed to any considerable extent, and if there was a rigid connection between the plungers 16 and the cleaner arm, the latter would be started in an abrupt, jerky manner. By providing the pin and slot connection, the driving connection between the plungers 16 and the cleaner arm is delayed until the air in the cylinder ends has been somewhat compressed and the movement of the plungers retarded. In this manner, I provide means for preventing abrupt initial movement of the cleaner arm.

The rate at which the plungers 16 move toward the outer ends of the cylinder 10, and, consequently, the number of strokes per minute of the cleaner arm, can be regulated to a very considerable extent by adjusting the needle valves 30 to permit a more or less rapid escape of air from the ends of the cylinders.

If the direction of inclination of the slot 38 be reversed, then the cleaner member will be moved into contact with the windshield upon the inward movement of the plunger 16, and, if the spring 18 then be made simply strong enough to return the cleaner member to its initial position while out of cleaning contact with the windshield, then the solenoids 20 will have to be made sufficiently large to move the cleaner member through its cleaning stroke and to compress the spring 18 at the same time. With the first arrangement of my invention, described above, there is a quick non-cleaning stroke and a slow cleaning stroke; with the second mentioned arrangement there is a quick cleaning stroke and a comparatively slow non-cleaning stroke. Either embodiment of my invention is contemplated in this appli-

cation, although I prefer the former, as it does not require quite as large solenoids.

The embodiment of my invention shown in Figures 7, 8 and 9 operates upon substantially the same principle as that disclosed above. In this embodiment, I make use of a single plunger 16 and a single spring 18, which spring is confined between the plunger 16 and the end closure 70 which is secured to one end of the iron cylinder 22 by means of screws 33 and replaces one of the caps 31 of my previous embodiment. The shaft 13 of this embodiment is journaled in the closure 70 and carries a pinion 14 which co-acts with the rack 17 carried by the plunger 16. The connection of the cleaner arm 39 with the shaft 13 is just the same as in my previously described embodiment, and need not be described in detail.

In this construction, the current to the solenoid 20 is controlled by a switch mechanism comprising the lever 71, which is pivotally supported upon the pin 71′ projecting from the closure 70, and is held in either one of its extreme positions by the spring 72. The outer end of the lever 71 is provided with two spring contacts 73 and 74, one of which contacts with the insulated binding post 75 and the other with the grounded binding post 76, so that, when the two contacts 73 and 74 engage the binding posts 75 and 76, they will bridge a gap in the circuit of the solenoid 20 and cause the same to be energized. The lever 71 is alternately actuated by the pins 77 and 78 projecting from the inner end of the shaft 13.

In both embodiments of my invention, I make use of a pivoted lever 79, the flattened free end of which engages the sides of slot 80 formed in the ends of the shaft 13, to lock the mechanism against movement when the plungers 16 have reached almost the limit of their outward movement, at which time the switch is open and the solenoids de-energized. This will mean that the spring 18 will be locked under slight tension, but the tension will not be sufficient to permanently deform the spring.

The modification shown in Figures 7, 8 and 9 can operate in either of the two methods described in connection with the embodiment first described,—that is, the spring 18 can be compressed either during the working or the non-working stroke, but I prefer to have this spring compressed during the non-working stroke, as this requires a smaller solenoid 20.

While I have described the details of the preferred embodiment of my invention, it is to be clearly understood that my invention is not limited to these details, and it is to be particularly understood that my invention, in its broad sense, is not limited to a construction in which electricity is used for compressing the spring or any other equivalent compressible and expansible element, such, for instance, as gas, since my invention contemplates broadly any means for compressing a compressible element and then using this expansion for operating a windshield cleaner through one of its strokes, and more particularly, a construction in which the compressible element is compressed while the cleaner member is on its return or non-cleaning or non-working stroke.

Having thus described my invention, what I claim is:

1. A windshield cleaner motor comprising a rock shaft, an electro-magnetically operated plunger for actuating said rock shaft, an air chamber into which air is drawn and from which air is exhausted by the reciprocations of the plunger, and means for varying the rate of escape of air from said chamber for controlling the speed of operation of said plunger.

2. A windshield cleaner motor comprising a rock shaft, an electro-magnetically operated plunger for actuating said rock shaft, an air chamber into which air is drawn and from which air is exhausted by the reciprocations of the plunger, means permitting relatively unobstructed admission of air to said chamber during movement of the plunger in one direction and regulable restricted means through which air escapes from said chamber during reverse movement of the plunger.

3. A windshield cleaner motor comprising a rock shaft, opposed plungers for actuating said shaft by their simultaneous movements in opposite directions, electro-magnetic means for moving said plungers toward each other, spring means for moving them apart, chambers from which said plungers are adapted to displace air as they move apart, and regulable means for controlling the escape of air from said chambers.

4. A motor construction comprising a cylinder, a solenoid surrounding a portion thereof, a closure disc seating on one end of the cylinder, valve means providing for a quick admission of air through the disc into the cylinder and a retarded controllable exit therefrom, a housing inclosing the solenoid, and from which said end of the cylinder projects, a cap inclosing the projecting end of the cylinder and overhanging said disc to secure the same on its seat, a core-like plunger slidably fitting in the cylinder and movable in one direction therein upon passing a current through said solenoid, means for returning said plunger in the opposite direction, and power transmission means operable by said plunger.

5. A motor construction comprising a cylinder, a solenoid surrounding a portion

thereof, a closure disc seating on one end of the cylinder, valve means providing for a quick admission of air through the disc into the cylinder and a retarded controllable exit therefrom, a housing inclosing the solenoid, and from which said end of the cylinder projects, a cap inclosing the projecting end of the cylinder and overhanging said disc to secure the same on its seat, a core-like plunger slidably fitting in the cylinder and movable in one direction therein upon passing a current through said solenoid, means for returning said plunger in the opposite direction, a shaft operable by the plunger, and a switch operable by said shaft for intermittently interrupting the passage of current through said solenoid.

6. In a windshield cleaner motor, a cylinder, a core-like plunger having a sliding fit therein, valve means permitting a rapid intake of air into one end of the cylinder and providing a controlled exhaust of air therefrom whereby the plunger will be cushioned in its movement toward said end of the cylinder, a solenoid surrounding a portion of the cylinder for attracting the plunger from said end of the cylinder, power transmission means operable by said plunger and resilient means for returning said plunger toward said end of the cylinder.

7. In a windshield cleaner motor, a cylinder, solenoid means surrounding the same with the opposite ends of the cylinder projecting therefrom, a core-like plunger in each end of the cylinder, a power shaft interposed between the plungers and journaled in the cylinder, an operative connection between each plunger and the shaft whereby when the plungers are moved within the cylinder the shaft is rotated, said solenoid means attracting said plungers from the ends of the cylinder, and resilient means interposed between said plungers for urging the same back into the ends of the cylinder.

8. In a windshield cleaner motor, a cylinder, solenoid means surrounding the same with the opposite ends of the cylinder projecting therefrom, a core-like plunger in each end of the cylinder, a power shaft interposed between the plungers and journaled in the cylinder, an operative connection between each plunger and the shaft whereby when the plungers are moved within the cylinder the shaft is rotated, said solenoid means attracting said plungers from the ends of the cylinder, spring means interposed between said plungers for returning them to the ends of the cylinders, and controllable means for governing the speed of movement of said plungers in one direction of travel.

In witness whereof, I hereunto subscribe my name this 23 day of December, 1921.

EARL F. PIERCE.