Oct. 3, 1950 A. RAPPL 2,524,271

PISTON OPERATED LOCKING MEANS FOR SERVOMOTORS

Original Filed Aug. 13, 1942 2 Sheets-Sheet 1

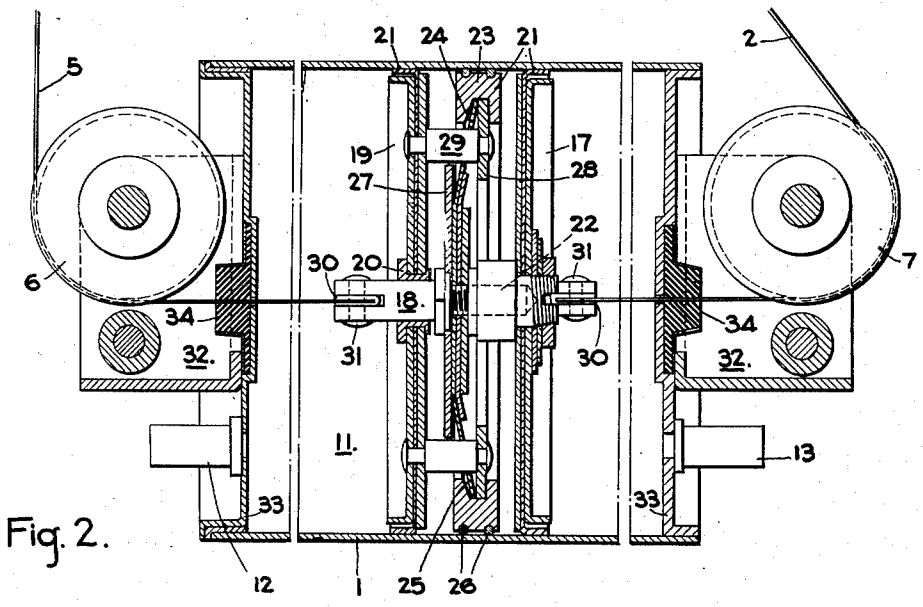



Fig. 2.

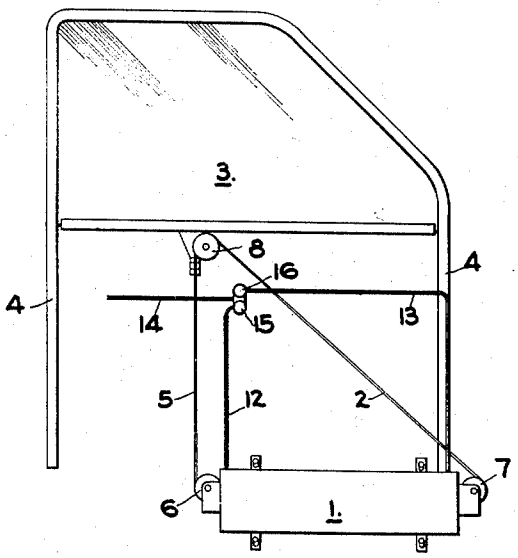



Fig. 1.

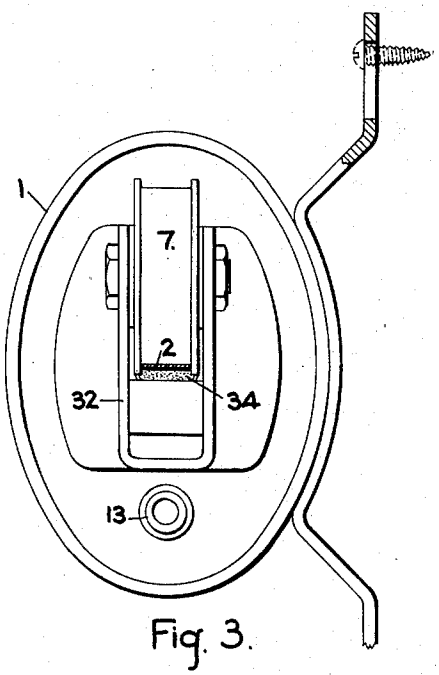



Fig. 3.

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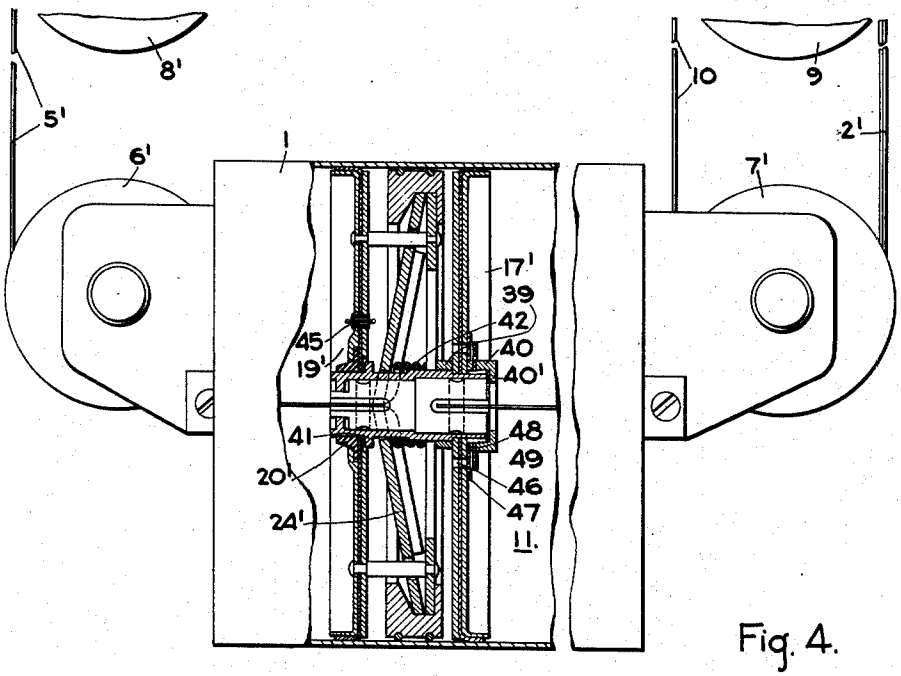



Fig. 4.

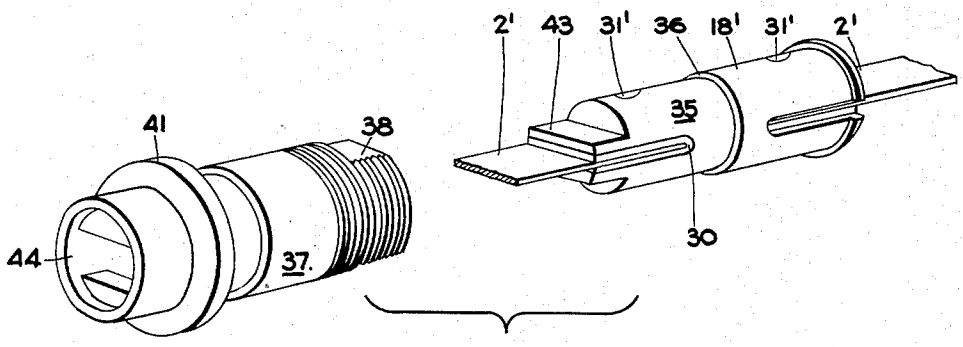



Fig. 5.

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2,524,271

## PISTON OPERATED LOCKING MEANS FOR SERVOMOTORS

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Original application August 13, 1942, Serial No. 454,634, now Patent No. 2,432,799, dated December 16, 1947. Divided and this application January 13, 1945, Serial No. 572,679

7 Claims. (Cl. 121—40)

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This invention relates to the fluid motor art and is a division of my copending application Serial No. 454,634, now Patent No. 2,432,799, granted December 16, 1947.

It has heretofore been proposed to provide a self-locking fluid motor embodying a piston assembly having relatively movable parts so related to a locking device as to actuate the latter by an extraneous force and thereby secure the motor arrested.

An object of the present invention is to provide a practical fluid motor of this type which embodies a flexibility of construction and compactness designed to facilitate its installation in confined quarters.

Further, the invention has for its object to provide a self-locking fluid motor embodying an endless flexible power transmission acting in tension throughout with the motor and lock parts arranged in a practical manner to insure long life and durability to the power unit for the greatest efficiency.

In the drawings:

Fig. 1 is a diagrammatic view showing a practical application of the improved motor.

Fig. 2 is a longitudinal sectional view through the motor with a portion of the flexible power transmitting member being broken away;

Fig. 3 is an end elevation of the motor with portions in section;

Fig. 4 is a view similar to Fig. 2, but showing another physical embodiment of the invention; and

Fig. 5 is an exploded perspective of the piston rod connecting means.

Referring more particularly to the drawings, the numeral 1 designates the motor part of a power unit and 2 the flexible portion of an endless power transmission to which the load 3 is connected. By way of illustration the load is shown as a window slidable vertically in guideways 4. In Fig. 1, the endless power transmitting member is suitably supported by pulleys 6, 7 and 8 to provide the single active flight 5 whereas in Fig. 4, and in my parent application, four supporting pulleys 6', 7', 8' and 9 provide two active flights 5' and 10.

Between the lower pulleys 6 and 7 may be arranged the motor part herein shown as a fluid motor having a chamber and a piston. The opposite ends of the motor chamber 11 are connected by conduits 12 and 13 to a pressure supply line 14 which may be connected to the intake manifold of the vehicle engine as a source of power. Of course, superatmospheric pressure

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may be used but suction is preferred, and in the illustrated embodiment the source of suction is in constant communication with the chamber at both sides of the piston to thereby balance the latter. When it is desired to operate the motor either valve 15 or 16 will be operated to interrupt the suction communication and vent the corresponding side of the motor chamber to the atmosphere, thereby creating an unbalanced condition and providing a pressure differential for moving the piston toward the low pressure side. This causes the flexible transmission to pull in one direction or the other to raise or lower the load 3.

In the embodiment shown in Fig. 2, the piston assembly is illustrated as having a section 17 anchored to a stem or link 18 and a floating section 19 which is slidable in a fluid tight manner on the link by means of a sleeve 20. Each section is provided with a packing 21 adapting the same for fluid actuation in one direction and that being opposite to the fluid pressure imparted movement of the companion section. The link 18 is inserted in and forms a part of the endless power transmitting member so that a movement of the latter by a force originating in the window will slide the link relative to the floating piston 19 which in turn is held stationary by reason of the packing imposed drag. The link, which constitutes a connector between spaced flexible portions of the endless transmission may comprise separable parts threadedly connected as at 22 for ease of assembly, and while the connector passes continuously through the piston it nevertheless serves to connect the flexible member to the opposite sides of the piston assembly.

A lock is provided to secure the piston unit against movement, this lock being designed for actuation by a load imparted force. According to the illustration the lock is interposed between the pistons 17 and 19 and is of the expansible and contractible clutch type having one or more shoes 23 supported on a resilient toggle-like structure. The toggle arms 24 may be shaped from a spring plate and engaged at their free ends in seats 25 in the back faces of the shoes where they are retained by encircling rings 26. These rings may be formed of fine coiled spring wire or, as shown, of a heavier spring wire split to permit expansion and contraction of the shoes and may actually constitute the active faces of the shoes. The spring plate, of which the arms constitute radial extensions, is rigidly connected to the piston link 18 along with a suitable backing plate 27, as by being conveniently clamped between the sep-

arable parts of the link. Also engaged in the seats 25 is a coupling plate 26 which is rigidly connected to the floating piston by spacers 29. By this construction the fluid pressure actuation of the floating piston will move the lock shoes toward the fixed piston 17 initially to thereby bend or deflect the toggle arms and allow the shoes to contract from effective engagement with the chamber wall under the influence of the spring retaining rings 26. However, any attempt to lower the load from without will be frustrated by an imparted movement of the link relative to the floating piston (to the right in Fig. 2) which will cause the toggle arms to expand the shoes into firm locking contact with a fixed part of the chamber. The opposite ends of the flexible transmission member may be reinforced by end caps 30 and anchored in slots in the opposite ends of the link by fasteners 32.

The pulleys 6 and 7 may be journaled in brackets 32 fixed to the end walls 33 of the motor chamber. The flexible piston rod which forms the endless transmission may be a band or ribbon, the same emerging from the motor chamber through a slit in each end gasket 34. In having the flexible member of ribbon-like form the fluid tight sealing of each end of the motor chamber is facilitated by reason of the fact that the ribbon design actually presents two flat surfaces joined by extremely narrow edges. Consequently, the gasket opening need only be in the form of a slit, the opposing sides of which engage the flat surfaces of the flexible band to effectively seal the opening against air leakage, while the ends of the slits hug the narrow edges in like manner.

In Figs. 4 and 5 another embodiment of the invention is illustrated. The opposite ends of the flexible piston rod 2' are joined by a connector link 18', the reinforcing end caps 30 being secured in slots in the ends thereof as by removable pins 31'. The link insert shown in these views is in the form of a cylindrical body having a reduced end portion 35 providing a shoulder 36, the link being removably fitted within a piston carrying sleeve 37 fixed to the piston 17'. The sleeve which also holds the pins in place has a peripheral flat formation 38 received within a like shaped opening in such piston and the two are fixed in this definite relationship by a pair of clamp nuts 39 and 40. The link shoulder 36 engages an internal shoulder in the sleeve where it is secured by a flange 40' of the nut 40 which overhangs the adjacent end of the link.

The floating piston 19' has limited sliding movement on the opposite end portion of the sleeve, the packing gland 20' serving to seal this sliding fit. A flange 41 limits the fluid driven movement of the floating piston on the sleeve during which relative motion the lock shoes at the outer ends of the toggle arms 24' are released in a manner similar to that in the embodiment of Fig. 2. The toggle arms 24' are rigid and have pivotal bearing upon each other and against the back of flange 41 where they are held by a light coil spring 42 that tends to urge the shoes lightly against the chamber walls ready for an immediate response to a load imparted movement. A flat 43 on the link engages in a slot 44 in the sleeve to resist relative turning of the parts.

In this embodiment the pressure in the space between the piston sections is normally equalized with that in the opposite ends of the motor



chamber 11 through small bleed ports 45 and 46. Where the port capacity is large a check valve 47 may be provided to close the same for motor operation. This check valve is in the form of a ring plate freely movable on a spacer washer 48 as limited by the retainer 49, the retainer and spacer being conveniently held in place along with the piston 17' by the clamp nuts 39 and 40.

From the foregoing it will be noted that the endless flexible transmission member, made up of interconnected parts 2 and 18 (18'), extends through the motor chamber and slidably supports the piston 19 (19'). The endless power transmitting member, therefore, is slidable through the piston for limited relative movement by a force originating in the window to actuate the lock and thereby secure the window against unauthorized movement. On the other hand the slidably mounted piston is responsive to the fluid pressure during motor operation for initially rendering the lock inoperative and thereafter engaging a shoulder on the link to move the flexible power transmitting member in accomplishing its intended purpose. The endless power transmitting unit always acts in tension, pulling the window up and down or pulling upon the lock mechanism to lock and unlock the window. The pulleys 6 and 7 arranged at the opposite ends of the chamber support the flexible piston rod in tension as it extends through the motor chamber to thereby prevent its buckling whether the motor is operative or is arrested. The endless power transmitting member is movable as a unit with respect to the floating piston section and is readily attached to and detached from the same for making adjustment and repair. The power unit, including the motor and its endless power transmitting element, is designed for various uses and especially where the load is supported normally by the endless transmission.

While the foregoing description has been given for clearness of disclosure, it is not intended thereby to limit the inventive principles involved which may be incorporated in other physical embodiments without departing from the spirit and scope of the invention claimed.

What is claimed is:

1. A fluid motor having a flexible power transmitting member, pulley means supporting the same, a chamber and a piston operable therein, said piston comprising a fluid sealed section having an axially extending sleeve, a second fluid sealed section mounted on the sleeve for limited movement, motor locking means operable upon a predetermined relative movement between the sections, and means removably engageable in the sleeve for connecting the flexible member to the first piston section in such manner that member imparted movement of the first section will actuate the locking means.

2. A fluid motor having a flexible power transmitting member, pulley means supporting the same, a chamber and a piston operable therein, said piston comprising a fluid sealed section having an axially extending sleeve, a second fluid sealed section mounted on the sleeve for limited movement, motor locking means operable upon a predetermined relative movement between the sections, a link disposed in the sleeve and connecting the spaced portions of the flexible member at opposite sides of the piston for completing an endless flexible member, and means removably connecting the link to the sleeve, whereby movement of the flexible member imparted thereto

from without the motor will effect such predetermined relative movement between the sections.

3. A fluid motor having a chamber and spaced members individually operable therein by fluid pressure, one member operable in one direction and the companion member operable in the opposite direction, a power transmission element connected to said one member, means connecting the two members for limited relative movement and enabling said transmission element being operated by said companion member, a pair of lock shoes interposed between said spaced members and movably supported on said companion member, said one member having a part extending into such space and between said shoes, said part and said shoes having opposed seats, and toggle bars interposed between said part and said shoes and pivotally engaged in said seats for expanding the shoes to an operative position when said one member is moved by an external force and acting by and during relative movement between the two members under fluid pressure to dispose the shoes inoperative, the inner ends of the toggle bars being separable from each other and rocking upon each other when expanding the shoes.

4. A fluid motor having a chamber, a piston therein comprising a pair of relatively movable sections each fluid operable but in a direction opposite to the companion section, a power transmission constituting in effect an endless flexible unit supported to provide an exteriorly disposed load actuating part and an interiorly disposed part, the latter supported in the opposite end wall portions of the chamber and including a relatively rigid link extending through both piston sections in a fluid sealed manner and affording relative positional support therebetween, one of said sections being supported by said interiorly disposed part for limited independent movement whereby said endless unit may be pulled in one direction or the other to such limited extent, and piston locking means operable by such independent movement of the endless unit in one direction, said rigid link having a detachable part on which the other piston section is fixed.

5. A fluid motor having a chamber, a piston therein comprising a pair of relatively movable sections each fluid operable but in a direction opposite to the companion section, a power transmission constituting in effect an endless flexible unit supported to provide an exteriorly disposed load actuating part and an interior disposed part, the latter supported in the opposite end wall portions of the chamber and extending through both piston sections in a fluid sealed manner, one of said sections being supported by said interiorly disposed part for limited independent movement whereby said endless unit may be pulled in one direction or the other to such limited extent, and piston locking means operable by such independent movement of the endless unit in one direction, such interiorly disposed part embodying a rigid insert having a sleeve fixedly carrying the other piston section and slidably supporting said one piston section, with a detachable unit connector removably engaged in the sleeve,



6. A fluid motor having a chamber, a piston therein comprising a pair of relatively movable sections each fluid operable but in a direction opposite to the companion section, a power transmission constituting in effect an endless flexible unit supported to provide an exteriorly disposed load actuating part and an interiorly disposed part, the latter supported in the opposite end wall portions of the chamber and extending through both piston sections in a fluid sealed manner, one of said sections being supported by said interiorly disposed part for limited independent movement whereby said endless unit may be pulled in one direction or the other to such limited extent, and piston locking means operable by such independent movement of the endless unit in one direction, such interiorly disposed part embodying a rigid insert having a seat in each end in which opposed flexible portions of the endless unit detachably engage.

7. A fluid motor having a chamber, a piston therein comprising a pair of relatively movable sections each fluid operable but in a direction opposite to the companion section, a power transmission constituting in effect an endless flexible unit supported to provide an exteriorly disposed load actuating part and an interiorly disposed part, the latter supported in the opposite end wall portions of the chamber and extending through both piston sections in a fluid sealed manner, one of said sections being supported by said interiorly disposed part for limited independent movement whereby said endless unit may be pulled in one direction or the other to such limited extent, and piston locking means operable by such independent movement of the endless unit in one direction, such interiorly disposed part embodying a rigid insert having a seat in each end in which opposed flexible portions of the endless unit engage, pins removably securing the flexible portions in their seats, and a piston supporting sleeve fitting over the insert and acting to hold the pins in place.

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