

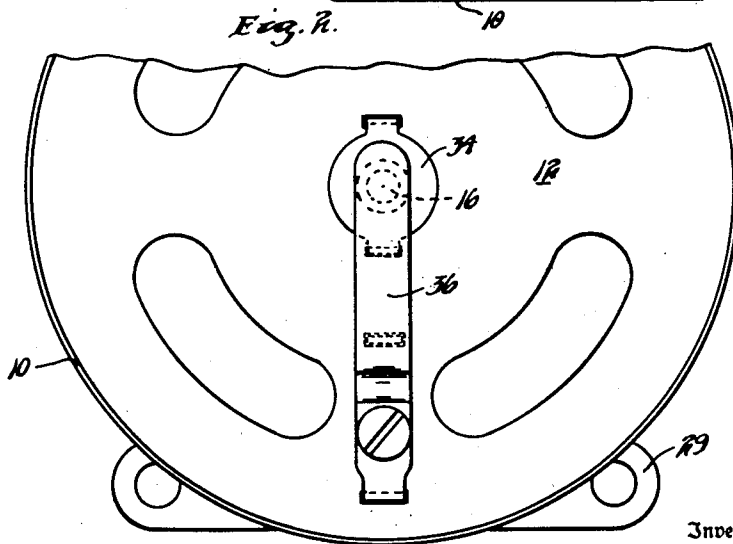
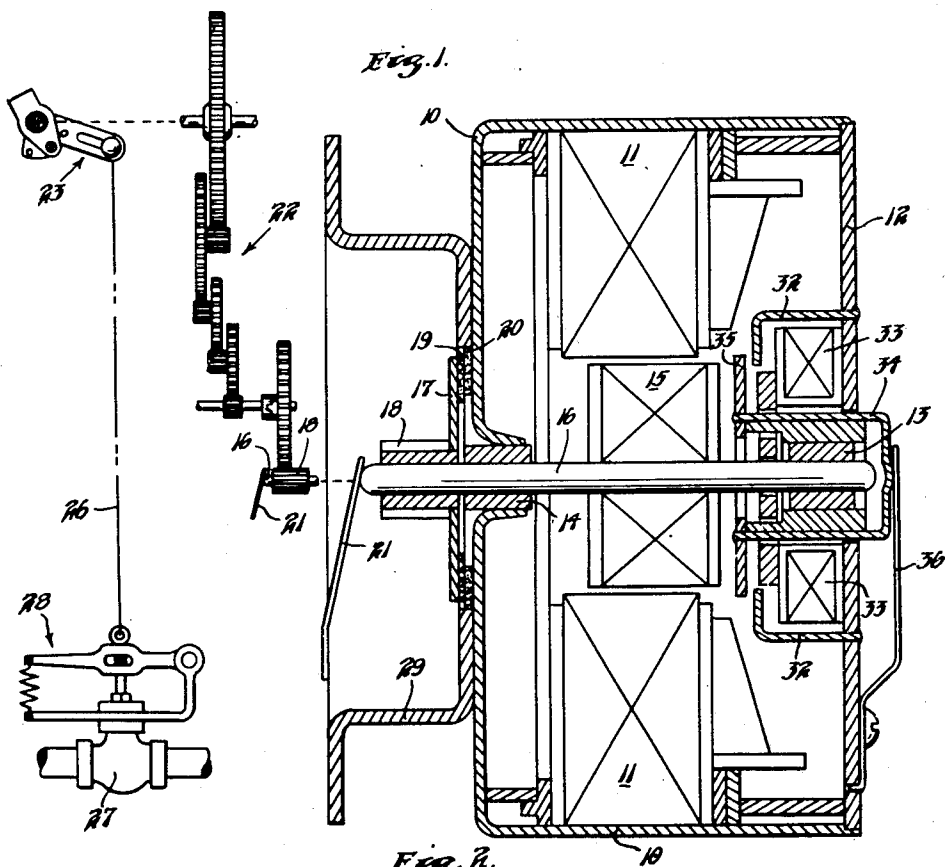
July 20, 1948.

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2,445,658

MOTOR AND BRAKE CONSTRUCTION

Filed Dec. 24, 1943



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2,445,658

MOTOR AND BRAKE CONSTRUCTION

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Application December 24, 1943, Serial No. 515,488

9 Claims. (Cl. 318—366)

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This invention relates to an improved fail safe motor construction wherein means are provided for returning a motor and mechanism operated thereby to a safe position in the event of power failure for any reason. The improved device of this invention is especially adapted to be used in conjunction with various kinds of controls including valves, dampers and the like, but is by no means limited to such employment.

In the field of controlled apparatus, especially valves for controlling the flow of fuel, it is essential that positive acting means be provided for promptly moving the valve to a safe position in the event of power failure. This is especially true in devices employing brake or stop means which may lock in applied position. Additionally, apparatus of this kind must be relatively small and inconspicuous and also be controlled by delicate and sensitive control equipment. Consequently fail safe devices to be successful must in no way impede the normal function or noticeably increase the size of the apparatus with which it is associated.

In previous constructions the reluctance or inability of the brake or stop means to free itself or be freed by normal biasing means is occasioned by the angular strains set up between the pinion or worm and gear. This strain prevents longitudinal movement of the worm or pinion by normal biasing means and thus also prevents the freeing of the holding means. Increasing the tension of the biasing means by increasing its size results in a large structure which functions erratically and is also difficult to control.

Accordingly, one of the principal objects of advantage and importance of the improved device of this invention is the provision of means for providing a positive acting fail safe feature which is extremely compact and which will not interfere with the normal running or stopping operating function of the device.

Another object of advantage and importance is the provision of means for imparting a hammer action to release the holding means upon the occasion of power failure.

A still further object of advantage and importance resides in the provision of means for overcoming the normal brake biasing means. Thus in the event of power failure the improved device is immediately moved to and maintained in free running position, whereby the object operated thereby may be returned to its safe position.

Additional objects of advantage and importance will become apparent as the following detailed description progresses, reference being had to the accompanying drawing wherein

Figure 1 is a vertical section of a motor, which embodies the invention, together with a sche-

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matic showing of a gear train and valve operated thereby.

Figure 2 is an end elevation of the motor, parts thereof being broken away.

Referring to the drawing, the reference numeral 10 indicates generally a motor housing which may be of any suitable shape or material. Positioned within the housing 10 is a stator 11. Positioned within the housing 10 closely adjacent one end thereof is a wall 12. The wall 12 is spaced from the closed end of the housing 10 as is best shown in Figure 1 and has positioned therein a bushing 13. A similar bushing 14 is positioned in the closed end of the housing 10 in alignment with bushing 13. A rotor 15 secured to a shaft 16 is rotatively journaled in the bushings 13 and 14.

The shaft 16 which extends beyond the bushing 14, as is best shown in Figure 1 carries a disc 17 and a pinion 18. The disc 17 is provided with a friction surface 19 which is adapted to move into and out of an engagement with a friction surface 20 positioned on the housing 10. A biasing spring 21 engageable with the end of the shaft 16 normally urges the shaft to the right, as shown in the drawing, thus moving the friction surfaces 19 and 20 into engagement with each other. It is to be noted that this movement of the shaft 16 moves the rotor 15 out of alignment with the stator 11. This movement is possible only when the stator is deenergized. Upon energization of the stator 11 the rotor 15 together with the shaft 16 is moved to the left, as shown in the drawing, until the rotor is in alignment with the stator. This movement which is against the urge of the biasing spring 21 separates the friction surfaces 19 and 20 thus releasing the brake. From the foregoing it will be apparent that energization of the motor releases the brake and deenergization of the motor permits the biasing spring 21 to function to apply the brake.

The pinion 18 is adapted to be associated with a gear train 22 which in turn is operably associated with an operating arm 23. Operably associated with arm 23 through any suitable linkage means 26 is a control valve 27. The control valve 27 is biased to safe position. In the illustrated embodiment of the invention the biasing means is shown as a spring 28, however it will be obvious that any other suitable biasing means may be employed for this purpose. It is understood, however, that the biasing means is capable of moving the operating arm 23, the gear train 22, the shaft 16 and the rotor 15 in a reverse direction when the friction surfaces 19 and 20 are disengaged and the motor is deenergized.

Secured to the housing 10 by any suitable means is a supporting bracket 29. The support-

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ing bracket 29 provides a cover for the projecting end of the shaft 16, the pinion 18 and a portion of the gear train 22.

Secured to the wall 12 is a substantially cup-shaped casing 32 in which an electromagnet element 33 is housed. The electromagnet element 33 and the casing 32 are preferably concentric in relation to the shaft 16. Extending through the wall 12, the electromagnet element 33 and casing 32, as is best shown in Figure 1, is a substantially U-shaped armature supporting member 34. An armature 35 is carried by the open ends of the U-shaped member 34. In Figure 1 of the drawing the electromagnet is shown in energized relation with the armature 35. It is to be noted that when the armature 35 is in energized position the closed end of the U-shaped member 34 and the adjacent end of the shaft 16 are in spaced relation to each other. It will therefore be apparent that when the armature 35 is released and permitted to move to the left, as shown in the drawing, considerable momentum is obtained before the closed end of the U-shaped member 34 impacts upon the end of the shaft 16. This impact provides a hammer action which is positive in its function of separating the friction elements 19 and 20. The electromagnet element 33 may be connected to a source of power, not shown, either directly or through a suitable control device or devices.

Secured to the wall 12 and having an end portion thereof in engagement with the closed end of the U-shaped member 34 is an off-set biasing spring 36. The biasing spring 36 is considerably stronger than the biasing spring 21 and when unopposed by energization of the electromagnet easily overcomes the biasing spring 21. Thus under the influence of the spring 36, the shaft, rotor, pinion, disc and friction surface 19, may be moved to and maintained in an extreme position to the left of the location in which they are shown in the drawing.

It will be apparent from the foregoing that the motor may operate to start and stop entirely independently of the fail safe means and conversely the fail safe means operates independently of the normal functioning of the motor. Thus at any point in its normal operation a power failure effects the prompt release or disengagement of the motor permitting the biasing means to return it to safe position.

Operation

The operation of the improved device of this invention is as follows: In the position shown in Fig. 1 of the drawing the electromagnet member is energized. The armature 35 thereof being in energized position has through the yoke or U-shaped member 34 forced the heavy spring 36 to its extreme right-hand position. With the armature 35 and spring 36 in this position, the shaft 16 and its associated parts, except for the biasing spring 21, are free to move longitudinally in the bearings 13 and 14. As shown, the motor is deenergized; thus the biasing spring 21 functions to move the shaft 16 displacing the rotor 15 from its running position and bringing the friction surface 19 of the disc 17 into engagement with the friction surface 20. Rotational movement of the shaft and associated parts in either direction is prevented. The operating arm 23 is in lowered position. The valve 27 is in closed position and the spring member 28 is contracted. Upon a call for action, which in this case must be in opening direction for the valve 27, the motor is energized. Energization of the motor moves

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the rotor thereof both longitudinally and rotationally to separate the friction surfaces 19 and 20 and overcome the biasing spring 21. Through the rotational movement of the rotor the pinion 18 operates the gear train and associated operating arm 23 to move the valve to the desired open position. Upon the valve reaching the desired position, current to the motor may be discontinued in any of the manners well known in the art. The stored up energy in the biasing spring 21 promptly moves the shaft 16 longitudinally to the right. This movement brings the friction surfaces 19 and 20 into engagement to arrest further rotational movement of the disc 17 or the rotor 15 as well as reverse movements thereof. The motor structure is again in the position shown in Figure 1. From this position the rotor may be operated in either direction to raise or lower the valve.

Assume, however, that with the valve is open position there is a power failure. Such a power failure will immediately release the armature 35 and by reason of the bias of the spring 36 the armature 35 and the U-shaped member 34 would be snapped to the left impacting upon the end of the shaft 16 to overcome the biasing spring 21, thus releasing the engaged friction surfaces 19 and 20, whereupon the spring member 28 through the linkage means 26 and operating arm 23, would rotate the gear train 22 and the shaft 16 in a reverse direction to close the valve 27.

Now assume that a power failure occurred during a time when the motor was energized and the valve 27 was being raised or lowered. The deenergization of the motor through power failure would release the rotor from alignment with the stator and would tend to permit its being controlled by the biasing spring 21. However, inasmuch as the electromagnet is deenergized concurrently with the motor the spring 36 assumes control of the positioning of the rotor and so long as the power remains off maintains the rotor in a free position. Thus the spring member 28 closes the valve by rotating the gear train and rotor in a reverse direction. It will therefore be apparent that the motor may operate independently to open or close the valve or to hold the valve in any desired position. But immediately upon the occasion of power failure the brake releasing means and the motor cooperate to provide means whereby the valve may be returned to its safe position.

When used in conjunction with various types of control devices, the motor of the improved device of this invention is preferably energized and operated through a thermostat or other control apparatus, not shown, and the electromagnet element is connected across the line to operate independently of the motor. The improved construction is adapted to function equally well when incorporated in either reversible or single direction motors.

It will be apparent from the foregoing that herein is provided an improved construction wherein a motor and brake combination thereof may be utilized to raise, lower or hold a load at any point of operative movement but which will immediately upon the occasion of power failure return the load to its starting point. In other words the motor may be energized or deenergized to set or release the holding means entirely independently of the fail safe releasing mechanism.

It will also be apparent from the foregoing that the improved device of this invention is en-

tirely automatic, is dependable and positive in its action, and requires no manual operation for resetting or the like.

It will also be apparent to those skilled in the art to which the improved device of this invention appertains that numerous changes in construction and design may be made without departing from the spirit or scope of the invention. Accordingly, the patent granted hereon is not to be limited to the illustrative embodiment here shown or in any other manner except as may be necessitated by the terminology of the appended claims when given the range of equivalents to which they may be entitled.

We claim as our invention:

1. In a motor, a stator, a rotor adapted to be moved into and out of alignment with said stator, a member movable with said rotor, a stationary member, cooperative braking surfaces on said members, means normally biasing said rotor and said movable member toward brake engaging position, electromagnetic means including an armature biased toward deenergized position, said biased armature when in energized position permitting longitudinal and rotational movement of said rotor and said movable member, said biased armature upon deenergization providing means for moving said biased movable member longitudinally against the normal bias thereof to release its braking surface from the braking surface of said stationary member.

2. In an electric motor, a stator, a rotor biased to move out of alignment with said stator upon deenergization thereof, a shaft extending through said rotor, a member fixed to said shaft and movable therewith, a stationary member, cooperating braking surfaces on said members, said cooperating braking surfaces being disposed to normally engage upon deenergization of said motor and to disengage upon energization thereof, and means for imparting a hammer action to disengage the braking surfaces of said members against the normal biasing of said rotor upon the occasion of power failure thereto.

3. In an electric motor, a stationary member, a rotatable member, cooperative braking surfaces on said members, means biasing said members toward braking engagement with one another, means for imparting a hammer action to said rotatable member to disengage said braking members, and means for maintaining said braking surfaces disengaged.

4. In an electric motor, a stationary member, a rotatable member, cooperative braking surfaces on said members, means biasing said rotatable member longitudinally of its axis toward braking engagement with said stationary member, said rotatable member being disposed upon energization of said motor to overcome said biasing means and to move from said stationary member and upon normal deenergization of said motor to be moved toward said stationary member by action of said biasing means, means for overcoming said bias by moving said rotatable member axially and separating said members to disengage said braking surfaces in the event of power failure, and electromagnetic means operable when energized to maintain said means for overcoming said biasing means ineffective.

5. In an electric motor, a stationary member, a rotatable member, cooperative braking surfaces on said members, means for normally biasing said rotatable member into braking engagement with

said stationary member, and means upon power failure for imparting a hammer action to said rotatable member to release said braking engagement.

6. In an electric motor adapted to operate a member between two extreme positions, means biasing said member to a first of said positions, biased brake means for arresting the movement of said member at any point between said extreme positions upon the termination of power to said motor, spring actuated means for overcoming and releasing said biased brake means to permit said member biasing means to return said member to a first extreme position in the event of power failure, and electromagnetic means for maintaining said spring actuated means in inactive position.

7. In an electric motor having a brake, a first means operable upon deenergization of said motor for moving said brake into engaged position, a spring biasing means operable to overcome said first means and move said brake to disengage position, an electromagnetic means, and means including said electromagnetic means operable when said electromagnetic means is energized to maintain said spring biasing means ineffective.

8. In an electric motor adapted to operate a device between two extreme positions, means biasing said device to a first extreme position, brake means, first spring means biasing said brake means to engaged position and operable upon the deenergization of said motor to move said brake means into engaged position to hold said device at any point between its extreme positions, second spring means operable to overpower said first spring means and to move and maintain said brake means in non-engageable position, and electromagnetic means operable upon energization thereof to move and maintain said second spring means in an ineffective position.

9. In an electric motor, a stationary member, a rotatable member driven by said motor, cooperative braking surfaces on said members, means for selectively moving said members into and out of braking engagement, a yieldable biasing means for preventing the movement of said members into braking engagement, electromagnetic means, means positioned by said electromagnetic means for exerting a force on and rendering said yieldable biasing means ineffective when said electromagnetic means is energized, and connections adapted to extend from said electromagnetic means to a source of power for causing said electromagnetic means to be energized whenever said source of power is effective.

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