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(54) DOOR OPERATOR ASSEMBLY

(75) Inventor: **Brian Hass**, Torrington, CT (US)

Correspondence Address:
RYAN KROMHOLZ & MANION, S.C.
POST OFFICE BOX 26618
MILWAUKEE, WI 53226 (US)

(73) Assignee: **Dynatool Industries Inc.**

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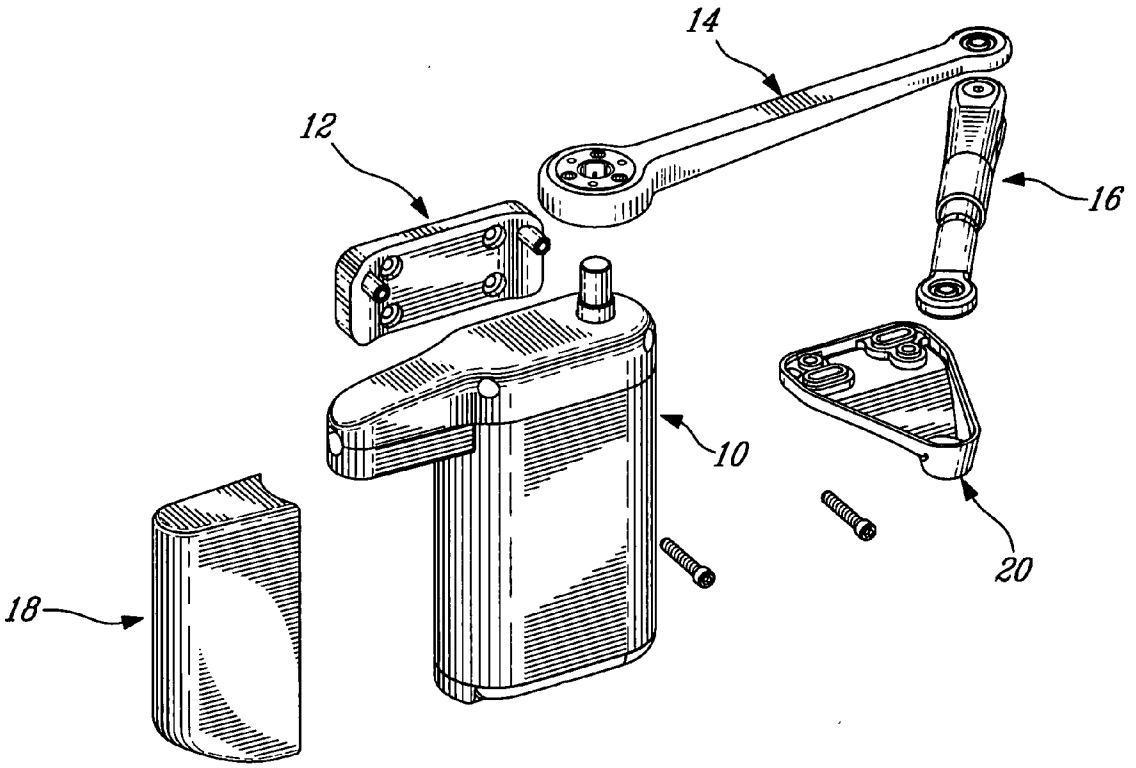
(52) **U.S. Cl.** **292/336.3**

(57) **ABSTRACT**

A door operator assembly, comprising an operator unit mounted to a first position, relative to the door, by a first mounting bracket; and an arm linkage connecting the operator unit and a second position, relative to the door; the arm linkage being mounted at the second position by a second mounting bracket.



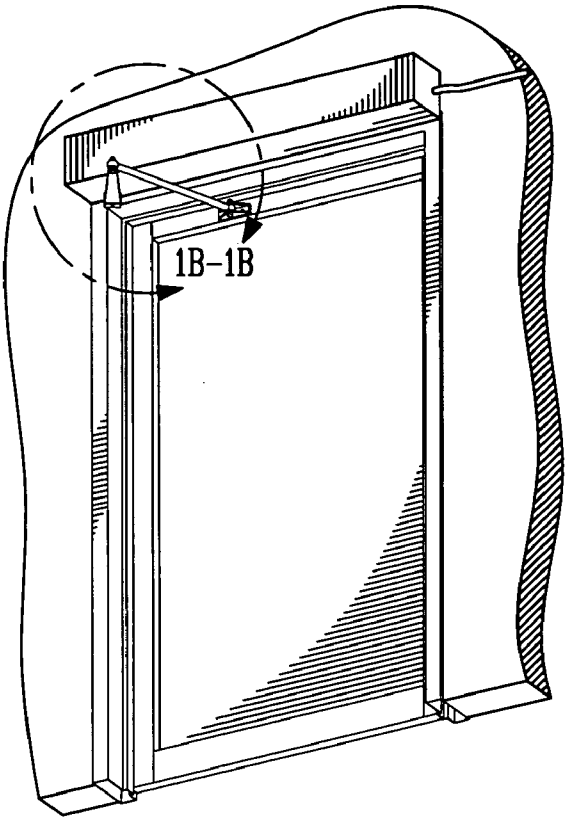


Fig. 1A (Prior Art)

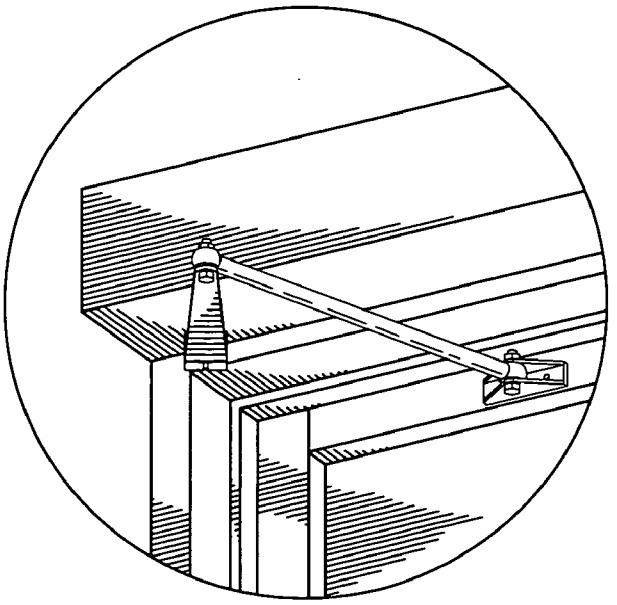


Fig. 1B (Prior Art)

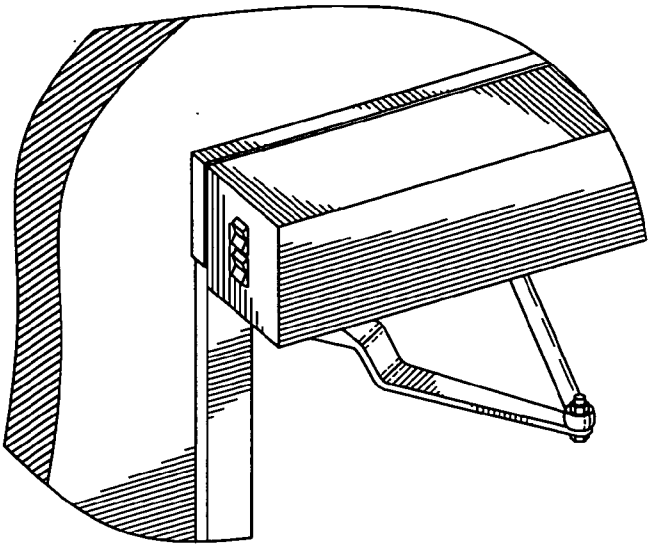


Fig. 2A

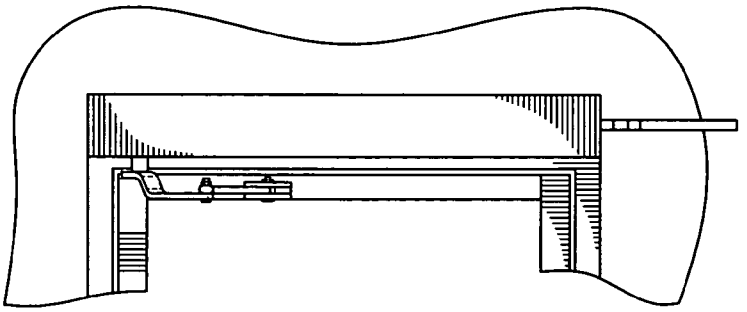


Fig. 2B

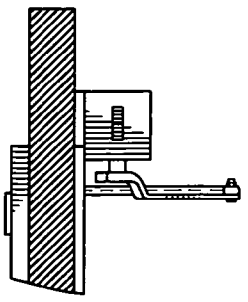


Fig. 2C

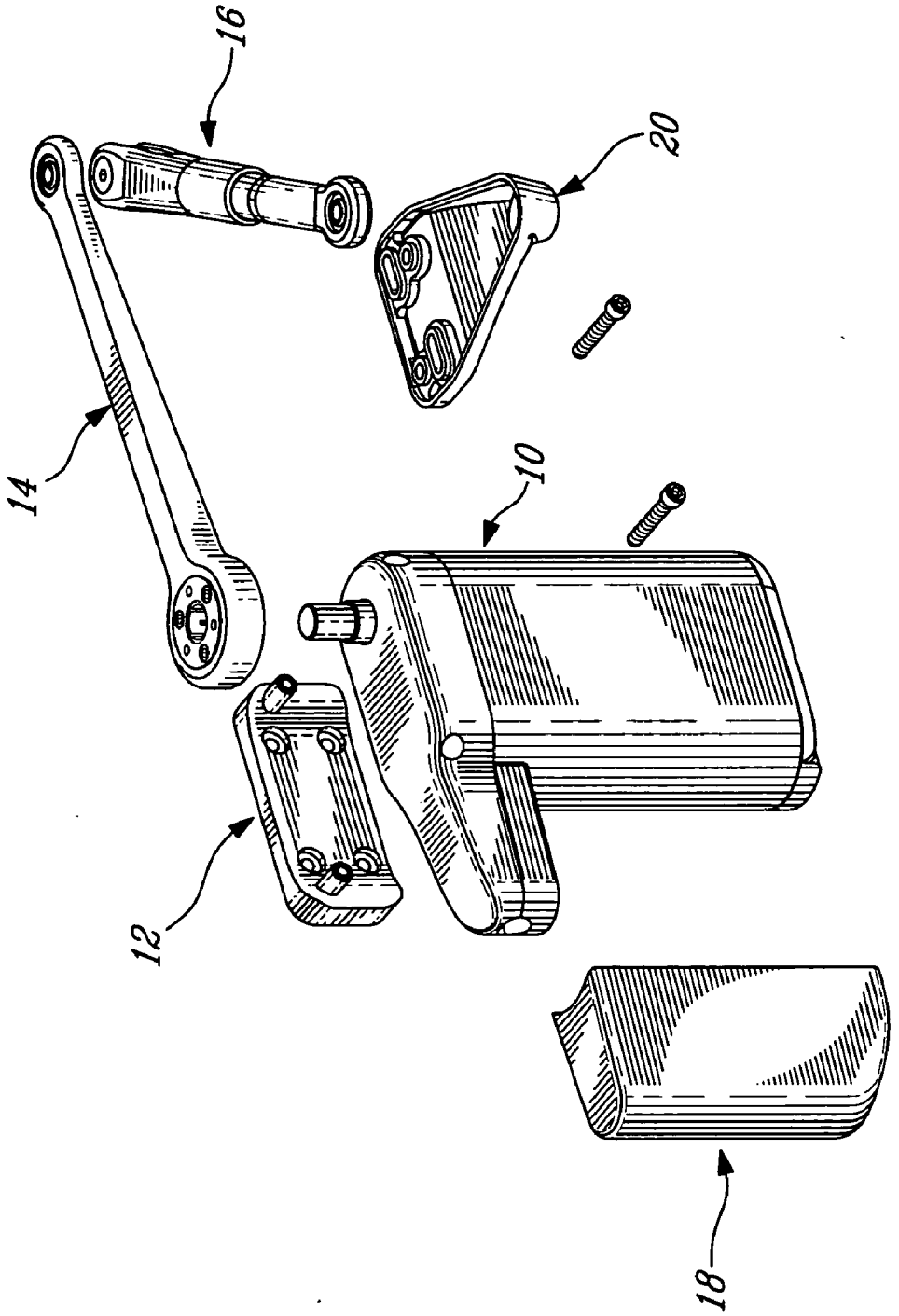


Fig-3

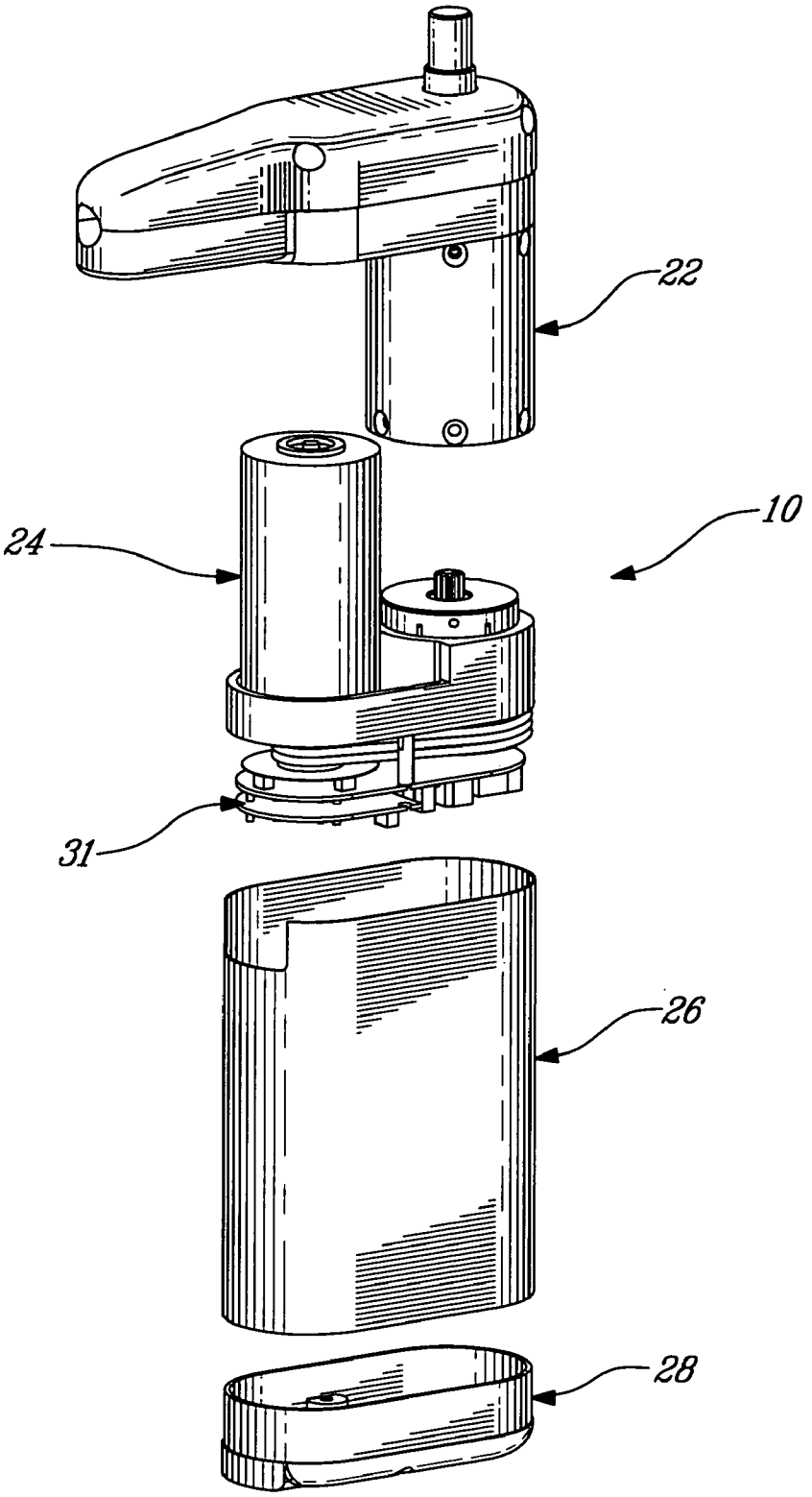


Fig-4

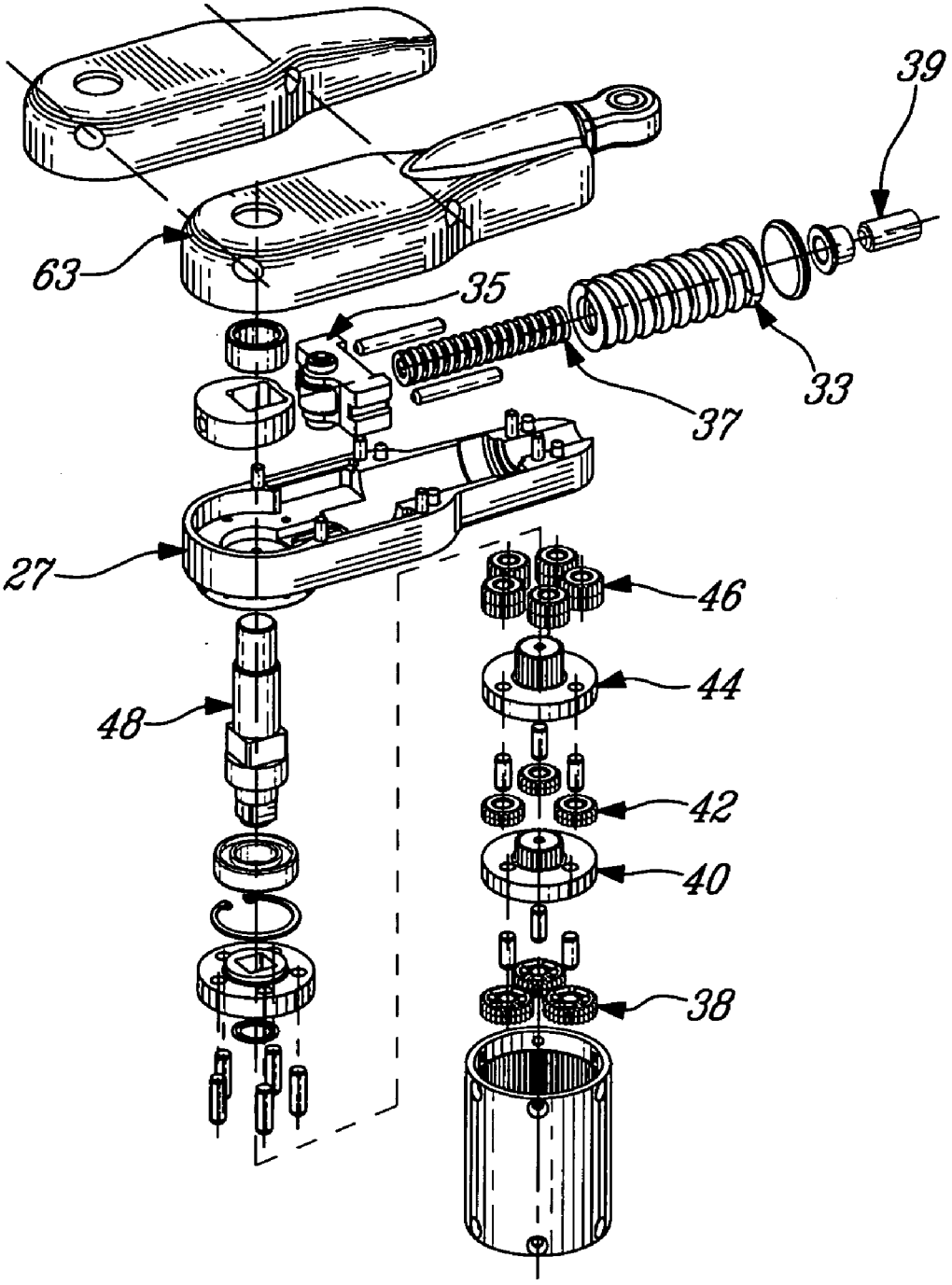


Fig. 5

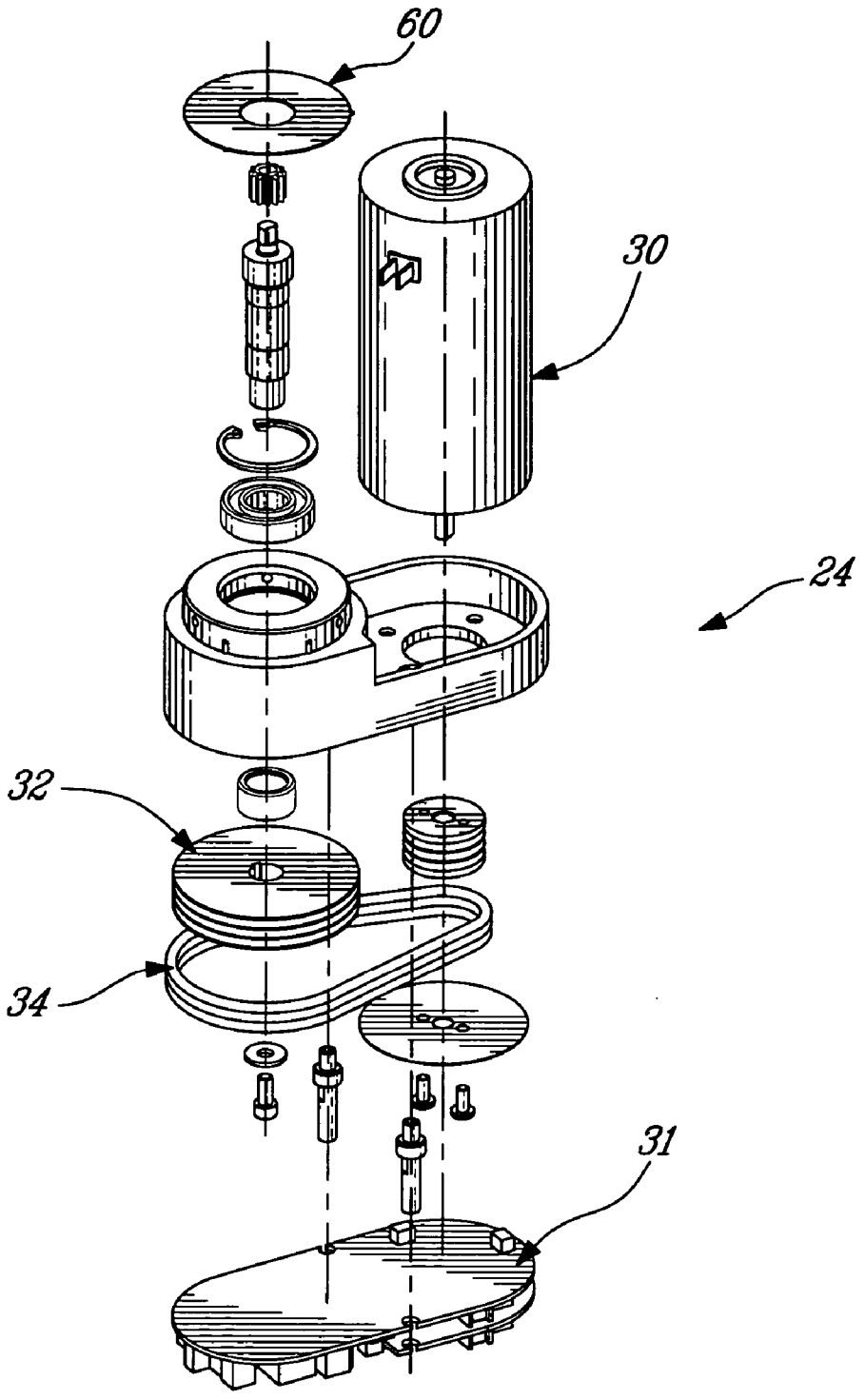


Fig. 6

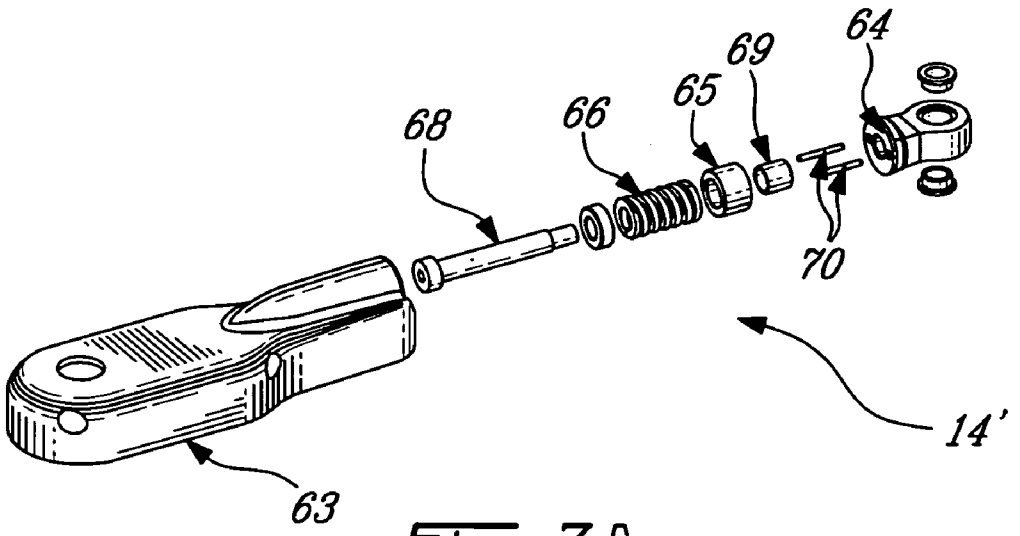


Fig. 7A

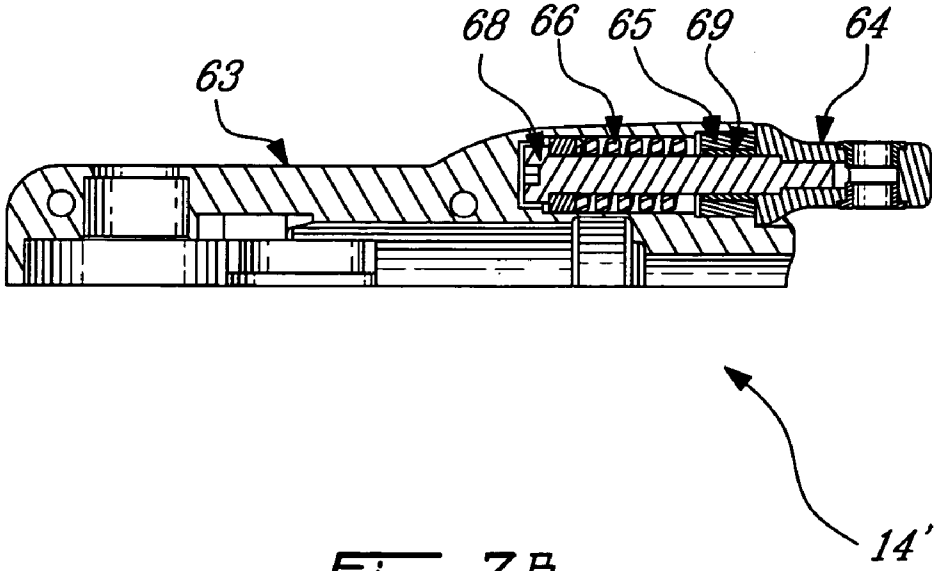


Fig. 7B

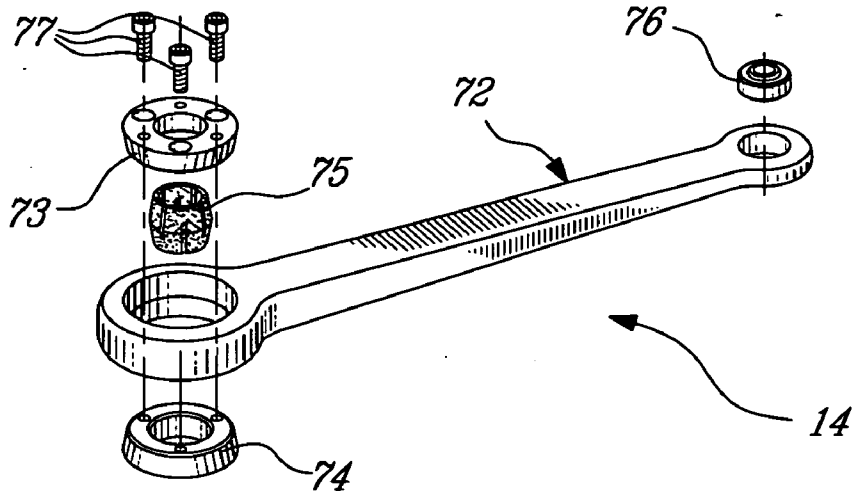


FIG. 8A

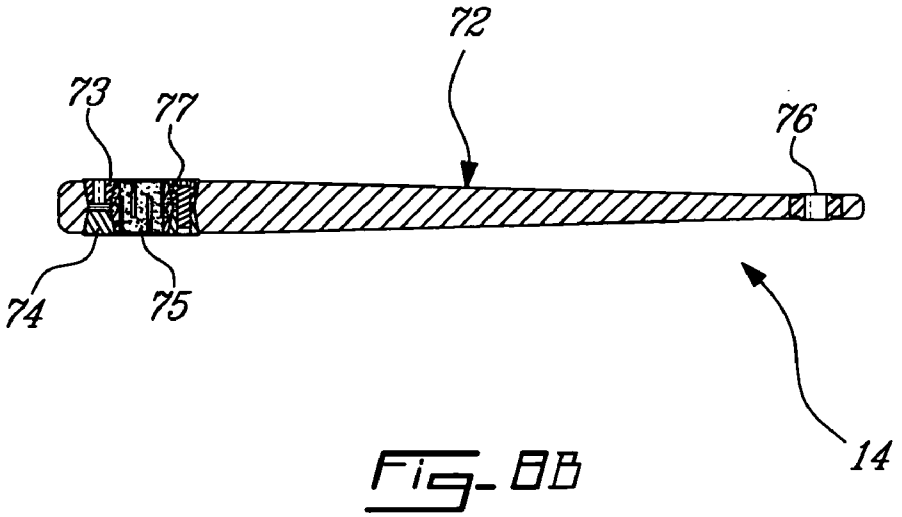


FIG. 8B

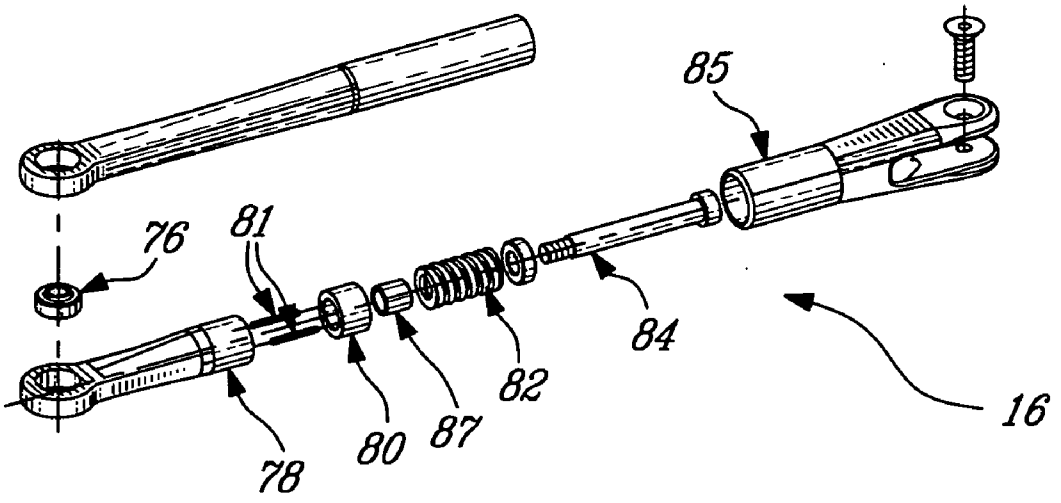


Fig. 9A

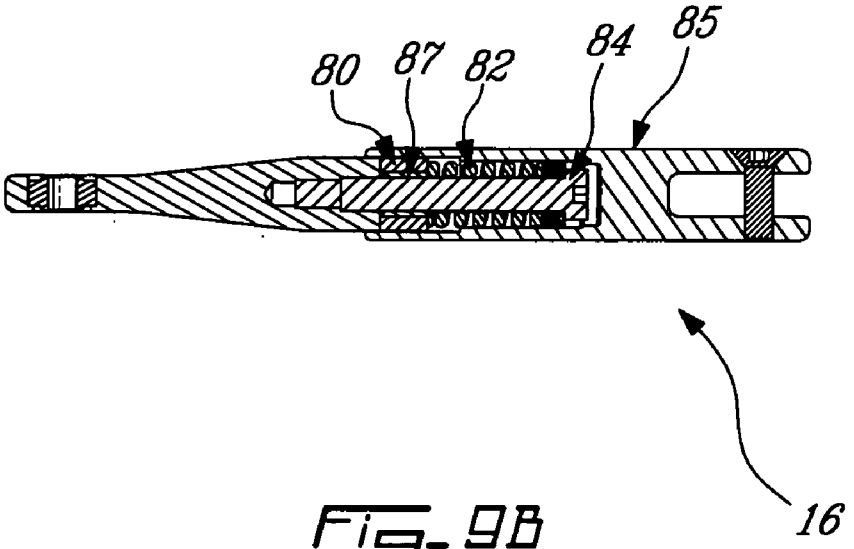


Fig. 9B

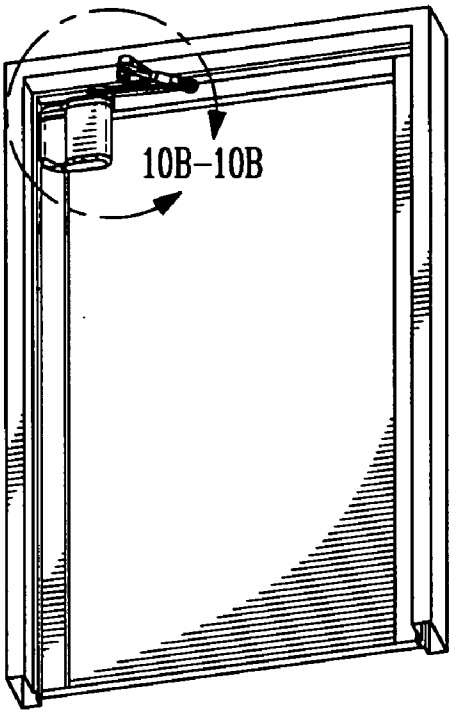


Fig. 10A

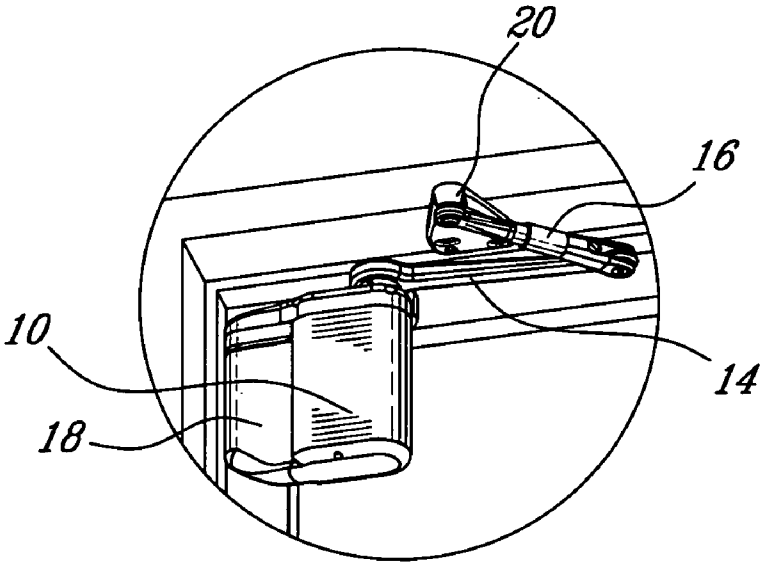


Fig. 10B

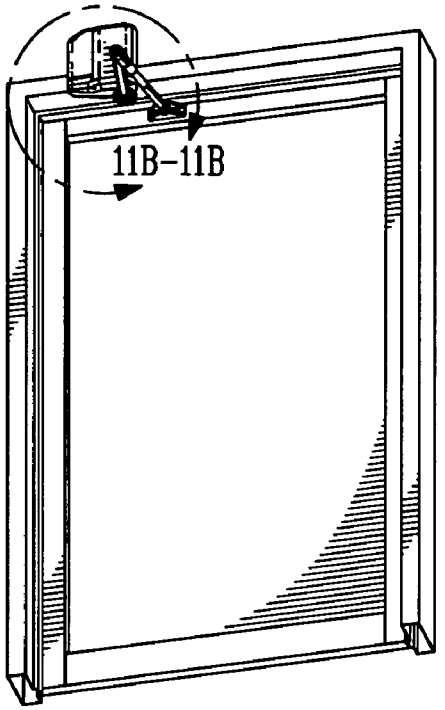


Fig. 11A

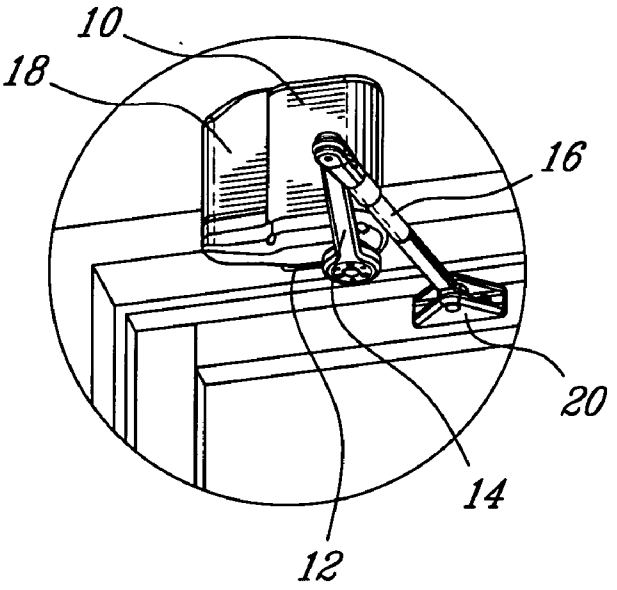


Fig. 11B

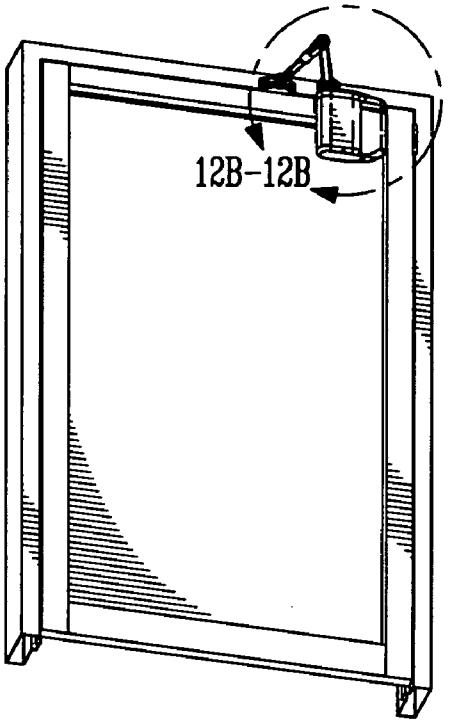


Fig. 12A

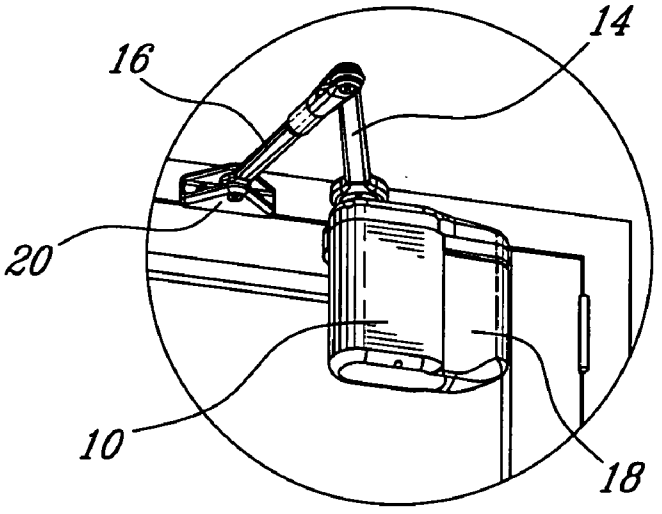


Fig. 12B

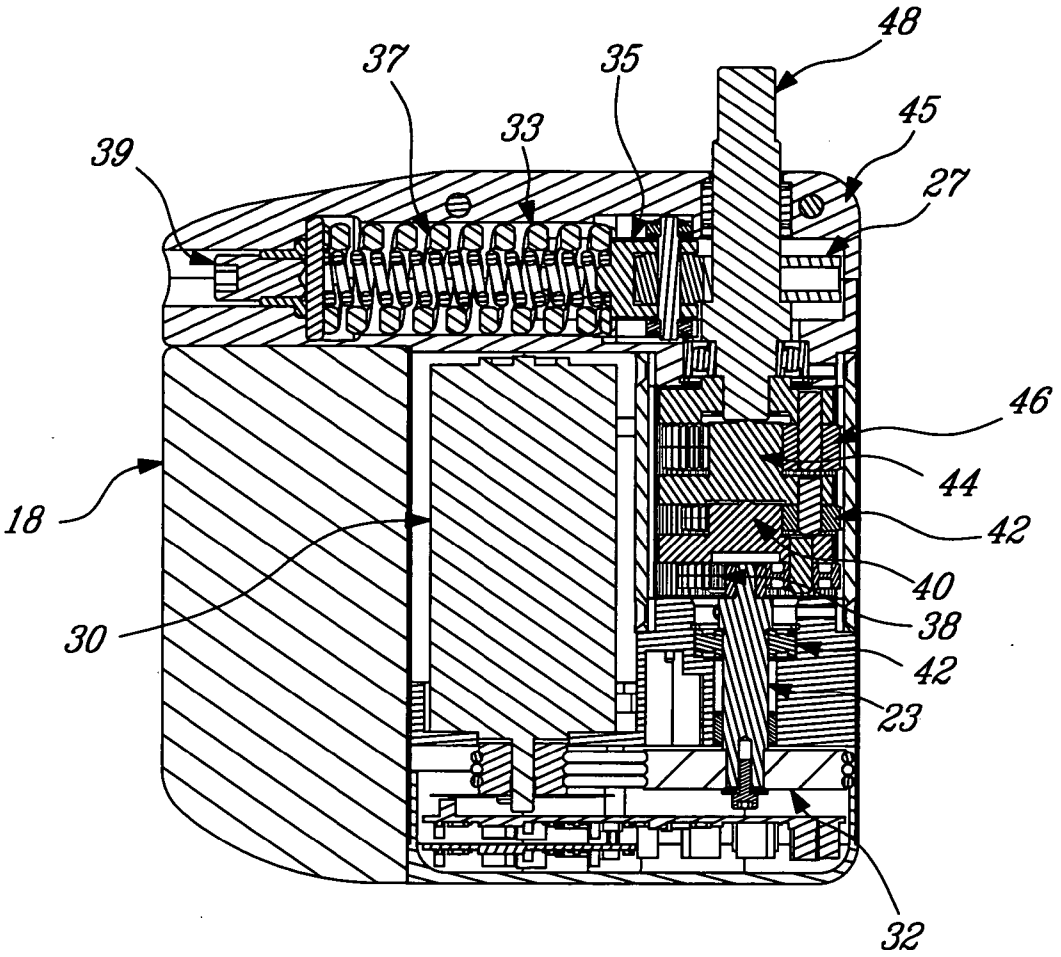


Fig. 13

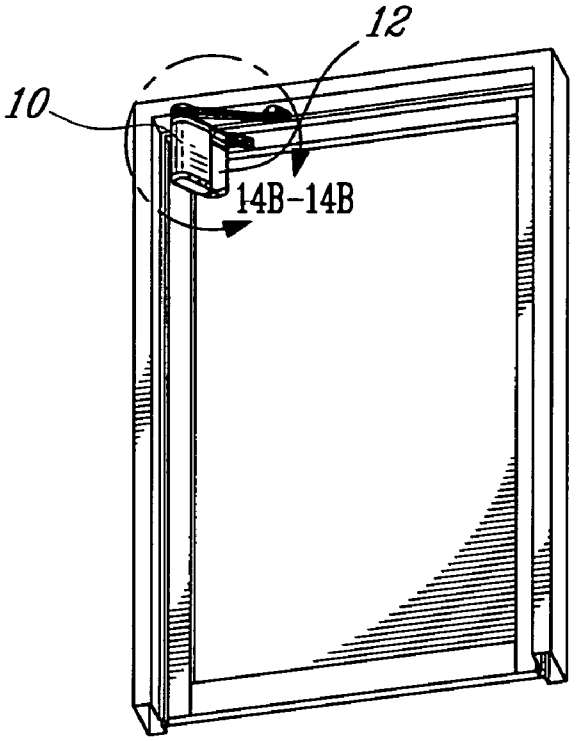


Fig. 14A

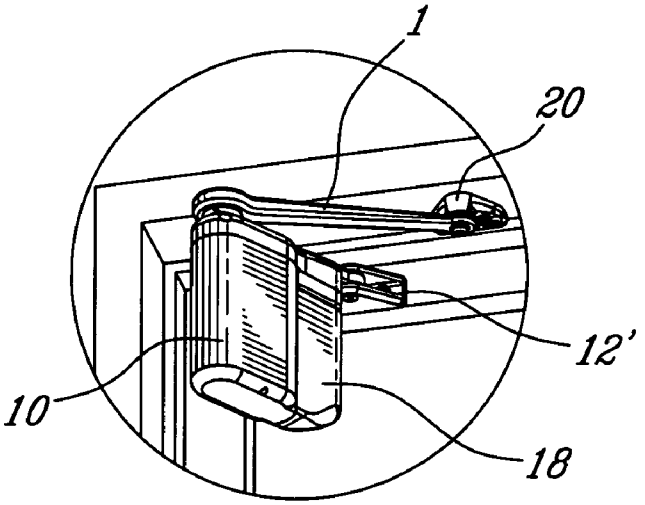


Fig. 14B

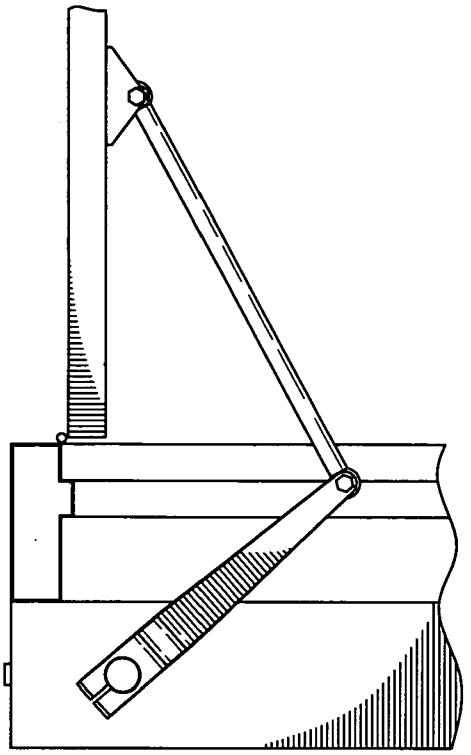


Fig. 15A

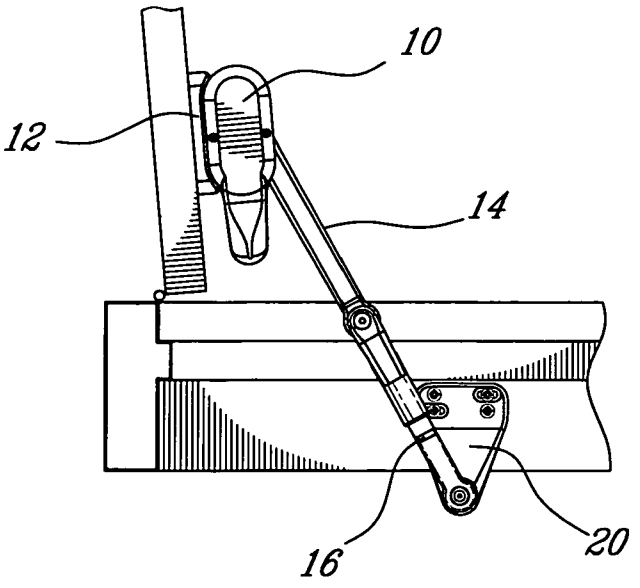


Fig. 15B

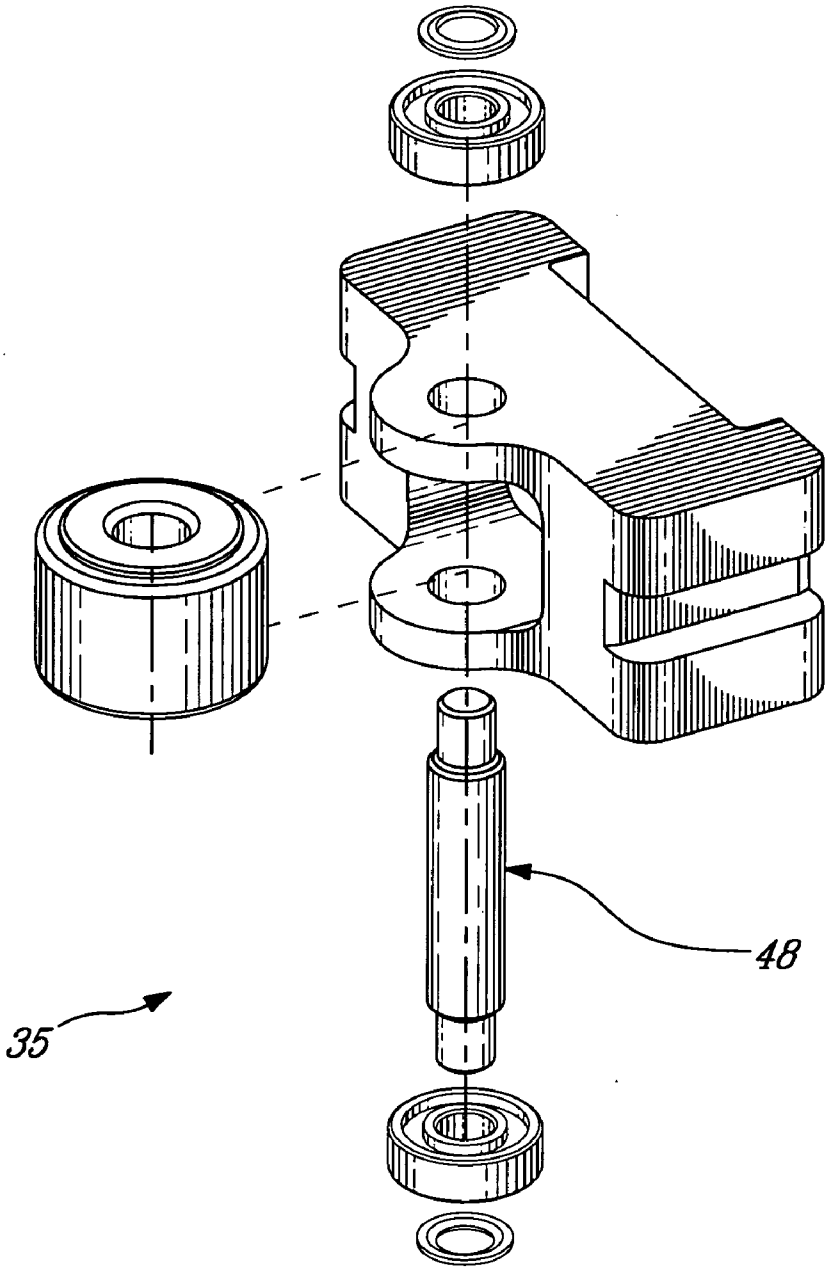


Fig. 16

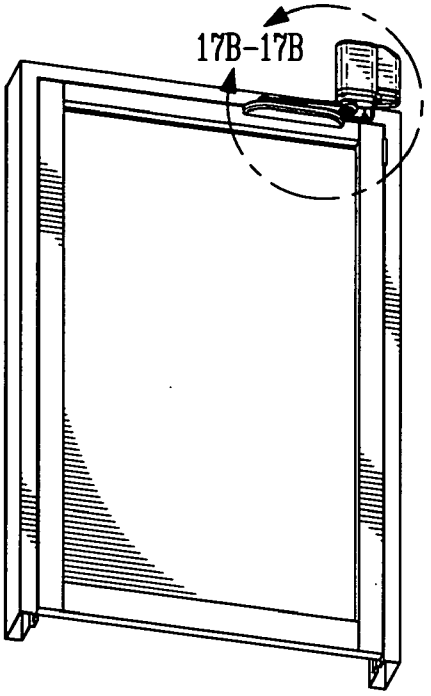


FIG. 17A

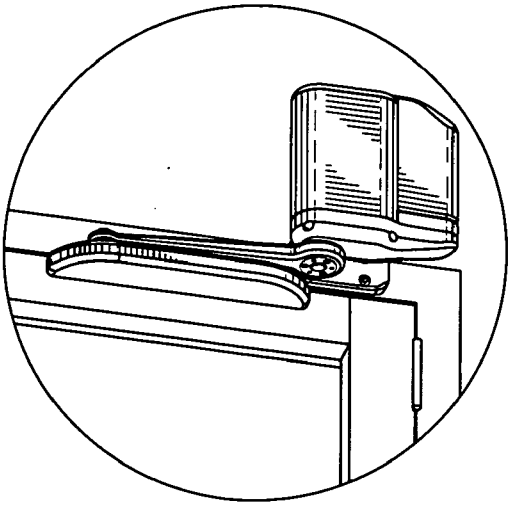


FIG. 17B

DOOR OPERATOR ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority on U.S. provisional application No. 60/751,623, filed on Apr. 13, 2005. All documents above are herein incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to door operators. More specifically, the present invention is concerned with a door operator assembly.

BACKGROUND OF THE INVENTION

[0003] Low energy door operators as illustrated in **FIGS. 1 and 2** are typically used as manual doors. The door opens automatically by an action such as pressing an activation switch.

[0004] Installation of a low energy door operator is usually very expensive, since a typical installation requires an installer attaching a header to the frame of the door, which often requires custom mounting work, installing the operator in the header and installing door arms. Then, a licensed electrician is required to provide power to the door operator. The installer then has to return to complete "tune-in" of the door, including for example adjustments to ensure door meets standard requirements.

[0005] Wind is a common cause of failure for exterior application swing door operators. The force of the wind on the door can cause the door to rapidly accelerate. When the door reaches the full open position all of the energy of the door must be absorbed in a very short period of time. These impact forces cause high stresses on the door operator, door arms, doors, doorframes, and mounting hardware. **FIG. 15**(*a*) illustrates a standard door operator mounting above the door, which causes very high stresses on the door arm linkages when the door is fully open and is forced by wind or a user and often causes significant problems since the arms are loaded in bending as well as in tension, causing high stresses on the door operator, causing failure of the operator or requiring the installation of an additional door stop.

[0006] Most available door operators provide different finishing options on the header, under the form of a large box, which mounts above the door and contains all of the electrical and mechanical components, which is a structural member of the system. Each door operator must be custom ordered to meet a desired finish.

[0007] There is a need in the art for door operator that mitigated the problems of the prior art.

SUMMARY OF THE INVENTION

[0008] More specifically, there is provided a door operator assembly, comprising an operator unit mounted to a first position, relative to the door, by a first mounting bracket; and an arm linkage connecting the operator unit and a second position, relative to the door; the arm linkage being mounted at the second position by a second mounting bracket.

[0009] Other objects, advantages and features of the present invention will become more apparent upon reading of the following non-restrictive description of specific embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In the appended drawings:

[0011] **FIG. 1** is a view of a door operator system as known in the art;

[0012] **FIG. 2** is a close up view of a door operator system as known in the art

[0013] **FIG. 3** is an exploded view of a door operator assembly according to an embodiment of the present invention;

[0014] **FIG. 4** is an exploded view of an operator unit in a door operator assembly according to an embodiment of the present invention;

[0015] **FIG. 5** is an exploded view of an output drive unit of the operator unit of **FIG. 4**;

[0016] **FIG. 6** is an exploded view of an input drive unit of the operator unit of **FIG. 4**;

[0017] **FIG. 7** *a*) is an exploded view and **FIG. 7** *b*) is a sectional view of an integrated door arm for a door operator assembly according to the present invention;

[0018] **FIG. 8** *a*) is an exploded view and **FIG. 8** *b*) is a sectional view of a drive arm unit of a door operator assembly according to the present invention;

[0019] **FIG. 9** *a*) is an exploded view and **FIG. 9** *b*) is a sectional view of an adjustable length shock absorbing arm unit according to the present invention;

[0020] **FIG. 10** is a general view of door operator assembly according to an embodiment of the present invention, mounted in a configuration a known in the art;

[0021] **FIG. 11** is a general view of door operator assembly according to an embodiment of the present invention, mounted in a first alternative configuration;

[0022] **FIG. 12** is a general view of door operator assembly according to an embodiment of the present invention, mounted in a second alternative configuration;

[0023] **FIG. 13** is cross sectional view of an operator unit in a door operator according to the present invention;

[0024] **FIG. 14** is a general view of door operator assembly according to an embodiment of the present invention, mounted in a third alternative configuration;

[0025] **FIG. 15***a* is a top view of a linkage of a door operator assembly as known in the art; **FIG. 15***b* is a top view of a linkage of a door operator assembly according to an embodiment of the present invention;

[0026] **FIG. 16** is an exploded view of a roller assembly of a door operator assembly according to the present invention;

[0027] **FIG. 17** is a general view of door operator assembly according to an embodiment of the present invention, mounted in a fourth alternative configuration;

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0028] The present invention is illustrated in further details by the following non-limiting examples.

[0029] As illustrated in **FIG. 3**, a door operator assembly of the present invention comprises an operator unit **10** and a linkage.

[0030] The operator unity **10** is connected to a power storage pack **18** and mounted to a first position, relative to a door (not shown in **FIG. 3**), by a first mounting bracket **12**. The linkage connects the operator unit **10** and a second position, relative to the door, the linkage being mounted at this second position by second mounting bracket **20**.

[0031] The first mounting bracket **12** comprises two posts for example, and is of reduced dimensions, allowing an easy mounting.

[0032] As illustrated in **FIG. 4**, the operator unit **10** comprises an output drive unit **22**, an input drive unit with controls **24**, a cover **26** and a control cover **28**.

[0033] The cover **26** may be used to provide a finished look to the door operator assembly. It is a non-structural member, and may be easily changed. As a result, a number of different finishes may be provided, eliminating the requirement for distributors to stock a number of different door operator assemblies to meet customer needs. Additionally, the covers can be replaced without any need to remove the door operator assembly from the door, so the covers can be changed to a custom finish at any time.

[0034] Power is supplied to the motor **30** by the power storage pack **18**. Motor control is achieved by the controller **31** with an integral magnetic or optical encoder.

[0035] The power storage pack **18** is a self-contained power storage pack, comprising batteries or high capacity capacitors for example, or alternative means as known in the art.

[0036] The present door operator assembly uses low voltage power. It may be powered by the power storage pack **18**, or a low voltage transformer plugged into an outlet, or both (battery backup). This means that no licensed electrician or trained installer is required for installation of the present door operator assembly.

[0037] As the present door operator assembly is typically used as a manual door with occasional activation by remote or push plate, part of the energy used to operate the door manually is recaptured and used to recharge the power storage pack **18**. This allows the batteries to be constantly charged without having to remove and replace the power storage pack **18**. If it is necessary to replace the batteries for charging purposes, the power storage pack **18** is easily removable.

[0038] A low battery LED may be provided as an indicator of low batteries, which may happen for example in case of misapplication of the door operator assembly or in case of automatic cycles outnumbering manual cycles required to generate power as will be described hereinafter. In this case, an optional plug in transformer may be used.

[0039] No wires are required to be run to the door operator assembly. As a result, the door operator assembly may be mounted according to a range of mounting arrangements, described hereinafter. Moreover, by using Radio Frequency remote control to activate the door operator assembly, the present door operator may be totally self-contained.

[0040] As seen in **FIG. 5**, the output drive unit **22** comprises an output shaft **48**, a spring assembly, and a planetary gear train.

[0041] As seen in **FIG. 6**, the input drive unit **24** comprises the motor **30**, a pulley **32** using a belt **34**, an output shaft unit and the controller **31**.

[0042] The pulley **32** is connected to a first stage planetary sun gear **23** (see **FIG. 13**). The sun gear **23** drives a first stage planetary gear consisting of three plastic planet gears **38** driving an output carrier **40**. The output carrier **40** drives a second set **42** of three planet gears, which are cut or powdered metal gears driving drives an intermediate carrier **44**. The intermediate carrier **44** drives a final set of five planetary gears **46**, which are cut or powdered metal gears driving the output shaft **48**.

[0043] The use of a pulley and belt arrangement allows for a parallel rotational axis structure of the door operator assembly, which allows the motor **30** to be positioned next to the gear train. Alternatively, a set of straight spur or helical spur gears may be used instead of the pulley arrangement to allow for an increased reduction ratio.

[0044] As a result, the door operator the door operator assembly is extremely compact while maintaining high strength and high efficiency. For example, the overall dimensions of the operator unit **10** are approximately 8" tall, 8" wide (including battery pack), and 2.5" thick.

[0045] An eccentric is used to load the spring assembly and provide torque to close the door, which offers the ability to control the force profile of the door. As shown in **FIG. 5**, the output shaft **48** is connected to an eccentric **27**. As the output shaft **48** is rotated, the eccentric **27** causes a roller assembly **35**, shown in **FIG. 16**, to move and compress two-nested helical compression springs **33** and **37**. The linear force of the springs **33** and **37** results in a torque in the closing direction on the output shaft **48**. By modifying the profile of the eccentric **27**, the torque on the door can be controlled to be a constant through the range of door motion.

[0046] Alternatively, the profile of the eccentric **27** can be modified to provide increased torque near the closed position of the door as is often desired to ensure proper door closing in conditions where there is wind or stack pressures which tend to push the door open. This provides for a smooth manual opening feel to the user and ensures reliable closing of the door.

[0047] The eccentric **27** design allows the use of robust compression springs instead of commonly used clock type springs, which are known to fail prematurely. Moreover, since clock type springs only provide torque in one direction, door operators using this type of spring system are handed and require disassembly to reverse the handing thereof. By making the profile of the eccentric **27** symmetrical, the present door operator can be used in either direction and allows for use of a same door operator on either a left or a right hand door.

[0048] Interestingly, once the present door operator assembly is installed on the door, the spring force may be

adjusted by a spring adjustment set screw **39**, whereas other door operators require the door arms to be repositioned, the header to be opened for access, or the door operator to be removed from the header to adjust the spring force.

[**0049**] The spring assembly absorbs energy when the door is opened and stores that energy for use later in closing the door, which is typically required to allow the door to close when no power is supplied to the door operator assembly, as in a case of power failure for example. Each time the door is opened by a person, energy is applied to the door and stored in the spring assembly, the thus stored energy being then released to close the door. The motor is used as a generator, the excess energy released by the spring assembly is recaptured to be stored in the self-contained power pack, each manual cycle being used to recharge the power pack.

[**0050**] When the present door operator is battery powered and able to capture energy on the open cycle by using the motor as a generator, as will be described hereinafter, it is possible to use the power pack to temporarily store the power, instead of a spring. The energy can then be released into the motor to close the door. In such an alternative embodiment, the door operator does not comprise any spring assembly, which reduces the number of parts required and hence the total cost.

[**0051**] In **FIG. 3**, the linkage comprises a shock absorbing door arm **16** and a drive arm unit **14**. The output shaft **48** is supported by a housing **45**. The output shaft **48** is connected to the drive arm unit **14** as shown in **FIG. 5**.

[**0052**] As shown in **FIG. 8**, the drive arm unit **14** comprises a main arm **72**, which has a spherical bearing **76** at a first end and a shaft coupling assembly consisting of a tapered mandrel **75** and two tapered collars **73**, **74** held together with three fasteners **77** at a second end. Such tapered coupling between the door arm and the output shaft, compared to conventional splined or square shape on the output shaft of the operator unit, allows the arm to be attached in a range of positions on the door operator output shaft, and provides a robust connection to the output shaft **48**.

[**0053**] As shown in **FIG. 9**, the shock absorbing door arm **16** comprises a solid arm **78** and a hollow arm **85**, which are connected through a threaded housing **80** and a plastic bearing **87** by means of a shock-absorbing medium **82**, such as a spring or a closed cell polyurethane for example. A shoulder bolt **84** is used to preload the shock absorbing door arm **16** when connected to the solid arm **78**. Length adjustment is accomplished by rotating the hollow arm **85** in relation to the threaded housing **80**, which is fixed to the sold arm **78** through two dowel pins **81**.

[**0054**] The shock absorbing door arm **16** reduces the impact force frequently caused by wind or abuse, which are common causes of system failure. Contrary to hydraulic dampening currently used, wherein an hydraulic fluid is used to control the speed of the door on the closing cycle, the shock absorbing arm allows absorbing the shock occurring when the door is forced in the full open position, or when wind causes an impact when the door hits the open position. In contrast, typical hydraulic systems fail to absorb an impact when the door is in the open position.

[**0055**] The shock absorbing door arm **16** is attached on a first end to the second mounting bracket **20**, which is mounted on the frame of the door through a spherical bearing **76** (see **FIG. 9**), and on a second end to the drive arm unit **14** as shown in mounting configurations illustrated in FIGS. **1012**, **14**, **15** for example.

[**0056**] In an alternative mounting arrangement as shown in **FIG. 11**, the second mounting bracket **20** is affixed to the door.

[**0057**] As may be seen in **FIG. 15***b*, the drive arm unit **14** and the shock absorbing door arm **16** maintain a linear alignment when the door is fully opened, thereby reducing stress on the door operator assembly and on the mounting brackets. People in the art will appreciate that linear alignment of the door arms implies that the arms are in either tension or compressions, and have no bending loads, which reduces stress on the door operator assembly.

[**0058**] Depending on the selected mounting arrangement, the drive arm unit **14** and the shock absorbing door arm **16** may be an integrated into an arm unit **14'** as shown in **FIG. 14**. As shown in **FIG. 7**, the integrated arm unit **14'** comprises a housing **63**, a linkage attachment **64**, which is connected to the housing **63** through a bearing support **65** and bearing **69** by means of a shoulder bolt **68** held, in place by a heavy spring **66**.

[**0059**] The door operator assembly of the present invention incorporates a closed loop control circuit and a regenerative drive circuit, effective in both the open and closing directions. The controller constantly monitors door speed and position, in such a way that if the door begins to move faster than a predetermined speed, the motor is used as a generator to remove the energy from the door and slow the door down. This allows the energy to be absorbed over relatively long period of time and dramatically reduces the forces of the door when the full open position is reached, as opposed to a traditional door system using a stop to absorb impact energy upon the full open position. The excess energy is used to recharge the power pack.

[**0060**] The regenerative drive circuit also allows gaining energy from a manual opening of the door. Since the controller monitors the speed of the door, any excess energy applied by a user to the door can be stored in the power pack, as a way to eliminate this excess energy from rapid manual opening, which reduces the stress and wear on the operator unit.

[**0061**] To further reduce abusive forces on the door operator assembly, as described hereinabove, the shock absorbing door arm absorbs the impact of a large, heavy door operating at maximum allowed speed when it reaches full open or if the door is subject to impact by a person or object.

[**0062**] As mentioned hereinbefore, the use of the regenerative drive circuit in both the open and close directions of operation allows an alternative where the energy storage springs and related components may be eliminated, providing storing the energy from the open cycle in the power pack for use to provide power to the motor to close the door.

[**0063**] Moreover, the closed loop control circuit whereby the controller calculates the approximate inertia of the door by monitoring the power (voltage and current) provided to the door and the resulting speed of the door, may be used so that the controller automatically set the speeds and forces of the door to meet standard limitations. This feature in the

control of the door ensures safe installation by those not familiar with standard requirements and dramatically reduces the installation time of the operator.

[0064] From the foregoing, it should now be apparent that the present door operator assembly is easily installed without expert knowledge. Moreover, being powered by a self-contained power pack, which is recharged during manual use, it does not require external wiring.

[0065] Interestingly, the present door operator assembly may be mounted to a door without the need for custom work to either the operator unit or the mounting surface of the operator unit. Using a separate mounting bracket allows to easily mount the bracket to the door and to apply the operator unit to the mounting bracket on two guideposts. Provision of a length-adjustable shock absorbing door arm allows easily adjusting the door arm length and further facilitate easy installation.

[0066] As mentioned hereinabove, depending on the door width and height or customer preferences, a range of mounting arrangements may be contemplated.

[0067] The first mounting bracket **12** may be mounted in a traditional, above the frame, configuration as shown in **FIG. 11**, while the second mounting bracket **20** is mounted to the door, the door operator mounting to the first mounting bracket **12**, which mounts to the top of the doorframe

[0068] In **FIG. 12**, the first mounting bracket **12** is mounted to the opposite face of the door, to accommodate for in-swing applications, and the second mounting bracket **20** mounts to the frame of the door.

[0069] In **FIG. 17**, the first mounting bracket **12** is mounted to the opposite frame of the door, to accommodate for in-swing applications. In this embodiment, a track is mounted to the face of the door through a slider block.

[0070] In **FIG. 14**, the second mounting bracket **20** is mounted on the doorframe, and the operator unit **10** is mounted to the door by an adaptor **12'**.

[0071] As shown in **FIG. 15** (*b*), in the full open condition, the linkage is in a straight line so the door arms are in tension only. This means there is no torque on the door operator assembly itself and, since the arms are not subject to bending, the stress on the door arms is lower. The shock-absorbing arm further reduces the stress on the door itself.

[0072] Therefore, the present door operator assembly, which, instead of being placed above a door in a large header, may mount directly between the frame and the door, which dramatically reduces the complexity of installation. Alternative mounting arrangements may be contemplated, depending on customer requirements. Using an optional mounting plate, the present door operator assembly may be mounted to the interior or exterior face of the door, in swing or out swing application, or may be mounted on the interior or exterior above the door, on the doorframe. This allows accommodation of condition where the door operator may not be mounted in the clear door area, for doors under 36" for example, for door with limited space behind the door, or for doors where the space above the door is limited, in the cases of high doors or low ceilings for example.

[0073] People in the art will appreciate that mounting the door operator assembly between the front face of the door and the bottom of the frame dramatically simplifies installation, compared with typical door operators that mount above the frame and require shimming or reinforcing of the frame. The mounting arrangement between the bottom of the frame and face of the door does not require reinforcing the frame or any shims, since the frame has existing support where the door operator mounts. A mounting plate may be used depending on the reveal of the door. Such mounting arrangement also eliminates issues where not enough space over the door is available to mount the door operator assembly. Alternative mounting arrangement comprises mounting the door operator assembly on the frame above the door or on the in-swing face of the door.

[0074] From the above, people in the art should now be in a position to appreciate that the present invention provides a door operator assembly, connected to the frame of the door by means of a pivot instead of being fixedly mounted to the frame of the door or to the face of the door, which allows the door operator assembly to more or less "float" in the doorway. This mounting arrangement is much simpler than traditional mounting arrangements in a box above the door, which often requires reinforcing of the area above the door.

[0075] The present door operator assembly may be operated by a power pack alone, if desired, since the power pack may be recharged by using the motor as a generator during manual open and spring closing of the door as described hereinbefore, which allows using only the power pack to operate the door even though the power pack has a limited energy storage. Such a feature eliminates the need to have a licensed electrician bring power to the door and eliminates the need for any electrical cords to the door operator. It may be further contemplated having the door operator plugged in for doors that are typically power operated rather than typically manually operated.

[0076] The present door operator assembly may also be used as a power-assisted door opener, by supplying only enough power to the door to reduce the force required to open the door, the door having no minimum hold open time in this case. The force of the door operator, in a power-assisted mode, is controlled by the amount of current supplied to the motor. The amount of current is determined in an initial set up of the door to be below the amount of current required to open the door under power for example. Activation of the power assist function occurs when the encoder indicated motion of the door has started.

[0077] Alternatively, power assist may be provided by adding measuring the backlash between the door arm and the motor. When pressure is applied to the door and the backlash is taken up, the controller applies power to the door, and, if the backlash is increased, indicating the door is stopped, power may be removed. One method of accomplishing this is by allowing the output stage ring gear to rotationally float plus or minus 2-3 degrees. A pin in a slot may be used to limit the rotation with a switch mounted externally so that when the backlash is taken up, the switch is actuated. Pushing on the door causes the ring gear to rotate and the switch is actuated. The controller may then be used to provide power to the motor and assist in the opening of the door. If the door motion stops, the ring gear rotates in an opposite direction and disengages the switch, thereby eliminating power to the motor. Power is only supplied to the motor as long as there is some pressure on the door.

[0078] A method of adjusting the door operator assembly in compliance with ANSI 156.19 standard will now be described. This procedure is commonly called "tune-in" of the door.

[0079] According to this standard ANSI 156.19, opening and closing speeds of the door are related to the size and weight of the door and are determined by the equation $T=(D*(W)^{1/2})/133$, where T is the time in seconds, D is the door width in inches, W is the weight of the door in lbs. The time T is determined by inputting the door width and weight into the controller by means of a discrete position potentiometer.

[0080] Setup of the door operator is initiated by pressing a switch on the controller twice with the door in the closed position, thus setting the close door position. The 90-degree open position is set by manually opening the door to the 90-degree position and pressing the button on the RF transmitter once.

[0081] The hold open time of the door is next set by depressing the button on the RF transmitter the desired number of seconds that the door will be held open. This completes the position input of the setup.

[0082] With the closed loop control circuit described hereinabove, the controls can automatically calculate the required door speeds and eliminate the need to manually set the door operator.

[0083] The opening force of the door is set by a variable potentiometer and does not exceed a predetermined current limit based on the size of the door. The maximum closing force, with the power close option, is set by a variable potentiometer and does not exceed a predetermined current limit based on the size of the door.

[0084] The spring force is set by adjusting the spring adjustment set screw as previously described.

[0085] Although the present invention has been described hereinabove by way of specific embodiments thereof, it can be modified, without departing from the nature and teachings of the subject invention as described herein.

1. A door operator assembly, comprising

an operator unit mounted to a first position, relative to the door, by a first mounting bracket; and

an arm linkage connecting said operator unit and a second position, relative to the door; said arm linkage being mounted at said second position by a second mounting bracket.

2. The door operator assembly of claim 1, said operator unit including a motor and a controller, said controller constantly monitoring a speed and a position of the door, wherein, when the door begins to move faster than a predetermined speed, the motor is used as a generator to remove energy from the door and slow the door down.

3. The door operator assembly of claim 2, wherein any excess energy applied manually to the door is removed from the door.

4. The door operator assembly of claim 3, comprising batteries, said excess energy being used to recharge said batteries.

5. The door operator assembly of claim 3, comprising a low battery indicator.

6. The door operator assembly of claim 1, wherein said controller calculates an approximate inertia of the door by monitoring a power provided to the door and a resulting speed of the door.

7. The door operator assembly of claim 1, wherein said controller automatically sets a speed and a force submitted to the door.

8. The door operator assembly of claim 1, wherein said operator unit comprises a power storage pack for powering the door operator.

9. The door operator of claim 1, activated by Radio Frequency remote control.

10. The door operator assembly of claim 1, powered by a self-contained power storage pack.

11. The door operator assembly of claim 1, said operator unit comprising a removable cover.

12. A door operator assembly of claim 1, said first position being selected between one of: i) the door and ii) a frame of the door, said second position being one of: i) the door and ii) the frame of the door depending on said first position.

13. The door operator assembly of claim 1, wherein said arm linkage comprises a shock absorbing door arm, said shock absorbing door arm being attached at a first end thereof to said second mounting bracket and at a second end thereof to said operator unit.

14. The door operator assembly of claim 13, wherein said shock absorbing door arm is connected to said operator unit by a drive arm unit, said drive arm unit comprising an arm having a spherical bearing at a first end thereof for connection to said shock absorbing door arm and a tapered shaft coupling assembly at a second end thereof for connection to said operator unit.

15. The door operator assembly of claim 13, wherein said shock absorbing door arm comprises a solid arm and a hollow arm connected through a threaded housing, said hollow arm rotating in relation to said threaded housing for length adjustment of said shock absorbing door arm.

16. The door operator assembly of claim 15, said solid arm and said hollow arm being further connected by a shock-absorbing medium.

17. The door operator assembly of claim 12, said second mounting bracket being mounted on the frame of the door through a spherical bearing.

18. The door operator assembly of claim 12, said second mounting bracket being affixed to the door.

19. The door operator assembly of claim 1, wherein said arm linkage is linear when the door is fully opened.

20. The door operator assembly of claim 14, wherein said drive arm unit and said shock absorbing door arm are integrated into an integrated arm unit.

21. The door operator assembly of claim 1, wherein said motor is one of: i) a low voltage brushless DC motor and ii) an ironless core DC brush motor.

22. The door operator assembly of claim 1, said operator unit comprising a spring assembly for storing energy on an open cycle, the energy being released during a closed cycle.

23. The door operator assembly of claim 22, wherein an eccentric is used to load the spring assembly and provide a torque to close the door.

24. The door operator assembly of claim 23, said eccentric having a symmetric profile.

25. The door operator assembly of claim 22, wherein a force of the spring assembly is adjustable by a spring adjustment set screw.

26. The door operator assembly of claim 23, wherein a profile of said eccentric is used to control a torque on the door to be a constant through a range of door motion.

27. The door operator assembly of claim 23, wherein a profile of said eccentric is used to provide increased torque near a closed position of the door.

28. The door operator assembly of claim 1, said motor and said controller being low voltage devices.

29. The door operator assembly of claim 12, wherein said second mounting bracket is mounted above the frame of the door, while said operator unit is mounted to the door.

30. The door operator assembly of claim 12, wherein said second mounting bracket is mounted on the frame of the door, and said operator unit is mounted to a face of the door.

31. The door operator assembly of claim 12, wherein said second mounting bracket is mounted on the door while the operator unit is mounted on the frame of the door.

32. The door operator assembly of claim 12, wherein said second mounting bracket is mounted on the frame of the door, and the operator unit is mounted to the door by an adaptor.

33. The door operator assembly of claim 1, mounted at one position selected in the group consisting of: i) above the door, ii) directly between a frame of the door and the door; iii) to an interior face of the door; iv) to an exterior face of the door; in a swing or out swing application.

34. The door operator assembly of claim 8, wherein said power pack temporarily stores energy for use in closing the door.

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