The power drive and speed control means for a revolving door along with related electrical control circuitry and mechanical components are all contained compactly in the center shaft or column of the door structure. Costly and time-consuming servicing of parts mounted in the ceiling or floor is eliminated.

19 Claims, 9 Drawing Figures
REVOLVING DOOR OPERATING AND SPEED CONTROL MECHANISM

BACKGROUND OF THE INVENTION

The revolving door art has been considerably improved and refined in recent years in the interest of economy of manufacturing and installation, reliability of operation and safety. For example, in prior art U.S. Patents to Shekells, No. 3,307,660 and No. 3,349,876, dated respectively Mar. 7, 1967 and Oct. 31, 1967, low profile speed control mechanisms for revolving doors are disclosed which include highly compact centrifugal brake mechanisms and coating continuous lubrication means. In the later of the above Shekells patents, a motor drive and clutch arrangement is disclosed in combination with centrifugal brake means and a lubricating pump. In an even more recent Shekells U.S. Patent, No. 3,497,997, dated Mar. 3, 1970, a quarter-line electrical stop control system for revolving doors is disclosed ensuring immediate and easy starting of the power operated door in response to finger tip pressure, followed by a smooth controlled speed cycle of operation and a safe slowing to an automatic stop at the quarter-line position. These patented prior art features have advanced the revolving door art to a state of relatively high sophistication and have eliminated many of the chief deficiencies and inconveniences of the older prior art which, to some extent, have hindered public acceptance and commercial acceptance of revolving doors, despite numerous recognized advantages inherent therein.

In spite of the relatively advanced state of the art, at least one persistent problem has remained unsolved with the result that installation and maintenance costs for revolving doors remain relatively high. More particularly, this problem is concerned with the placement of operating and speed control mechanisms and associated components for revolving doors either in the ceiling above the door or in the underlying floor structures. In spite of great improvement in the compactness and relatively simplicity of these mechanisms, the necessity for mounting them above or below the door proper and for servicing the mechanisms in these locations continues to be rather awkward and expensive.

It is therefore the object of the present invention to completely eliminate this continuing difficulty or problem by arranging all of the operating and control components within the center shaft of the revolving door in such a way that initial installation and subsequent servicing of the door is rendered much more convenient and economical. In effect, the revolving door becomes substantially a self-contained assembly or unit which can be bodily removed from the doorway with little difficulty in the event that major maintenance operations are necessary. The only components remaining in the ceiling and floor are a simple overhead vibration absorber and a bottom support bearing for the door structure. The center shaft which contains the power drive and speed control elements as well as the quarterline stopping means is constructed in such a manner as to be relatively simple to disassemble when necessary for maintenance. The particular power drive and speed control elements of the mechanism have the ability by virtue of their very compact design to be contained totally in the center shaft of the door without rendering the center shaft excessively large and thus preserving the architectural merits of the door construction.

BRIEF DESCRIPTION OF DRAWING FIGURES

FIG. 1 is a side elevation of a revolving door embodying the present invention.
FIG. 2 is an enlarged fragmentary central vertical section taken through the center shaft and associated elements of the revolving door, partly in elevation.
FIG. 3 is an enlarged fragmentary central vertical section through the speed control mechanism and associated elements in the center shaft.
FIG. 4 is an enlarged horizontal section taken on line 4—4 of FIG. 3.
FIG. 5 is a similar section taken on line 5—5 of FIG. 3.
FIG. 6 is a similar section taken on line 6—6 of FIG. 3.
FIG. 7 is a similar section taken on line 7—7 of FIG. 3.
FIG. 8 is a partly schematic horizontal section taken on line 8—8 of FIG. 3, with parts omitted and showing quarter-line stop control switches and the associated relatively movable magnetic strip.
FIG. 9 is a sectional view similar to FIG. 3 showing a modification.

DETAILED DESCRIPTION

Referring to the drawings in detail wherein like numerals designate like parts, the numeral 10 designates a revolving door in its entirety, of the type consisting of four circumferentially equidistantly spaced wings 11 radiating from a vertical center shaft 12. The revolving door according to the invention is substantially a self-contained assembly or unit and is installed between a ceiling structure 13 and floor 14 in a very expeditious and simplified manner. More particularly, the top relatively stationary cylindrical sleeve 15 forming the upper end of the center shaft 12 has a radial flange 16 connected by a suitable number of bolts 17 to a block-like element 18 of vibration-absorbing material. The element 18 lies snugly between a pair of horizontal ceiling joists 19 and rests on the bottom plate of the ceiling structure, as shown in FIG. 2. Through the yielding elements 18, the upper end of the center shaft 12 is firmly held and is insulated against shocks and vibrations.

The entire revolving door 10 including the center shaft 12 is supported on the floor 14 through a short upstanding stub shaft 20 resting on a base 21 which is recessed into the floor 14. A suitable low friction thrust-type bearing 22 on the stub shaft 20 supports the revolving door by being recessed into a cap or plug 23, secured rigidly in the bore of a lower end sleeve 24 constituting the bottom terminal of the center shaft 12 and being a rotational component of the center shaft. Thus, the entire door structure has a simplified two point support through the top and bottom terminals of the center shaft 12, whereby installation and removal of the door is greatly simplified.

Within the lower end portion of the top non-rotatable sleeve 15 is a door drive motor 25 having a central depending drive shaft 26 adapted to revolve at approximately 750 RPM. The space above the motor 25 in the bore of the sleeve 15 is utilized to house the electronic controls for the quarterline stop system substantially as disclosed in the prior Shekells U.S. Patent No.
3,497,997. These electronic controls in the sleeve 15 are indicated diagrammatically at 27 in FIG. 2. The casing of drive motor 25 is fixedly secured by bolt means 28 to a ring 29 in the lower end of sleeve 15 and fixed to the sleeve so as to become a part of the non-rotating section of the center shaft 12. An upwardly open cup-like coupling 30 has screw-threaded engagement within the ring 29, FIG. 3, and has a bottom wall 31 recessed to receive a ball bearing 32 or the like for rotation of the center shaft 12. Immediately below the coupling 30 in the center shaft 12 is a harmonic drive 33 or speed reducer substantially of the type disclosed in U.S. Pat. No. 2,906,143 to Musser dated Sept. 29, 1959. This harmonic drive is manufactured and sold by USM Corporation, Gear Systems Division, as Model IM. The harmonic drive 33 embodies a central vertical input shaft 34 connected by a rigid coupling 35 with the drive shaft 26 of motor 25. The coupling 35 contains a one-way active and one-way free wheeling clutch 36, such as a Torrington roller clutch, and the input shaft 34 of the harmonic drive is driven through this clutch 36, as shown in FIG. 3, the clutch rendering the shaft 34 free-wheeling or free-turning in the same direction in which it is driven even whenever the speed of the shaft 34 exceeds the driving speed of the shaft 26. The harmonic drive 33 further comprises, as disclosed in the Musser patent, an elliptical bearing 37 driven by a loose fit connector 38 on the input shaft 34. The outer race 39 of elliptical bearing 37 is received within the bore of a thin-walled normally cylindrical cup 40 having a multiplicity of spline teeth 41 on the exterior thereof around the top open end of the cup. The side wall of cup 40 will flex or deflect radially in response to rotation of the elliptical bearing 37 and the points of deflection in the cup wall will advance circumferentially around the cup during the unique action of this drive, as explained in the Musser patent.

Surrounding the upper end portion of the cup 40 adjacent to its teeth 41 is a rigid internally toothed ring gear 42 whose teeth 43, FIG. 4, will be intermittently engaged at two opposing positions with the teeth 41 of the deflectable cup 40 as the elliptical bearing 37 rotates. Approximately 20 teeth on the cup 40 will be engaged with the ring gear teeth at any one time. As the wall of the cup 40 is deflecting in and out during turning of the elliptical bearing, the cup teeth 41 are pushed into engagement with the ring gear teeth, and due to a difference in the number of teeth on the cup and ring gear, the cup will gradually revolve relative to the ring gear. In practice, there may be one hundred of the teeth 41 on the cup and one hundred and two teeth on the surrounding ring gear 42. With this arrangement, the cup 40 will glide over two teeth on the ring gear during each revolution of the bearing 37, thus imparting the desired rotational speed to the rotary section of the door center shaft 12. With the motor shaft 26 turning at 1750 RPM, there will be a 200:1 speed reduction through the drive 33 with the described embodiment of the drive, and the revolving door shaft will be driven at approximately 8.5 RPM which is a safe walking speed for users of the door. A constantly advancing sinusoidal deflection wave is set up in the cup side wall due to the movement of the balls in bearing 37 around the elliptical race of the bearing.

The ring gear 42 is held against rotation by screws 44 and through these screws is joined rigidly to the coupling 30 and thus becomes a part of the non-rotating section of the door center shaft 12 along with the top sleeve 15. The same screws 44 also join the ring gear 42 to another ring section 45 directly therebelow and a reduced diameter extension 46 on the bottom of this ring section serves as a seat for another low friction bearing 47 which is interposed between the non-rotating and rotating sections of the center shaft 12.

In this latter connection, the bottom wall 48 of the cup 40 is secured by screws 49 to the upper section 50 of a shock-absorbing Boston coupling. This coupling which is of a well known type embodies a coacting lower section 51. As best shown in FIG. 6, the two sections 50 and 51 of the Boston coupling have upwardly and downwardly directed interdigitating fingers 52 and 53 intervened by circumferentially spaced resilient fingers or strips 54, radiating from a center resilient body 55. The harmonic drive 33 tends to create a cyclic vibration in the center shaft 12 and this Boston coupling is very effective in absorbing the vibration and eliminating it. The Boston coupling composed of the two sections 50 and 51 being joined to the cup 40 of the drive 33 becomes a part of the rotating section of the center shaft 12. Surrounding the harmonic coupling 33 and stationary components 31, 42 and 45 is an external sleeve 56 also forming a part of the rotating section of the door center shaft. This sleeve is fixed to coupling part 50 by screws 57. The top end of the rotating sleeve 56 overlaps an annular seal 58 mounted on an annular shoulder 59 of the non-rotating coupling 30. This establishes an oil barrier or seal between the non-rotating and rotating sections of the door center shaft 12.

An additional ring 60 immediately above the seal 58 is secured suitably to the sleeve 56 and rotates therewith. On its interior, the rotating ring 60 carries an arcuate magnetic strip element 61, FIG. 8, which corresponds to the magnetic strip 23 in the Sheckells U.S. Pat. No. 3,497,997 and functions in precisely the same manner to provide the automatic quartermile stop feature disclosed in said patent. The teachings of this Sheckells patent concerning the quartermile stop control system are incorporated by reference totally into the disclosure of this application, and therefore it is unnecessary to completely describe the quartermile stop control system herein. The nonrotating ring 29 contains embedded therein a plurality of magnetic reed switches 62 whose spacing and relation to the magnetic strip 61 is essentially identical to the arrangement of the reed switches in U.S. Pat. No. 3,497,997, and the switches 62 operate in the same manner in connection with the control circuitry as disclosed in the Sheckells patent. Whenever there is relative rotation between the non-rotary and rotary sections of the center shaft 12, there will be corresponding relative rotation between the magnetic strip 61 and the reed switches 62.

In order to regulate and limit the rotational speed of the revolving door 10, a centrifugal brake mechanism is utilized in conjunction with the harmonic drive 33. This brake mechanism is shown in FIGS. 3 and 5 and comprises a pair of back-to-back massive semi-circular shoes 63 having friction linings 64, the shoes being contained inside of a cup-like drum 65 whose bottom wall is fixedly secured by the screws 49 to the section 50 of the Boston coupling and to the cup 40. Therefore, the drum 65 turns with the cup 40 and the other related parts which make up the rotational portion of the center shaft 12.
However, as will be fully explained, there can be relative rotational movement between the brake shoes 63 and the drum 65 to facilitate this relative movement, the two shoes 63 are coupled to the input shaft 34 of drive 33 by diametrical pins 66 anchored within openings 67 of the shaft 34 and extending slidably into radial guide openings 68 of the brake shoes. The brake shoes are adapted to expand outwardly along the guide pins 66 under the influence of centrifugal force until the linings 64 engage the drum 65. Expansion of the shoes 63 is resisted by springs 65 FIG. 3; mounted on headed pins which are anchored to the adjacent portion of shaft 34. The lower end of the shaft 34 is jour- nelled within a low friction bearing 69 held in a recess of the coupling section 50 so that relative rotation can occur at proper times between the shaft 34 and the drum 65 and associated parts. The bearing 32 in a similar manner forms a journal for the upper portion of shaft 34 which must also rotate relative to the stationary elements of the center shaft 12, all previously identified.

The revolving door 12 additionally comprises hanger or suspension means for the door wings 11 on the center shaft 12. This hanger means is in two sections or units 70 on the center shaft 12 above and below the vertical center of the door, FIG. 1. The details of one hanger unit are shown primarily in FIGS. 3 and 7, it being understood that the two units 70 are identical and therefore a description of one unit will serve to de- 10cribe both. It should be pointed out that both hanger units 70 are carried by the revolving portion of the door center shaft 12.

The upper unit 70 of the hanger means, referring to FIGS. 3 and 7, comprises a coupling 71 immediately below the lower section 51 of the Boston coupling and having a firm screw-threaded connection therewith as shown at 72. The coupling 71 forms another segment of the rotating section of the center shaft 12 below the Boston coupling. Under the coupling 71 in stacked concentric relation are four sturdy hanger rings 73 for the four wings 11 of the door. The lower hanger unit 70 similarly embodies four hanger rings 73. Referring to FIG. 3, the several rings 73 are separated by low friction bearings 74 and a similar bearing 75 is placed beneath the lowest hanger ring 73 and an underlying disc or plug 76. A similar disc 76' lies below the lowermost ring 73' of the lower hanger unit 76, FIG. 2. Still another disc 77 of a similar nature is disposed above the uppermost ring 73'.

The discs 76 and 77 are disposed in the end portions of a vertical cylindrical tube section 78 forming an intermediate part of the revolving portion of center shaft 12, FIG. 1. The disc 76' and the plug 23, FIG. 2, are similarly held in the lower sleeve 24 which constitutes the lowest portion of the revolving part of the door center shaft. The elements 71, 73 and 76, FIG. 3, and the elements 77, 73' and 76'FIG. 2, all receive through aligned central axial openings a center hanger shaft 79 common to the two hanger units 70. The top of this central shaft is securely locked to the coupling 71 by a nut 80 which engages a threaded extension 81 on the top end of the shaft 79. Another nut 82, FIG. 2, similarly locks the lower end of the shaft 79 to the disc 76'. Thus, the center hanger shaft 79 is fixed and non-rotatable relative to the several rings 73 and 73' although it forms a part of the rotating portion of the door center shaft 12.

Each door leaf 11 has a marginal frame or molding 83 and each interior vertical section of the door wing moldings adjacent the center shaft 12 carries a rigid solid framing bar 84, these bars being held in bearing parts 85 on the moldings 83, FIG. 7. The framing bars 84 are preferably constructed in sections which are joined adjacent to the units 70 by dowel type socket connections 86, where the interfitter pin and socket elements are polygonal in cross section. The top and bottom extremities of the framing bars 84 are splined at 87 to horizontal framing bars 88 in the tops and bottoms of the door wing moldings. In a similar manner, the horizontal bars 88 are connected to vertical framing bars, not shown, on the outer sides of the door wings. Thus, each wing 11 is framed by a system of rigid bars so that the wing cannot sag or be deflected which would cause breakage of glass. Additionally, the vertical bars 84, as will now be described, form the wing supporting elements which connect with the hanger or suspension rings 73 and 73'.

Continuing to refer to FIGS. 3 and 7, the hanger rings 73 and 73' each have a single radial knuckle 89 projecting therefrom at one circumferential point. The knuckles 89 of rings 73 and the corresponding knuckles 89' of rings 73' are spaced 90° circumferentially from the knuckles of rings immediately above and below.

This arrangement establishes the proper circumferential spacing of the door wings 11 around the center shaft 12. As illustrated in FIG. 3, the several knuckles 89 receive reduced diameter sections 84' of the bars 84 and this is also illustrated in FIG. 7. Associated with each knuckle 89 is a yielding pin detent 90 on the particular ring 73 or 73' releasably held within a recess 91 in the adjacent bar portion 84' by a compression spring means 90' contained in the body portion of the ring 73 or 73' at an acute angle to the common center line for elements 79 and 84'. This forms a first safety release for each door wing 11 allowing the wing to collapse or pivot around the axis of the bar 84 when approximately 400 foot pounds of torque is applied to the wing. Below this level of force, the detents 90 will maintain a rigid connection between the wings 11 and the rotating portion of the center shaft 12.

A second or back-up or safety release for the revolving door is provided by the inclusion of an additional spring-loaded detent 92 on each ring 73 and 73'inwardly of the detents 90. Detent pins 92 engage releasably in recesses 93 formed in the hanger center shaft 79 at 90° intervals. This double release arrangement on the door wings allows the four wings to yield under torque loading and collapse into parallelism like the leaves of a book. If there was only a single collapse point for each wing at the center axis of the door, the wings could collapse under pressure but could not be pressed around into the desired compact formation because the rigid wings could not wrap around the center shaft. Consequently, the double jointed arrangement is required. This wing folding arrangement is necessary on all revolving doors so that people under panic conditions can pass through the doorway in two streams of traffic without having the wings impede their travel.

Returning to the operation of the speed control means for the revolving door 16, it should be men- tioned that the door may be motor driven as shown and described, or may be manually operated without a motor and therefore without the electrical quarterline stop feature of U.S. Pat. No. 3,497,997. In the illus-
trated arrangement where the motor 25 and the quart-
terline stop control system of U.S. Pat. No. 3,497,997
are employed, the motor shaft 26 will be driven at ap-
proximately 1750 RPM, and through the one-way ac-
tive clutch 36, the input shaft 34 of harmonic drive 33
will be driven at a similar speed. The centrifugal brake
means will not be activated at this time because the
springs 65 resist application of the brake until a speed
somewhat in excess of the motor shaft speed is reached,
as when someone attempts to operate the revolving
door at a running speed rather than a safe walking
speed.

With the shaft 34 turning at normal motor shaft
speed, the eccentric bearing 37 of the harmonic drive
is turned by the loose fit connector 38 and the previ-
sously-described advancing deflection wave is set up in
the cup 40 and due to the difference in the number of
teeth 41 on the cup and the number of teeth 43 on the
non-rotating ring gear 42, the previously described
200:1 reduction in speed between the motor shaft 26
and the cup 40 will be achieved. This means that the
cup 40 and all parts of the center shaft 12 secured
thereto will now revolve at approximately 8.8 RPM
which is a safe walking speed. Because of the utilization
of the Reed switches 62 and magnetic strip 61 and the
relative rotational movement of these parts, the quart-
terline automatic stop and the finger tip pressure start-
up of the revolving door 10 will take place exactly as
disclosed in the Checkells U.S. Pat. No. 3,497,997 and
therefore this important feature has also been built
bodily into the center shaft 12 along with the speed
controller and other associated components.

Whenever someone pushes against one of the leaves
11 while walking or running through the revolving door
at more than a safe speed, such pushing force is trans-
mitted from the door wing through the hanger and
safety detent structure shown in FIGS. 3 and 7 to the
revolving section of the center shaft 12. This revolving
section includes the cup 40 of the harmonic drive. This
cup 40 has a gear tooth 100 which is normally engaged
by the driving motor 25 but will be turning in the same
direction. Therefore, the harmonic drive 33 will begin to operate in an opposite
manner as a speed increaser, rather than a speed
reducer, back through the interengaging teeth 41 and 43
and through the eccentric bearing 37 and shaft 34. The
one-way active clutch 36 will permit the shaft 34 to re-
voice in the same direction at a speed greater than the
1,750 RPM produced by the motor shaft 26. This
greater speed will reach a degree approximately when
the user of the revolving door 10 causes it to turn more
than 12 RPM sufficient to overcome the restraining
force of the springs 65 and the resulting centrifugal
force at the speed above 1,750 RPM will cause applica-
tion of the centrifugal brake. That is to say, the shoes
63 will shift radially outwardly and the linings 64 will
contact the interior of drum 65 and the revolving com-
ponent of the center shaft 12 carrying the wings 11 will
be gently slowed down to a safe speed automatically;
such safe speed not exceeding the normal approxi-
mately 12 RPM established and maintained by the driv-
ing motor 25. This automatic braking action on the re-
volving door will occur whenever a user pushes the
door at more than a prescribed safe speed. When the
speed of the door has returned to normal, the motor 25
again takes over and continues to drive the door at a
normal speed below that at which the brake will be ac-
tivated by centrifugal force, namely, not exceeding
1,750 RPM.

In cases where the revolving door is not power-driven
and no motor is involved, the door is pushed manually
in the customary manner for non-powered doors. How-
ever, in this situation, whenever the user speeds up the
door beyond the predetermined safe speed, the har-
monic drive 33 will regulate the speed by causing appli-
cation of the centrifugal brake means in the same man-
ner described immediately above where the user re-
volves the door in excess of the speed established by a
motor. That is to say, the excessive speed will be trans-
mitted to the shaft 34 through the drive 33 as a speed
in excess of that at which the brake will remain inac-
tive. As a consequence, the invention speed controller
operates essentially the same with or without a power
drive.

In FIG. 9, a modification is shown wherein the ar-
range ment of the harmonic drive 94 is reversed in com-
parison to the drive 33 in the previous embodiment.
That is to say, in FIG. 9, the ring gear 95 having the
internal spline teeth 96 is secured as at 97 to a revolving
component 98 of the door center shaft 99 instead of to
a fixed component as in the prior embodiment. The
cup-like deflectable gear 100 with the external teeth
101 is inserted relative to the cup 40 in FIG. 3 and is
attached at 102 along with an inverted brake drum 103
to a fixed coupling part 104 of the door center shaft 99.

FIG. 9 additionally shows a drive motor 105 similar
to the motor 25 inside of fixed sleeve 106 and the shaft
of this motor is coupled to a center drive shaft 107
through a one-way engaging clutch 108 corresponding
to the clutch 36 in FIG. 3. The drive shaft 107 is jour-
neled for independent rotation in bearings 109 and 110
and the lower end of the shaft 107 is coupled with and
drives an elliptical bearing 111 through a loose fit con-
ector 112 similar to the connector 38. The elliptical
bearing engages inside of the lower end of the cup gear
100 near the teeth 101 and 96.

As in the prior embodiment, the centrifugal force ac-
tuated brake shoes 113 are pinned to the shaft 107 by
guide pins 114, which pins slidably engage within radial
openings of the shoes. Radial expansion of the shoes is
resisted by springs 115 whose tension may be adjusted.

In FIG. 9, the previously-described quarterline stop
control means is indicated, the Reed switches 116 being
carried by the fixed element 104 adjacent to the mag-
netic strip 117 carried by the rotatable part 98 of the
center shaft.

The mode of operation of the drive and speed con-
troller is essentially identical to the mode of operation
in the prior embodiment except for the described re-
versal of the gears 95 and 100 and associated elements
and it is believed that the description need not be re-
peated for a full understanding of the modification by
anyone skilled in the art.

The terms and expressions which have been em-
ployed herein are used as terms of description and not
of limitation, and there is no intention, in the use of
such terms and expressions, of excluding any equiva-
lents of the features shown and described or portions
thereof but it is recognized that various modifications
are possible within the scope of the invention claimed.

I claim:

1. A revolving door comprising a center shaft adapted to be positioned in a doorway between the
celling and floor structures of said doorway, said center
3,766,686

shaft being at least in part rotatable on the longitudinal axis thereof, radiating circumferentially spaced door wings attached to the center shaft and revolving with the rotatable part of the center shaft in the doorway, and speed control means for the revolving door mounted bodily inside of said center shaft.

2. The structure of claim 1, and said speed control means for the revolving door comprising a rotational speed changing drive within the center shaft coupled to the rotatable part of the center shaft, and a centrifugal force actuated brake means coupled to said drive and adapted to engage an element of said rotatable part of the center shaft when said drive causes rotation of the brake means at a speed in excess of a prescribed rotational speed.

3. The structure of claim 2, and a drive motor for the revolving door inside of said center shaft and having a driving connection with said speed changing drive.

4. The structure of claim 3, and said center shaft comprising a fixed section and a rotatable section, said rotational speed changing drive having a connection with each section of the center shaft, and coacting electrical means on the fixed and rotatable sections of the center shaft associated with said drive motor and operable to stop the revolving door automatically at a quarterline position and also initiating the starting of the revolving door in response to manual pressure thereon.

5. The structure of claim 2, and a resilient coupling means in the rotatable part of said center shaft to absorb torsional vibrations created by said rotational speed change drive.

6. The structure of claim 2, and hanger means for said door wings on the rotatable part of the center shaft.

7. The structure of claim 6, and said hanger means including pivotal bearing supports for the door wings, and yielding detent means carried by the hanger means and engageable with said wings and permitting the wings to collapse in response to excessive manual pressure thereagainst.

8. The structure of claim 4, and a lubricant seal interposed between said fixed and rotatable center shaft sections.

9. The structure of claim 1, and support means for the ends of the center shaft adjacent said ceiling and floor structures and being substantially flush with the exterior faces of the ceiling and floor structures.

10. The structure of claim 9, and said support means for the lower end of the center shaft adjacent the floor structure including a low friction bearing having a connection with the rotatable part of the center shaft, and means to anchor the bearing to the floor structure.

11. The structure of claim 9, and said support means for the upper end of the center shaft adjacent the ceiling structure comprising a resilient body attached to the ceiling structure and secured to a non-rotatable part of the center shaft.

12. The structure of claim 4, and electrical control circuitry for said drive motor and coacting electrical means disposed inside of said center shaft.

13. The structure of claim 3, and said center shaft comprising fixed and rotatable sections, said rotational speed changing drive including a gear element anchored to one of said sections of the center shaft, a coacting deflectable gear element attached to the other of said sections and positioned to engage the first-named gear element, an eccentric operator for said deflectable gear element connected with and driven by said motor and operable to create a circumferentially traveling deflection wave in the deflectable gear element to thereby induce relative rotation between said deflectable and first-named gear elements, and a centrifugal force actuated brake means connected with and driven by said eccentric operator and adapted when activated to arrest relative rotation between said fixed and rotatable sections of the center shaft.

14. The structure of claim 13, and said deflectable gear element comprising a thin-walled cup-like element arranged within the first-named gear element, the first-named gear element being a ring gear, a brake drum arranged inside of said cup-like element and secured to one of said sections of the center shaft, and said brake means comprising radially expansible brake shoes arranged inside of said drum.

15. The structure of claim 13, wherein the first-named gear element is anchored to said fixed section of the center shaft and said deflectable gear element is attached to the rotatable section of the center shaft.

16. The structure of claim 13, and said first-named gear element is anchored to the rotatable section of the center shaft, and said deflectable gear element is attached to the fixed section of the center shaft.

17. The structure of claim 13, and a driving shaft for said brake means having a connection with said eccentric operator and coupled with and driven by said drive motor.

18. The structure of claim 17, and a one-way active clutch coupling between said driving shaft and motor.

19. The structure of claim 18, and said eccentric operator comprising an elliptical bearing element coupled to said driving shaft and engaging inside of said deflectable gear element.