

ELECTRICALLY-OPERATED ROLLER DOOR

This invention relates to an improved electrically operated roller door or shutter, and in particular to the operating mechanism by which the door or shutter curtain can be wound onto or unwound from its supporting drum (or rim) wheels to thereby open or close same.

BACKGROUND OF THE INVENTION

It is well known to operate roller doors by means of chain and sprocket mechanisms; however, such systems are not very satisfactory in that they require periodic service, are noisy to operate and require regular lubrication.

It is also well known to control the operation of the roller door or shutter by electrical means. Two known mechanisms make use of an electric motor having a reduction gear mechanism operatively associated therewith terminating in a pinion which is arranged to mesh with a ring gear to rotate the door curtain in a rolldown or rollup direction. The electric motor in each case is mounted on a movable bracket which can be displaced by actuation of manually operable releasable latch means to a position wherein the pinion no longer meshes with the ring gear whereupon the door curtain may be raised or lowered by hand.

With both arrangements, the electric motor and its supporting bracket is mounted externally of and to one side of the curtain drum or rim wheel and as a result, the installation of these control mechanisms require

5 additional room or space. Furthermore, with the electric motor and its associated gear train exposed in this manner, accidental damage may result, for example by a knock or blow, and furthermore the mechanism is likely to accumulate dust and dirt particles which may impede its
10 operation.

It is the main object of the present invention to provide an improved electrically-operated roller shutter or door which requires no additional room or space than is

15 required with the normal installation of a conventional roller door and wherein the likelihood of damage (due to external forces), to the operating mechanism is less likely to occur.

20 It is a further object of the present invention to provide an improved electrically-operated roller door assembly of improved appearance, of less cost and which is able, in the event of a power failure, to be easily operated by hand.

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BRIEF SUMMARY OF THE INVENTION

Briefly, in accordance with the present invention there is provided roller door curtain or shutter assembly

30 comprising a roller door curtain or shutter, drum support means onto which and from which the roller door curtain or shutter can be wound and unwound, a reversible electric motor attached to said drum means for bodily rotation therewith, a reduction gear mechanism having an input
35 connected to the motor and an output terminating in a driving pinion, and a ring gear with which the pinion meshes in use which in use is fixed against rotation to

cause the drum means and motor to rotate to unwind or wind up the roller door or curtain when the motor is driven by virtue of the reaction between the driving pinion and the fixed ring gear.

Preferably the drum means comprises axially spaced drum wheels supported on a drum shaft, said motor being attached to one of said drum wheels for said bodily rotation.

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There may be a releasable locking means for holding the ring gear against rotation, but which is selectively releasable to enable the ring gear to rotate with the drum means.

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Preferably, the assembly includes a stationary body spaced axially outwardly from said ring gear, said releasable locking means releasably connecting said stationary body and ring gear.

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The assembly may further comprise a bushing member coaxial with the drum shaft and being secured to the outer face of the end of the drum means adjacent said ring gear so as to rotate therewith, the axial length of the bushing member being sufficient to support said stationary body thereon, there being clamping means to retain said stationary body and said ring gear in contiguous relationship and also to prevent relative axial displacement of same.

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According to a further preferred feature, said ring gear comprises a cup-shaped body having internal gear teeth, said body having a wall defining a central aperture, and wherein said stationary body comprises an annular plate-like member having an annular locating boss co-axial with its said central axis for locating said ring gear against radial displacement, said locating boss having an outer diameter which is slightly less than the diameter of the central aperture of said ring gear, a portion of the outer surface of said boss being a bearing surface engaging the wall defining said central aperture.

Also, there may be included fixing means fixably connecting said stationary body with respect to support brackets which support said shaft, said fixing means comprising a connector rod secured to said stationary body and extending axially outwards therefrom and an anchor block non-rotatably mounted on one of said shaft support brackets, said connector rod being fixably connected to said anchor block.

The releasable locking means may comprise a pin carried by a said stationary body movable between a position of engagement wherein said ring gear is locked against rotational movement, and a disengaged position wherein said ring gear is free to rotate.

The pin may have operatively associated therewith a compression spring urging said pin towards its position of engagement with said ring gear.

The ring gear is preferably in permanent meshing engagement with said driving pinion.

The pinion and ring gear are preferably made of synthetic plastics material, suitably nylon.

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An embodiment is described hereunder in some further detail in order to more fully explain the Applicant's invention, with reference to and illustrated in the accompanying drawings in which:-

5. Fig. 1 is an end view of a roller door assembly, according to this invention,

Fig. 2 is a vertical sectional view taken through the drum wheel to which is secured the electric motor,

Fig. 3 is an end view partly sectioned, taken along the
10. lines 3-3 of Fig. 2; and

Fig. 4 is a section view taken along the lines 4-4 of Fig. 3.

In this embodiment, a roller door assembly 10 comprises a fixed or stationary supporting shaft 11 which is mounted
15. above an opening in a wall 12 by means of right-angle support brackets 13 arranged one adjacent each end of the shaft 11, the shaft 11 being secured to the brackets 13 by U-bolts 14 and threaded nuts 15. Two drum or rim wheels 18 (one only of which is shown) are rotatably carried on the supporting
20. shaft 11, one adjacent each end thereof, the rim wheels 18 being of conventional design having a plurality of web-like spokes extending from a hub 19 slidably engaged on the shaft 11. A flexible metal door curtain 20 (of known design) is wrapped or rolled up around the two drum wheels 18 and
25. rotation of the wheels 18 causes the door curtain 20 to be

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raised or lowered as desired to thus open or close off respectively, a doorway in the wall 12. The side edges of the door curtain 20 are slidably received in vertical channel-shaped guides 22 secured to the wall 12 at
5 opposite sides of the doorway.

In order to effect rotational drive to the drum wheels 18, there is provided a reversible electric motor 23 which has fixedly associated therewith a gearbox 24 which includes a
10 reduction gear mechanism, the reduction ratio of which can be selected to suit the speed at which the door is desired to be opened or closed. The electric motor 23 and gearbox 24 are secured to one of the drum wheels 18 adjacent the
15 periphery thereof by means of clamping members 26 passing through apertures in one of the spokes of the wheel 18 being threadably engaged in bosses 27 on the gearbox housing 24. The motor 23 is located axially inwards of
the drum wheel 18 to which it is fixed and is housed within the core of the door curtain, that is, within the
20 space defined by the inner most winding or convolution 28. The output shaft 29 from the gearbox 24 extends axially through an aperture 30 in the drum wheel 18 and carries a pinion 33 secured thereto by means of a bolt 34. The
pinion 33 meshes with a gear wheel or ring gear 35 having
25 internal gear teeth located over a bush 36 which is in turn rotatably carried on the fixed shaft 11, the bush 36 being secured by bolts to

the drum wheel 18 so as to rotate therewith. The ring gear 35 is substantially cupshaped and has a base wall 37 in which is formed a central opening, the diameter of which is large relative to the outer diameter of the bush 36. The ring gear 35, pinion 33 and bush 36 are all made of nylon in this embodiment.

Also supported on the bush 36 is a stationary or non-rotating main mounting body 38 positioned axially outwards of but contiguous with the ring gear 35, the main body 38 having an integrally formed annular boss 41 which projects through the central opening of the ring gear 35, the boss 41 being arranged to locate the ring gear 35 against radial displacement with respect to the bush 36 and to provide a bearing surface on which the ring gear is able to rotate. The main body 38 is held stationary by means of an axial connector rod 39 fixed to the outer face thereof the outer end of the rod 39 carrying an anchor block 40 which in turn is non-rotatably mounted on the mounting bracket 13. In this embodiment, the anchor block 40 is formed with a L-shaped slot 42 through which extends the horizontal arm 43 of the bracket 13. It will be realized that the mounting body 38 may be held stationary by simply fixing it to the shaft 11 using grub screws, for example. The body 38 and ring gear 35 are retained in position on the bush 36 by means of a split clamping ring 43' which abuts against an annular shoulder

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can be opened or closed.

- In the event of malfunction of the electric motor, or in the event of a power failure, the door may be manually operated simply by a person releasing the pin 45 from its extended position wherein the stem projects axially through the wall 50 of the ring gear 35. When the pin 45 is retracted, the ring gear 35 is thus free to rotate with respect to the supporting shaft 11 and as the drum wheel (along with the motor fixed thereto) is also free to rotate, the door curtain 20 can be very easily raised and lowered by hand. When the door is so manually operated, the electric motor, gearbox and pinion are bodily rotated and such an arrangement avoids one having to rotate the spindle of the motor 23 (which possibly could not be done in any case). It will thus be realized that it takes very little effort indeed to raise and lower the door curtain by hand.

- The electric supply to the motor 23 is provided by a circuit (not shown) and includes brushes 55 carried on the body 38 and slip rings 56 located on the axially inner end of the bush 36, the circuit being operable to regulate the supply of electric current to the motor so as to enable opening and closing of the curtain 20. The circuit can include response means responsive to a predetermined radio code signal to initiate operation of the motor 23 to open and close the door curtain 20. The coded signal thus may be

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emitted from a radio transmitter located in a vehicle, so that opening and closing can be achieved by an operator seated in the vehicle.

- As shown in Fig. 3, the upper and lower limits of movement of the door curtain 20 are controlled by micro-switches 57 on the body 38 having contacts 58 (one only of which is shown), these being engagable by cams 59,60 carried on a cam gear 61 which meshes with an idler gear 62 which in turn meshes with driving gear 63 integrally formed on the rotating bush 36. One of the cams 59,60 controls the upper limit of movement whilst the other cam controls the lower limit. In operation as the door reaches its upper or lower limit, one of the cams engages its corresponding switch contact and actuates the micro-switch 57, actuation of the switch being detected by the operating circuit for the motor 23 and causing the motor to turn off. The operation of the switch also is effective in reversing the direction of drive of the motor. Thus when the motor is next operated, the curtain is moved in the opposite direction. As described, the door operation may be controlled by a remote radio transmitter or by manually-operated switches located near to the door opening.

- In a variation of the above embodiment (not illustrated) there is provided a rotating shaft supported in end bearings, the drum wheels in this case being secured to the shaft for rotation therewith. The ring gear is rotatably supported on the shaft by an intermediate bearing carried on the shaft.

The stationary body can also be supported on such intermediate bearing or a further bearing can be used. However, these and other variations will be seen to lie within the scope of the Applicant's invention.

5. A brief consideration of the above embodiments will indicate that the invention is extremely simple but nevertheless provides a significant improvement in the operation of and installation of an operating mechanism for an electrically operated roller door. The operating mechanism of this
10. invention can be readily adapted to existing roller door assemblies and can be of course incorporated in new roller door installations.

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CLAIMS

1. A roller door curtain or shutter assembly comprising a roller door curtain or shutter, drum support means onto
5 which and from which the roller door curtain or shutter can be wound and unwound, a reversible electric motor attached to said drum means for bodily rotation therewith, a reduction gear mechanism having an input connected to the motor and an output terminating in a driving pinion,
10 and a ring gear with which the pinion meshes in use which in use is fixed against rotation to cause the drum means and motor to rotate to unwind or wind up the roller door or curtain when the motor is driven by virtue of the reaction between the driving pinion and the fixed ring
15 gear.

2. An assembly according according to claim 1, wherein the drum means comprises axially spaced drum wheels supported on a drum shaft, said motor being attached
20 to one of said drum wheels for said bodily rotation.

3. An assembly according to claim 2, wherein the motor is attached to and located to the inside of one of said drum wheels.

25 4. An assembly according to claim 2 or 3, including a releasable locking means for holding the ring gear against rotation, but which is selectively releasable to enable the ring gear to rotate with the drum means.

30 5. An assembly according to claim 4, including a stationary body spaced axially outwardly from said ring gear, said releasable locking means releasably connecting said stationary body and ring gear.

35 6. An assembly according to claim 5, further comprising a bushing member co-axial with the drum shaft and being secured to the outer face of the end of the drum means



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adjacent said ring gear so as to rotate therewith, the axial length of the bushing member being sufficient to



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support said stationary body thereon, there being clamping means to retain said stationary body and said ring gear in contiguous relationship and also to prevent relative axial displacement of same.

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7. An assembly according to claim 5 or 6, wherein said ring gear comprises a cup-shaped body having internal gear teeth, said body having a wall defining a central aperture, and wherein said stationary body comprises

10 an annular plate-like member having an annular locating boss co-axial with its said central axis for locating said ring gear against radial displacement, said locating boss having an outer diameter which is slightly less than the diameter of the central aperture of said ring
15 gear, a portion of the outer surface of said boss being a bearing surface engaging the wall defining said central aperture.

8. An assembly according to claim 5, 6 or 7, further
20 comprising fixing means fixably connecting said stationary body with respect to support brackets which support said shaft, said fixing means comprising a connector rod secured to said stationary body and extending axially outwards therefrom and an anchor block non-rotatably
25 mounted on one of said shaft support brackets, said connector rod being fixably connected to said anchor block.

9. An assembly according to any of claims 5 to 8, wherein
30 said stationary body is made of synthetic plastics material, preferably nylon.

10. An assembly according to any of claims 5 to 9,
wherein said releasable locking means comprises a pin
35 carried by a said stationary body movable between a position of engagement wherein said ring gear is locked against rotational movement, and a disengaged position



wherein said ring gear is free to rotate.

11. An assembly according to claim 10, wherein said
pin has operatively associated therewith a compression
5 spring urging said pin towards its position of engagement
with said ring gear.

12. An assembly according to any preceding claim, wherein
said ring gear is in permanent meshing engagement with
10 said driving pinion.

13. An assembly according to any preceding claim, wherein
said pinion and said ring gear are made of synthetic
plastics material, preferably nylon.

15 14. A roller door curtain or shutter assembly
substantially as hereinbefore described, with reference to
the accompanying drawings.

