ABSTRACT

A elongated rail is provided with a carriage which can be connected with a curtain to be pulled and is movable in opposite directions on the rail between at least two positions in which further movement of the carriage is blocked. A burn-out protected reversible electromotor is mounted stationarily relative to the rail and non-slip motion transmitting components, such as a tooth belt with associated gears and rollers, are provided for transmitting motion between the electromotor and the carriage so that the latter is moved when the electromotor is energized. The fact that the electromotor is protected against burn-out permits blocking of the movement of the carriage without requiring the de-energization of the electromotor.

14 Claims, 3 Drawing Figures
POWER-OPERATED CURTAIN RAIL UNIT

BACKGROUND OF THE INVENTION

The present invention relates generally to a power-operated curtain rail unit, and more particularly to a curtain rail unit operated with the aid of a stationary electromotor.

Curtain rail units are provided for permitting pulling of a curtain between open (or partially open) and closed (or partly closed) positions. Usually, lighter curtains are hung from the curtain rail units which must be manually operated, for instance by pulling on the curtain directly or by pulling on a cord, which then moves a carriage along the rail, with the curtain being connected with the carriage. Heavier curtains, such as over-curtains, are however frequently hung from power-operated curtain rail units in which an electromotor is provided which, when energized, moves the carriage to which the curtain is connected. According to the prior art, the electromotor is switched off when the carriage has reached its curtain-opening or curtain-closing end positions, for which purpose limit switches are provided which are operated by contact with the carriage as the latter reaches the respective end position. These limit switches can, of course, also be operated by other components, but usually they are operated by abutments provided on the carriage directly. Another possibility is to provide abutments which are coupled with the drive or motion-transmitting component, for instance a belt or a chain which is connected with the carriage, and which abutments move into contact with the limit switches at the appropriate time. The switching positions can frequently be adjusted by turning an adjusting spindle or screw.

According to another embodiment of the prior art it is also possible to interpose in the energization circuit of the electromotor a time relay which automatically switches off the supply of electrical energy to the motor after a lapse of a predetermined period of time from the moment of energization. In such a case the time required for the curtain to move from the fully closed to the fully opened position, or visa versa, must be determined and the timing relay must be so set that it switches off after a lapse of this time or slightly thereafter.

To some extent all of these prior-art power-operated curtain rail units perform their intended function. They all, however, have the disadvantage in common that they will operate without malfunction only if they have been precisely adjusted. This means that when such a unit is installed, it must be installed by a specialist who spends considerable time adjusting the operation of the unit, especially because the precise switching positions frequently can be determined only by time-consuming trials. Over a period of time a further source of malfunction comes into play, namely after such units have been operated for awhile the motion-transmitting components connected with the carriage, for instance a tape, a belt or the like, tend to become somewhat stretched and thus causes a change in the pre-set switching positions. This means that the electromotor is not shut off at the proper time and that it attempts to continue moving the curtains even after the same and the carriage have reached the respective end position. This usually results in damage either to the curtains or to the belt, tape or the like, and may also result in burning-out of the motor.

SUMMARY OF THE INVENTION

It is, accordingly, a general object of the present invention to overcome the disadvantages of the prior art.

More particularly, it is an object of the invention to provide an improved power-operated curtain rail unit which is not possessed of these disadvantages.

Another object of the invention is to provide such a power-operated curtain rail unit which is simpler than those known from the art, and wherein in particular the use of limits which are end associated actuating projections or the like is avoided.

In keeping with these objects, and with others which will become apparent hereafter, one feature of the invention resides in a power-operated curtain rail unit which, briefly stated, comprises an elongated rail, and a carriage adapted to be connected with a curtain which is to be pulled. The carriage is movable in opposite directions on the rail along the same between at least two positions in which further movement of the carriage is blocked. A burn-out protected reversible electromotor is mounted stationarily relative to the rail, and non-slip motion-transmitting means connects the electromotor with the carriage to effect movement of the same when the electromotor is energized. Due to the burn-out protection of the electromotor the movement of the carriage can be blocked without requiring de-energization of the electromotor.

Burn-out protected electromotors are, of course, already known, and the invention is in particular concerned with the type in which the winding of the electromotor will not burn out even though the movement of the carriage is blocked and the electromotor continues to be energized. The type of electromotor required for use in such a curtain rail unit need have only a low power output and the winding of such an electromotor can readily be appropriately dimensioned so as to avoid becoming burned out under the aforementioned circumstances.

Of course, in such a construction the motion-transmitting means must permit no slippage whatever relative to the drive components, and they must have a greater resistance to elongation or tearing than the force exerted by the electromotor itself. With such an arrangement the electromotor may either be permitted to remain energized temporarily or, in the event for instance of an oversight, for long "permanent" periods of time without causing damage either to itself or to any of the other components of the unit.

Advantageously, the motion-transmitting means may include a toothed belt whose strength and resistance to elongation is provided or enhanced by embedding in it an in-extensible embedment or insert, for instance of spring steel, fiber glass or the like.

The belt can cooperate with a toothed gear or coupling provided on a carriage of the unit, which gear or coupling can be prevented against rotation by blocking it with an appropriate component, so that the movements of the belt can be transmitted readily and without any slippage at all to the carriage.

The blocking of the toothed gear or coupling can be effected by means of a detent pin which is prevented against undesired movement (especially out of its detent position in which it prevents rotation of the gear) by an arresting portion. The pin can be withdrawn from
the gear so as to permit the latter to rotate, after the arresting portion of the pin has been disengaged so that the gear can be adjusted by shifting the carriage longitudinally of the rail whereupon the pin is again inserted.

A gear drive is provided underneath which the electromotor may be mounted, and the output shaft of the electromotor can be coupled with the input shaft of the gear drive so as to drive the latter. The gear drive itself may be provided, either on its housing or on a frame-shaped mounting bracket, with a plurality of journal openings whose number is greater than the number of guide rollers required for guiding the toothed belt in the region of the gear drive. This makes it possible to journal the shaft of the drive rollers in desired one of these journal openings, depending upon what position the respective guide rollers are to assume with reference to the gear drive. This, in turn, makes it possible to use the gear drive either at the left-hand or at the right-hand end of the rail.

The guide rollers themselves may be provided with projections or with flanges extending radially outwardly at the opposite axial ends of the circumferential face of the respective guide rollers, on which face the belt rests, so as to prevent slipping off of the belt.

The belt itself, which is of course in form of a closed continuous loop, may also cooperate with a reversing roller which is longitudinally spaced along the rail from the gear drive and which may be journalled on a mount which can be adjusted by displacing it to various positions along the length of the rail. A projecting portion of the mount may engage with portions of the rail in order to prevent the mount from moving in direction transversely to the elongation of the rail and from falling out of the rail when covering components of the latter are removed.

The belt could, of course, be made from one continuous loop. However, it is even simpler and less expensive if the belt is simply a section of a toothed belt strip, whose teeth ends are placed adjacent one another after the belt has been formed into the configuration of the loop. They are then connected by placing a toothed strip (for instance a section of the same toothed belt material) so as to overlap the adjacent end portions and for the teeth of the toothed strip to mesh with those of the end portions. A tightly sitting sleeve is then placed around the end portions and the strip and a pin may be passed through the sleeve and portions of the belt or strip to prevent relative displacement.

A particularly suitable electromotor for the purposes of the present invention is a low-output, single-phase, double-pole capacitor motor having a shunt-wound rotor.

According to a further concept of the invention a timing relay may be interposed in the current supply circuit of the motor, and the time allowed by the timing relay before it shuts off the current to the motor need not be particularly precisely adjusted, because no damage can occur to the motor or any other components of the rail unit even if the motor remains energized for some period of time after the carriage has reached its respective end position. The advantage of such a timing relay is, of course, that it aids in preventing unnecessary heating-up of the motor and undesired use of electrical current.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a bottom-plan view, in fragmentary form, of a rail unit according to the invention, with portions omitted for the sake of clarity;

FIG. 2 is an enlarged cross section taken on line II—II of FIG. 1; and

FIG. 3 is an enlarged longitudinal section through the connection where the opposite ends of the belt are connected in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing the embodiment in Figs. 1-3 in detail it will be seen that reference numeral 11 designates an elongated curtain rail of which only the upper rail section has been illustrated whereas the lower rail section has been omitted in order to permit a clearer view of the various components. Such rails are themselves completely conventional.

Mounted on the rail 11 by means of screws 12 is a gear drive 10 which receives power from the diagramatically illustrated electromotor M. The output shaft of the electromotor is in coupling engagement with the input leading to the drive reel 13 which is rotatably journalled in a bracket or frame 14 provided on the gear unit 10. The drive wheel 13 has teeth which mesh with the teeth of a toothed belt 15 which is guided by guide rollers 16 and 17. The bracket 14 is provided with a number of journalling openings which is greater than the number of guide rollers (here three openings) and which are designated with reference numerals 18, 19 and 20. The shafts of the guide rollers 16 and 17 can be inserted into which ever ones of these openings 18-20 are required to be used so that the position of the rollers 16 and 17 with reference to the gear unit 10 can be varied depending upon whether the gear unit 10 is to be mounted at the left-hand end of the rail, as shown in FIG. 1, or at the right-hand end of the rail. If it is desired to move or remove the drive 10, the screws 12 are loosened and the drive 10 can then be laterally slipped out of the respective end of the rail 11. The guide rollers 16 and 17 have substantially radially extending projections or rims 21 extending at opposite axial ends of their respective circumferential surfaces, so that the belt 15 which is trained about the guide rollers 16 and 17 cannot slip off them.

Also provided is a carriage 22 which is connected (in a manner known per se and not illustrated) with the curtain which is to be pulled by it. The carriage 22 has four wheels 23 with which it rolls on the rail 11 and, located between the reels 23, as Figs. 1 and 2 show, is a gear 24 which is mounted on the carriage 22 for rotation about an axis 25. The teeth of the gear 24 mesh with those of belt 15.

A detent pin 26 is provided which normally engages with its tip between two teeth of the teeth on the gear 24, thus preventing rotation of the latter about the shaft 25. In this position the pin 26 is retained by an arresting portion 27 a nose of which is provided with a groove and engages with an appropriate abutment so as to prevent undesired displacement of the pin 26 from the po-
sition shown in FIG. 2. If, however, it is desired to be able to shift the carriage 22 longitudinally of the rail, the pin 26 is withdrawn so that it no longer engages with the teeth of the gear 24, whereupon the carriage can be shifted longitudinally of the rail 11 and the gear will turn during such shifting. Subsequently the pin is restored to its position shown in FIG. 2.

The belt 15 here is not of the continuous type, but instead is in form of a strip the opposite end portions 28 of which are located adjacent one another, as shown in FIG. 3. Superimposed upon the end portion 28 is a toothed strip 29, which may be of the same material and the same type as the belt 15 itself, and the teeth of the strip 29 mesh with the teeth of the end portions 28. A tightly fitting sleeve 30 is slipped over the end portions 28 and the strip 29 and relative displacement of these various components is prevented by extending a pin 31 or the like through the sleeve 30, as shown in FIGS. 1 and 3.

A reversing roller 31 is provided about which the belt 15 is trained (see FIG. 1), and the roller 31 is journalled on a mount 32 which can be adjusted, that is can be shifted longitudinally of the rail 11. The mount 32 is provided with a projecting nose which may be formed on it and which engages portions of the rail 11 to prevent its displacement in direction transversely of the elongation of the rail 11. A screw 33 is provided for mounting the mount 32 on the rail 11 to prevent its displacement in longitudinal direction of the same.

When the unit according to the present invention is to be operated, the electromotor M is energized via an appropriate switch and transmits motion to the gear unit 16, turning the toothed drive wheel 13. The latter in turn advances the belt 15 because its teeth mesh with those of the belt, and the belt now advances the carriage 22 either towards the left or towards the right, depending upon the direction of rotation of the gear or wheel 15 which in turn is directed by the direction of rotation of the electromotor which is of the reversible type. Such movement of the carriage 22 causes movement of the associated curtain or curtains from open to close position, or visa versa.

As soon as the carriage 22 has reached its final end position either in open or in closed position of the curtains, it is blocked against further movement. Because the belt 15 which is connected with the carriage 22 cannot slip relative to the gear 24, and because the gear 24 cannot turn, the continued attempt of the drive wheel 13 to advance the belt 15 causes the electromotor to be blocked. In other words, further turning of the output shaft of the electromotor M is prevented due to the non-slip motion-transmitting connection described herein. The output shaft of the electromotor is now stopped from rotation but the electromotor continues to be energized until either the switch is used to interrupt its power supply circuit, or until a timing relay which is interposed in the power supply circuit for the electromotor and is set to operate after a predetermined period of time from the initial energization of the motor M has elapsed, interrupts the circuit after a lapse of this time period.

It will be clear that the embodiment illustrated and described is merely exemplary. Evidently, various modifications could be made, and by way of example it is merely mentioned that in place of the belt 15 it would be possible to use a chain.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a power-operated curtain rail unit, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A power-operated curtain rail unit, comprising an elongated curtain rail; a carriage adapted to be connected with a curtain which is to be pulled, said carriage being movable in opposite directions on said rail along the same between at least two positions in which further movement of the carriage is blocked; a burn-out protected reversible electromotor mounted stationary relative to said rail; elongated flexible non-slip motion-transmitting means connecting said electromotor with said carriage to effect movement of the same when said electromotor is energized, the burn-out protection of said electromotor permitting blocking of the movement of said carriage without requiring deenergization of said electromotor; and drive and reversing gear means about which said motion-transmitting means is trained.

2. A unit as defined in claim 1 wherein said motion-transmitting means comprises a toothed belt having a resistance to longitudinal yielding which is greater than the force of said electromotor.

3. A unit as defined in claim 2, wherein said belt is of elastic material and comprises an embedment having said resistance.

4. A unit as defined in claim 2, said gear means comprising a toothed gear rotatably mounted on said carriage and meshing with the teeth of said belt, and blocking means for blocking and unblocking the rotation of said gear.

5. A unit as defined in claim 4, said blocking means comprising a detent pin movable between two positions in which it respectively blocks and unblocks said gear, and including arresting means for arresting said detent pin against undesired movement from one to the other of said positions.

6. A unit as defined in claim 1, said gear means comprising a gear drive operatively associated with said electromotor and said motion-transmitting means for receiving motion from the former and transmitting it to the latter.

7. A unit as defined in claim 6, further comprising a mounting bracket on said gear drive and releasably connectable with said rail; guide rollers for said belt and each provided with a shaft for rotatably mounting the respective guide roller; and a plurality of selectively usable spaced spaced journal openings in said mounting bracket for the respective shafts, greater in number
than said guide rollers for permitting the position of said guide rollers relative to said gear drive to be changed by journaling their drive shafts in differing ones of said openings.

8. A unit as defined in claim 7 wherein said guide rollers each have a circumferential surface for contact with said belt, and substantially radially extending projections extending outwardly beyond the respective circumferential surface at the opposite axial ends thereof for preventing slipping-off of said belt.

9. A unit as defined in claim 2, and further comprising a reversing roller spaced from said electromotor longitudinally of said rail and about which said belt is trained; and a mount mounting said reversing roller for rotation and being displaceable to a variable extent in direction longitudinally of said rail.

10. A unit as defined in claim 9, said mount including a projection engaging with portions of said rail for preventing displacement of said mount in direction transversely of the elongation of said rail.

11. A unit as defined in claim 2, said belt forming a closed loop and having two adjacent end portions; and further comprising connecting means meshing with the teeth of said belt on said end portions and connecting the same against relative movement.

12. A unit as defined in claim 11, said connecting means comprising a toothed strip overlying said end portions and which teeth mesh with the teeth of said end portions, a sleeve closely surrounding said end portions and the overlying strip, and a retaining pin cooperating with said sleeve, end portions and strip for preventing relative displacement of the same.

13. A unit as defined in claim 1 wherein said electromotor is a low-output, single-phase, double-pole capacitor motor having a shunt-wound rotor.

14. A unit as defined in claim 1 further comprising a timing relay interposed in the current supply circuit of said electromotor for interrupting the supply of current to the same after elapse of a timed interval subsequent to energization of said electromotor.

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