This invention relates to apparatus for opening and closing stage curtains, draperies and the like. More particularly, the invention relates to an improved carrier for supporting a curtain in such apparatus and the combination of such a carrier with the track on which it operates.

The apparatus includes a track and a number of carriers, positioned thereon from which the curtain is suspended. To open the curtain all of the carriers are moved toward one end of the track where they abut each other so that the curtain is folded into a compact mass. To close the curtain the carriers are moved in succession away from the end of the track.

Space is at a premium in theatres so the equipment of this invention is designed to fold a curtain into the most compact mass possible. The improved carrier of this invention is advantageously designed to be less than two inches from front to rear.

The carrier is designed particularly to operate on a track formed with two spaced, parallel rails and having curved sections, therein as well as straight sections. The carrier may be moved freely around simple radius curves, or compound curves, or reverse curves without binding or jamming in the track rails.

The respective elements of the carrier are designed to roll along the portions of the track which they contact. The shape of each element is complementary to the surface contour of the portion of the track on which it rolls. The carrier structure includes a pair of supporting rollers mounted on a horizontal axis which are adapted to roll on the upper surface of the track rails. The rollers are mounted on a horizontal axis which are adapted to roll on the upper surface of the track rails. The rollers are adapted to rotate on a substantially vertical axis, one ahead of the other. Supporting means for these guide rollers is provided which is loosely connected to the spacing member so that the horizontal rollers may be turned swiftly with respect to the guide rollers. This structure permits the horizontal rollers to be turned or steered around a curved section of track so that the carrier moves freely around a curve without hindrance.

One or more vertical rotatable elements mounted above the supporting rollers are adapted to contact a guide member fastened along the outer side of the rails above the track. These elements follow the guide member, particularly, at a curve to prevent the carrier from tipping to one side or the other and they aid in guiding the carrier around the curve. In any installation each carrier is connected to the next adjacent carriers by flexible tension members such as link chains or the like. These chains are fastened to the respective carriers at the level of the track. The carriers are pulled by these chains when the curtain is closed and they aid in steering the carrier around a curve.

The vertical guide rollers which ride between the rails are rotatably mounted on two pins. One of these pins, preferably the one which is at the rear when the curtain is being closed, is somewhat longer than the other. Swivel fastened to its lower end is a loop to which the curtain is fastened. This keeps this end of the carrier weighted so that there is little tendency for it to jump the track. Below the guide roller on the other pin is a block which is of greater width than the distance between the rails. It prevents this end of the carrier from jumping the track.

The operation of the various elements as the carrier is moved will be more fully explained in what follows.

In the drawings—

Fig. 1 is the cross-sectional view of a preferred track and the front end of a preferred carrier positioned on the track;

Fig. 2 is a side elevation of the carrier and track shown partly in cross-section, taken along the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the carrier in the track taken on the line 3—3 of Fig. 2;

Fig. 4 is a view of the carrier alone from the back end, showing the upper and lower portions of the carrier turned relatively to one another;

Fig. 5 is a plan view of the carrier when it is being moved around a curve in the direction to open the curtain;

Fig. 6 is a plan view showing the position of the vertical guide rollers when the carrier is in the position shown in Fig. 5;

Fig. 7 is a plan view of the carrier when it is being moved around a curve in the direction to close the curtain;

Fig. 8 is a plan view showing the position of the vertical guide rollers when the carrier is in the position shown in Fig. 7;

Fig. 9 is a plan view of a reversely curved track with various positions of the vertical guide rollers shown schematically at different sections of the track; and

Fig. 10 is a plan view of a form of the carrier designed particularly for use with a reversely curved track.
The preferred track, shown in cross section in Fig. 1, is formed with two spaced parallel rails 2 and 3. The rails are supported at spaced intervals by the inverted U-shaped hangers 5, being fastened on the inside surface of the downwardly extending sides of each hanger 5 by the screws 6. In the usual installation the upper surface 10 of the rails is level. Certain sections of the track may be curved as shown in Figs. 5-8. Hereafter in this application whenever reference is made to a curved portion of the track, the rail having the greater radius of curvature at that curve will be designated as the “outside rail” and the rail having the smaller radius of curvature will be designated as the “inside rail.”

The carrier is supported on the track by the rollers 12 and 13 which are adapted to roll along the upper surface 10 of the rails 2 and 3 respectively. These rollers are mounted at the ends of a short horizontal axle 14 on opposite sides of the downwardly extending flanges 15 along the sides of upper plate 16. The roller support 18 and 20 fit through holes 21 in the bottom plate 23 and project upwardly through holes 24 in the spacing member 16. Their upper ends 25 are peened outwardly to support the pins from the spacing member. The pins 19 and 20 are located substantially along the centerline of the spacing member midway between the rollers 12 and 13, and on opposite sides of the axle 14, as shown in Fig. 1, pin 19 being toward the rear of the carrier and pin 20 being toward its front end.

Locally mounted on the pins 19 and 20, respectively, are the vertical guide rollers 26 and 27. These rollers are slightly narrower than the space between the rails, and as the carrier is moved along the track these vertical guide rollers are adapted to contact the inwardly facing surface 28 of either the rail 2 or the rail 3, as will be more fully explained. Both vertical guide rollers are supported on a circular block 29 which surrounds the lower portion of pin 20 between the bottom of roller 27 and the bottom plate 23. The block is suspended from the wire loop 32 which is swivelly attached to the lower end of the pin 19 between its head and the underside of the bottom plate 23. It is important that the curtain be swivelly connected to the carrier. Otherwise, while the carrier is moving around a curve, the weight of the curtain may tend to twist the carrier and cause it to jam between the rails. The weight of the curtain supported by pin 19 keeps the rear of the carrier on the rails and the block 29 prevents the front end from rising up and leaving the track.

The holes 21 and 24 in the bottom plate 23 and the spacing member 16, respectively, are of larger diameter than the diameter of the pins 19 and 20 which extend through them. This provides a non-rigid connection between the spacing member 16 and the bottom plate 23, so that the spacing member 16 may be swivelled through small arcs to the left or right, around pin 19 which is weighted by the curtain and therefore seldom tilts to the right or left. The pull of the curtain may tilt it forward as the curtain is being opened, and backward as it is being closed, although the block 29 limits the amount the carrier may be tilted forward or back. Fig. 4 shows the spacing member 16 swivelled relative to the bottom plate 23. When turned in such a position the pin is to one side. As the carrier is moved around a curve this construction makes it possible for the horizontal supporting rollers 12 and 13 to be steered into the curve so that they will roll freely, rather than being slid on the surface of the rail. To perm it the spacing member 16 to be turned through a greater arc, thereby permitting the rollers 12 and 13 to be turned more sharply, the holes 21 and 24 may be enlarged. Alternatively, the carrier may be formed with the pins 19 and 20 spaced farther apart but this will usually be undesirable since it is advantageous to keep the carrier as small as possible to conserve space at the end of the track when the curtain is opened. The preferred carrier operates most effectively on curves having a radius of at least three feet.

The forward end of the spacing member 16 is provided with a wing portion 35 which extends outwardly from the right side of the member (Fig. 3) and a vertical roller 36 is mounted on a pin 39 which projects vertically from the wing’s upper surface. The roller 36 is adapted to contact and roll against a guide member 40 which extends along the track above the rails. As shown in Figs. 1-3, the guide member 40 is preferably a flat, metal strip which is bolted to the sides 41. It is located along the straight portions of the track and around the inside rail at a curved section. In a preferred installation the movement of the carrier in the guide is controlled by the cable 42 which extends along the center of the track above the carriers. At a curved section of the track such as is shown in Figs. 5-8 the cable will shift over the inside rail, where it presses roller 36 against the guide member 40 as the carrier is moved around the curve.

For the usual installation the track will be curved only once, either toward the right or the left of the straight section. The carriers will be manufactured as “lefts” and “rights” and the proper carrier is selected to mate with the curvature of the track. The carrier shown in Figs. 1-3 is designated as a “right” except that the wing portion 35 projects from the left side of the spacing member 16. The roller 36 is located on the left wing portion in the same manner as on the carrier shown. For a track which curves in the opposite direction a “left” carrier will be employed. A “left” carrier is identical to a “right” except that the wing portion 35 projects from the left side of the spacing member 16. The roller 36 is located on the left wing portion in the same manner as on the carrier shown. For a track with a “left” curve the guide member 40 is located along the rail which is the inside rail at the inside end of the track and the roller 36 is pressed against the guide member by the cable. The guide member 40 is always located above the rail which is the inside rail at a curve.

When the roller 36 contacts the guide member it stabilizes the carrier in an upright position, keeping the rollers 12 and 13 centered properly on the rails. The roller 36 aids in guiding the carrier around the curve, as will be more fully explained.

The spacing member 16 is provided with a vertical post 43 at the front of the carrier, at about its centerline. As shown in Fig. 2, the cable extends between the post 43 and the guide roller 38. Along a straight section of the track this post tends to rub the side of the cable slightly, just enough to maintain the rollers 12 and 13 in proper alignment with the rail, and extend the cable.

A plurality of carriers are used to support a curtain along a track. The inside edge of the curtain which is moved toward an outer end of the track to open the curtain is supported by a master carrier (not shown). The control cable 42 is rigidly fastened to the master carrier and
is conventionally supported by pulleys (not shown) at the ends of the track. Each carrier is connected to the carriers next to it in the track by flexible members such as the link chain 50. The chains are connected to the pins 19 and 20 above the vertical rollers 26 and 27. In the open position of the curtain where the carriers abut each other at one end of the track the chains are draped downwardly between each two adjacent carriers and hang in the slot 51 formed at each end of the bottom plate 23. The downwardly extending flanges 54 at each end of the bottom plate 23 will be in face-to-face contact with the similar flanges on the two adjacent carriers, so that the slots 51 of abutting carriers cooperate to form a chamber to receive the chains. This construction is important so that the chains do not occupy any of the track space.

To close the curtain the cable is moved so that the master carrier is pulled away from the end of the track. The master carrier unfolds its portion of the curtain and moves along the track until the chain 50 connecting with the next carrier becomes taut. The chain then pulls this carrier, and in a similar manner the other carriers are successively pulled away from the end of the track by their respective chains. Thus the pull on the carriers to close the curtain is taken by the chains rather than the curtain fabric itself so that there is no danger of tearing the curtain when it is being closed. The carriers are conveniently fastened to the pins 19 and 20 above rollers 26 and 27. They should be attached to the carrier near the plane of the axle 14.

The carriers are pulled by the chains 50 to close the curtain and this direction is indicated by the arrow A in Figs. 2, 3, 5 and 6. Arrow B in Figs. 2, 3, 5 and 6 indicates the direction in which the carrier is moved to open the curtain. The chains 50 exert no pulling effect when the curtain is being opened. As soon as the cable is moved to open the curtain (arrow B) the rear-fold provision for each carrier, frictionally engages the cable so that each carrier is individually pulled by the cable.

The rear-fold attachment 55 is a flat plate loosely fastened to the downwardly extending flange 54 at the rear of the spacing member 18 on each carrier by wire ring 57. The outer end of the attachment is provided with a hole 58 which is of larger diameter than the diameter of the cable (see Fig. 2) which passes through the hole. This attachment is the subject of my U. S. Patent No. 2,012,460. Its purpose is to bring the carriers to the end of the track in an orderly manner, and prevent the various carriers from bunching together before they reach the end of the track.

As soon as the cable is moved in the direction of arrow B to open the curtain the rear-fold attachment 55 on each carrier is swung into the position shown in Figs. 2, 3 and 5 where the hole 58 produces a snapping effect on the cable to frictionally engage it. The cable is preferably of rubber hose with a steel covered with a fabric or plastic cover so that the attachment 55 is easily engaged. As each carrier reaches the end of the track its rear-fold attachment bumps against the carrier ahead of it, and is swung upward to a position shown in the dotted lines in Fig. 2. In this position the attachment is disengaged from the cable and the cable slides freely through the hole 56. The attachment 55 is also in the vertical position where it cannot engage the cable when the cable is moved in the direction of arrow A to close the curtain. Thus the carriers are brought to the end of the track in an orderly manner, and successive lengths of the curtain supported by the respective carriers, are folded, one after the other.

If the track is formed with reverse curves (Fig. 9), the carrier shown in Fig. 10 will be employed. This carrier is identical to the carrier shown in Fig. 3 except that there is a wing portion 35 projecting from each side of the spacing member. Vertical rollers, 38a and 38b, are provided on the wing. The sides of the track are lined with guide members 48a and 48b. When the carrier of Fig. 10 is moved into the first arcuate portion 44 of the track of Fig. 9 the control cable presses the roller 38a against the guide member 48a along rail 45. After the carrier is moved into the reversely curved portion 46 the cable shifts to a position over the opposite rail 47 and presses the roller 38b against the guide member 48b along rail 47. Post 43 is omitted from the spacing member of the carrier of Fig. 10 so that the cable can shift back and forth between rollers 38a and 38b.

The position of the vertical guide rollers 26 and 27 at a curve will depend upon whether the carrier is being pulled by the chains 50 (arrow A) or whether the carrier is being pulled by the engagement of the rear-fold attachment 55 (arrow B). Figs. 3 and 6 show the relative positions of the respective elements of the carrier when moving in direction B in contrast to the relative positions shown in Figs. 7 and 8 when the carrier is being moved in direction A.

When moving in direction A, at a curved portion of the track, the chains 50 pull on each of the pins in the direction shown in Fig. 8 so that the vertical guide rollers 26 and 27 are pressed against the inside rail at the curve as they roll around it. Fig. 7 shows that the control cable 52 presses the vertical guide roller 38 against the guide member 48. The pins and the guide roller 38 hold the spacing member 16 in position so that the horizontal rollers 12 and 13 roll freely along the rails at the curve.

When the carrier is moving in direction B into a curve the vertical roller 26 and 27 are shifted to a position such as is shown in Fig. 6. The pressure of the cable on roller 38 holds the vertical roller 27 in contact with the inside rail 2. There is no pull exerted by the chains so that the rear portion of the carrier is substantially free to float in an arc around the roller 27. When travelling in direction B the rear vertical roller 26 leads roller 27. As the carrier moves from a straight section of the track into a curve roller 26 continues to move ahead in a straight path until it strikes the inner surface 28 of the outside rail at the curve, as shown in Fig. 6. The pressure of the carrier against the rail causes the pin 19 to lean slightly toward the inside rail thereby turning or steering the rearward end of the spacing member 16 to a position wherein the horizontal rollers 12 and 13 ride on the rails. As the carrier proceeds around the curve the vertical roller 26 remains in pressure contact with the outer rail and progressively turns the spacing member so that the horizontal rollers 12 and 13 move freely. The pull exerted on the rear of the spacing member 16 by the attachment 55 complements the action of the roller 26.

After the carrier has passed beyond the curve
into a straight section the control cable 42 shifts laterally toward the center of the track and in doing so pushes against the post 43. This straightens the spacing member 16 and aligns rollers 12 and 13 with the rails. Figure 9 shows schematically the movement of the vertical rollers 38 of a carrier of the type shown in Fig. 10 when the carrier is being moved in direction B. If the carrier is moved in opposite direction (arrow A) it is understood that due to the pull of the chains, both vertical rollers will roll against whichever rail happens to be the inside rail at the curved portion at which the carrier is located.

When proceeding in the direction of arrow B, as shown in Fig. 9, roller 27 is held against inside rail 45 due to the pressure of the cable against roller 38a. The leading vertical roller 26 contacts the outside or opposite rail 47 at the point 61. The vertical rollers 26 and 27 remain in this relative position around the curve until the carrier reaches section 63 where the track begins to curve in the reverse direction. The cable then shifts to press against roller 38b and this presses vertical roller 27 against rail 45 which becomes the inside rail at this section and the leading roller 26 moves over into contact with the rail 45, which is the outside rail at this section.

The various rollers of the carrier, etc., are preferably of a hard wood and the rails 3 and 4 forming the track are also preferably of wood. The wood used for the rails is chemically impregnated with graphite or the like to prevent warping and to permit the portions of the car- rier to slide freely along them. The various rollers and the rails may be of metal, or they may be of a pressed fiber composition material, or may be of a suitable plastic. Non-metallic members are preferred since the operation is quieter as the carriers are moved back and forth along the track. The top plate and bottom plate and pins, etc., are preferably of a light-weight metal such as aluminum. The carrier is not limited to the particular design illustrated and changes may be made within the scope of the claims.

What I claim is:

1. A curtain carrier adapted to roll along a track formed of two spaced, parallel rails, which carrier comprises a frame, two spaced, rollers with horizontal axes in axial alignment rotationally mounted on said frame, said rollers being adapted to move along said rails, two pins supported by said frame and directed downwardly therefrom, one in front and one behind the axis of the rollers, and on each pin a guide roller adapted to move between the rails, one of said pins beingillibrable with respect to the frame so as to facilitate the use of the carrier on a curved track.

2. A curtain carrier adapted to roll along a track formed of two spaced, parallel rails, which carrier comprises a frame, two rollers with horizontal axes in axial alignment rotationally mounted on the frame and adapted to move along said rails, loosely supported by said frame two downwardly directed pins, one in front and one behind the axis of the rollers, on each pin a guide roller adapted to move between the rails, and curtain-supporting means fastened to the bottom of one of said pins.

3. A curtain carrier adapted to roll along a track formed of two spaced, parallel rails, which carrier comprises a frame, two rollers with horizontal axes in axial alignment rotationally mounted on the frame with spacing means between them, said rollers being adapted to move along said rails, loosely supported by said frame two downwardly directed pins, one in front and one behind the axis of the rollers, on each pin a guide roller adapted to move between the rails, and curtain-supporting means fastened to the bottom of one of the pins and a block on the other pin below the guide roller thereon a block which is wider than the space between the rails.

4. A curtain carrier adapted to roll along a track formed of two spaced, parallel rails, which carrier comprises a frame, two rollers with horizontal axes in axial alignment rotationally mounted on said frame and adapted to move along said rails, two downwardly directed pins loosely supported by said frame, one in front and one behind the axis of the rollers, a guide roller on each pin adapted to move between the rails, curtain-supporting means fastened to the bottom of one of the pins and a block on the other pin below the guide roller thereon which block is wider than the space between the rails.

5. A curtain carrier adapted to roll along a track formed of two spaced, parallel rails, which carrier comprises a frame, two rollers with horizontal axes in axial alignment rotationally mounted on said frame and adapted to move along said rails, two downwardly directed pins loosely supported by said frame, one in front and one behind the axis of the rollers, on each pin a guide roller adapted to move between the rails, curtain-supporting means fastened to the bottom of one of the pins, on the other pin below the roller thereon a block wider than the space between the rails, and curtain-supporting means fastened to the bottom of one of the pins, on the other pin below the roller thereon a block wider than the space between the rails.

6. A curtain carrier adapted to move along a track composed of two spaced, parallel rails, there being a guide member along one side of the track and adapted, it, which carrier comprises two supporting rollers in axial alignment and spacing means between them, the rollers being adapted to move along the respective rails, depending from the spacing means, guide means adapted to move between the rails, above the spacing means and near one corner of the carrier a vertical axis having thereon a follower which is adapted to contact the guide member, a vertical pin spaced inwardly from the follower, the space between the follower and the pin being adapted to accommodate a cable, and means for propelling the carrier by the cable.

7. A curtain carrier adapted to move along a track formed of spaced, parallel rails, which carrier includes an upper plate on which supporting rollers are mounted on horizontal axes in axial alignment, a lower plate, two holes in the upper plate along the centerline of the carrier, one before the axis of the supporting rollers and the other behind it, two holes in the lower plate, the distance between the holes in the lower plate being the same as the distance between the holes in the upper plate, two notches in the upper plate, heads on each pin above the upper plate and below the lower plate so that the plates are held together by the pin's, a guide roller on each pin located to move through the space between the rails, a chain fastened to each pin above the guide rollers and below the upper plate, and a notch in the front and back edge of the lower plate into which the respective chains are adapted to hang when not under tension.

8. A curtain carrier adapted to move along a track composed of two spaced, parallel rails, there
being a guide member along one side of the track and above it, which carrier comprises two supporting rollers in axial alignment and spacing means between them, the rollers being adapted to move along the respective rails, depending from the spacing means guide means adapted to move between the rails, above the spacing means and near one corner of the carrier. The rollers are adapted to contact the guide member, spaced inwardly from the following adjacent guide means, the space between the carrier and the guide member being the greater width than the space between the rails.

A curtain carrier adapted to move along a track formed of spaced, parallel rails with a guide at one side of the track and above the rails, which includes an axle, a supporting roller near each end of the axle, an upper plate which includes means which spaces the supporting rollers, a lower plate with vertical flanges at the front and rear, two holes in the upper plate along the centerline of the carrier, and the guide member spaced inwardly from the following adjacent guide means, the space between the carrier and the guide member being the greater width than the space between the rails.

A curtain carrier adapted to move along a track formed of two spaced, parallel rails with a guide member above the track and along one side thereof, which carrier comprises a spacing member located longitudinally of the carrier and extending from one side of one of the spacing members, a follower thereon adapted to contact the guide member, spaced inwardly from the follower and above the spacing means a guide between which and the follower a cable is adapted to move, a feed-back attachment surrounding the cable and fastened to the carrier, a horizontal axle fastened perpendicularly to the spacing member, a supporting roller at each end of the axle adapted to move along the respective rails, one hole in the spacing member in front of the axis and a like hole in the spacing member behind the axis, a lower plate, holes in the lower plate spaced the same distance as the holes in the spacing member and at substantially the centerline of the carrier, pins loosely mounted in the holes so as to be tiltable with respect to one another and broadened at each end to prevent removal from the holes, the forward pin being somewhat longer than the rearward pin, a guide roller on the forward pin between the spacing member and the lower plate, a chain fastened to this pin above the guide member, and fastened to the pin below the lower plate curtain-carrying means, a guide roller on the rear pin between the spacing member and the lower plate, another chain fastened to this pin between the guide roller and the spacing member, and on this pin below the guide roller a block wider than the space between the tracks, the guide roller on the forward pin being supported by this block, the two ends of the lower plate being flanged downwardly and at about the center of the front and back ends of the lower plate a notch into which the respective chains hang when they are not under tension.

A curtain carrier adapted to move along two spaced, parallel rails with vertical inner rails, which carrier includes a supporting roller adapted to move along each rail, a plate supported by said supporting rollers, a pin depending from the plate to the front and another to the rear of the rollers, the pins being loosely fastened in the plate so as to be tiltable with respect to one another, a guide roller rotatably mounted on each pin and adapted to be between the rails when the carrier is moving along the rails, on one pin immediately below the guide roller stop means wider than the guide roller, and means on the pin below the stop means for attachment of a curtain.
15. For use on a track formed of two spaced, parallel rails, a curtain carrier which includes two rollers in axial alignment adapted to be supported by the respective rails, means supported by said two rollers and two pins loosely fastened thereto so as to be tiltatable with respect to one another, one in front of the axis of the rollers and the other behind said axis, a guide roller rotatably mounted on each pin and adapted to be located between the rails, the pins being tiltatable so as to facilitate the use of the carrier on a curved track, and at the bottom of one of the pins curtain-carrying means.

16. For use on a track formed of two spaced, parallel rails, a curtain carrier which includes two rollers in axial alignment adapted to be supported by the respective rails, means supported by said rollers, two pins loosely fastened to said means so as to be tiltatable with respect to one another, one in front of the axis of the rollers and the other behind said axis, a guide roller rotatably mounted on each pin and adapted to be located between the rails, the pins being tiltatable so as to facilitate the use of the carrier on a curved track, curtain-carrying means at the bottom of one of the pins, and stop means wider than the space between the rails below the guide roller on the other pin.

17. In combination with a track formed of two spaced, parallel rails and a guide member above the rails and at one side thereof, a carrier formed with supporting rollers in axial alignment, means supported by the rollers, two pins loosely fastened thereto so as to be tiltatable with respect to one another, one of the pins being forward of the axis of the rollers and the other pin being to the rear thereof, a guide roller on each pin below the supporting rollers and located in the space between the rails, fastened to one end of the carrier a vertical axis with a follower thereon which contacts the guide member, spaced inwardly from the follower a stationary guide, the follower and stationary guide being adapted to accommodate a cable between them, and means connecting the carrier with the cable.

18. In combination with a track, two carriers thereon, a spacing chain with its respective ends fastened to substantially the longitudinal center line of the carriers, a plate in each carrier below the chain and extending in a longitudinal direction to the point where the chain hangs when the carriers are brought together, and a notch across the center of the rear edge of the plate of the forward carrier and a notch across the center of the front edge of the plate of the rear carrier, the edges of the notches substantially coinciding to provide a space in which the chain hangs when the carriers are in abutting relation.

EARL J. VALLEN.

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