

April 8, 1969

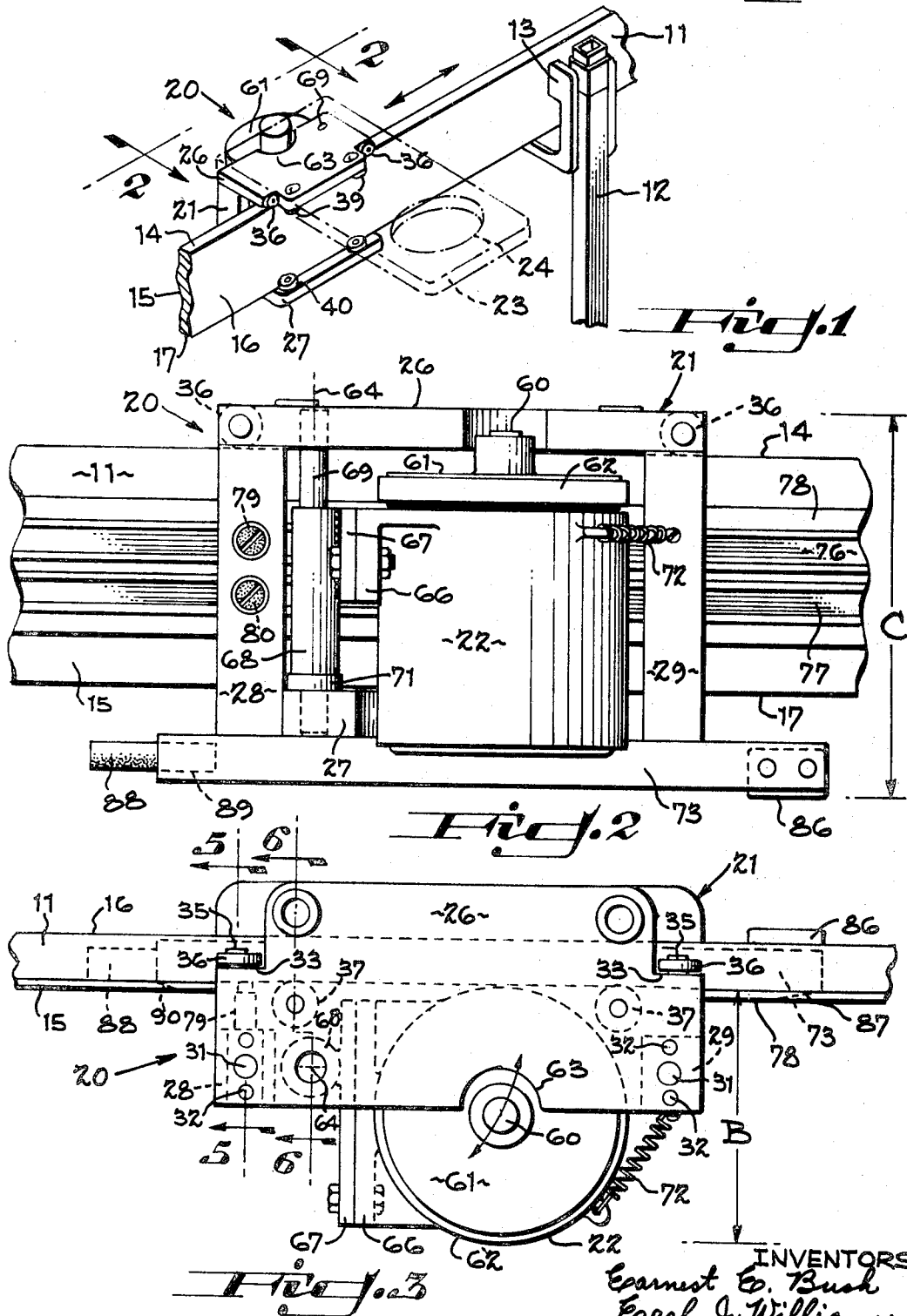
E. E. BUSH ET AL

3,437,053

MONORAIL CARRIAGE

Filed Feb. 14, 1967

Sheet 1 of 2



INVENTORS
Earnest E. Bush
Earl J. Williams
BY Wood, Heron & Evans.
ATTORNEYS.

April 8, 1969

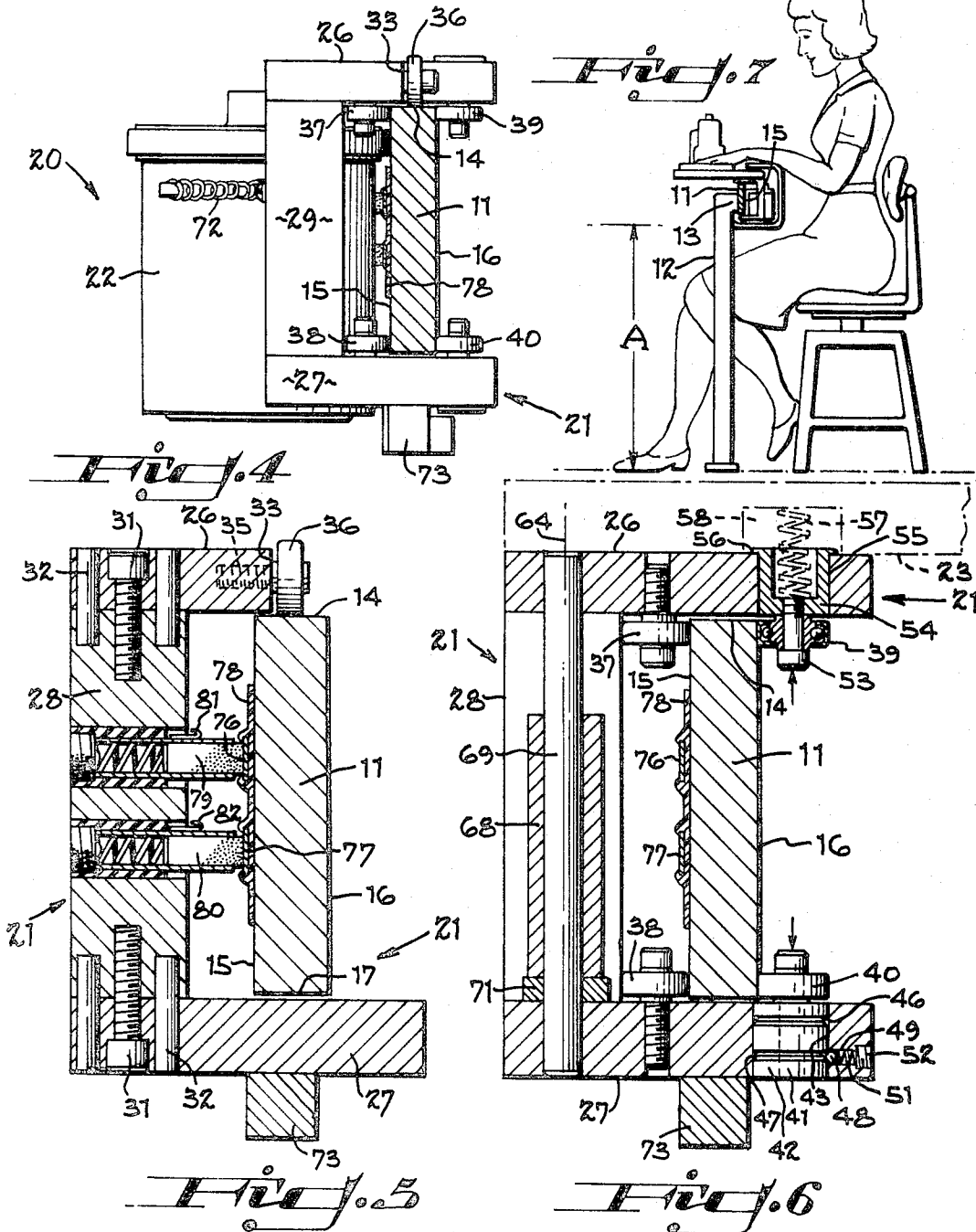
E. E. BUSH ET AL

3,437,053

MONORAIL CARRIAGE

Filed Feb. 14, 1967

Sheet 2 of 2



INVENTORS
Earnest E. Bush
By Earl J. Williams
Wood, Howe & Evans,
ATTORNEYS.

1

3,437,053

MONORAIL CARRIAGE

Earnest E. Bush, Covington, Ky., and Earl J. Williams, Cincinnati, Ohio, assignors to Precision Welder & Flexopress Corp., Cincinnati, Ohio, a corporation of Ohio

Filed Feb. 14, 1967, Ser. No. 616,060

Int. Cl. B61b 13/04; E01b 25/08; B60m 1/34

U.S. Cl. 104—119

6 Claims

ABSTRACT OF THE DISCLOSURE

A motorized carrier for conveying a work piece along a suspending track in an assembly system, wherein the carrier is provided with means for guiding it along the side surfaces of the track which means can be shifted vertically to provide clearance so that the carrier can be removed from the track. A frictional motor drive is mounted wholly within the height of the carrier body and engages the track along a path closely adjacent the point at which the carrier is suspended from the track.

This invention relates to an improved construction for motorized pallets of the type used in automatic non-synchronous assembly lines. Specifically, the invention relates to improvements in self-propelled pallets or cars of the type shown in Deschenes et al. Patent No. 3,039,176, issued June 19, 1962.

In Patent No. 3,039,176 there is disclosed a car and track assembly system wherein the work pieces, upon which various operations are to be performed automatically and/or manually, are carried on self-propelled or motorized cars along a track or monorail from work station to work station. Each car is powered by a torque motor, which is constantly energized and which propels the car along the track until movement is arrested. Each car is stopped in sequence at each work station by a pin or other means which is automatically moved into the path of car travel, so that the work piece on the car can be raised or engaged by the assembly equipment and the operation performed on it. At the completion of the work operation the arresting means is released and the car automatically proceeds to the next work station, or until it is stopped by cars ahead of it waiting to proceed into a work station. A great advantage of the system resides in its flexibility, and in the fact that it admits of non-synchronous operation; a delay or breakdown at one station does not automatically stop the entire line, but rather the line can continue to operate at normal rates of speed so long as there is a "bank" or "float" of cars upon which work can continue at other work stations.

The path along which the cars travel may comprise a monorail having a pair of spaced electrical conductors or bus bars which are engaged by brushes on the individual cars. The car is suspended on the monorail by wheels or rollers running along the top edge of the rail, and the car is guided along the rail by rollers which run along each side of the rail.

In the operation of such systems, work in some instances is performed on the work piece while the latter remains seated on the carrier. In this circumstance the alignment of the work piece with respect to the work-performing machinery may be determined by the position of the carrier on which the work piece is seated, when the carrier is stopped at the work station. Hence it is important that the orientation of the work piece in the vertical plane as well as in the horizontal plane be predetermined relatively accurately at such stations. This invention is predicated, in part, upon an improved carrier construction whereby more accurate carrier orientation on

2

the track is maintained and whereby the effect on carrier orientation of irregularities in the engagement of the carrier drive wheel with the track or rail is minimized.

Where work is to be performed manually by operators at certain work stations, rather than by automatic machinery, it is desirable that the operator be able to perform the work while he is seated. However, this presents certain requirements as to the shape and compactness of the carrier. Adequate clearance must be provided for the operator's knees beneath the monorail and carrier, while at the same time the work piece must travel in a plane which is at a convenient working level. Together, these considerations limit the maximum vertical dimension of the carrier. Moreover, dimension in the horizontal plane is limited by the "reach" of the average operator, since the operator often must reach across the track to the work piece. The invention is further predicated, in part, upon a more compact carrier construction whereby a greater degree of operator ease is established.

From time to time carriers must be removed from the rail on which they are suspended, as for servicing or modification. In the past this has required the removal or opening of a track section so that the carrier can be rolled off the open end of the track. This invention is further predicated upon a carrier construction whereby the carrier can readily and easily be mounted to and dismounted from the track at any point along the latter, without dismounting any track section, and without disassembling the carrier.

The invention can best be further described in relation to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a portion of a monorail track on which is mounted a motorized carrier in accordance with the principles of this invention;

FIGURE 2 is a front elevation of the carrier and track taken along line 2—2 of FIGURE 1;

FIGURE 3 is a top plan of the carrier and track shown in FIGURES 1 and 2;

FIGURE 4 is an end view, partly in section, of the carrier and track;

FIGURE 5 is a vertical section taken on line 5—5 of FIGURE 3, showing the engagement of the brushes with the current conductors on the monorail;

FIGURE 6 is a vertical section taken on line 6—6 of FIGURE 3, showing the pivotal connection between the motor and the carrier body; and

FIGURE 7 is a view illustrating the accessibility to a seated operator of the work piece at a manual station.

The overall conveyor system, of which the present carrier is a part, includes a monorail or track designated at 11 with which is supported by spaced standards or legs 12, as shown in FIGURES 1 and 7. The rail 11 may be steel bar stock in modular lengths, and is mounted edge-wise, that is, with its transverse dimension oriented vertically, by brackets 13 on the standards 12. The rail presents an upper edge or surface 14, on which the weight of the car is carried, and opposite vertical or side surfaces 15 and 16 respectively. The dimension A in FIGURE 7, between the lower edge 17 of rail and the floor, is adequate to permit an operator to be seated facing it with his knees under the rail.

In practice, a number of modular track units 11 are mounted end-to-end, typically in a loop or oval, although in some instances the track is arranged in an open end form. The standards 12 are ordinarily (but not necessarily) on the inside of the loop so that the surface 15 of the rail faces to the outside of the loop. Rail surface 15 is therefore occasionally referred to hereinafter as the "outside surface," and the surface 16 is occasionally referred to hereinafter as the "inside surface" of the rail.

The motorized work piece carrier or car to which the

invention is more specifically directed is designated generally at 20. In broad form the carrier 20 includes a generally C-shaped body 21 (as seen in FIGURES 4, 5 and 6), an electrically operated motor drive 22 driving a shaft parallel to the rail 11, and a plurality of roller or guide wheel means for supporting and guiding the carrier 20 on the rail 11, described in detail hereinafter.

As shown in FIGURE 1, in the usual manner of operating the assembly system the C-shaped carrier body portion 21 is ordinarily on the outside of the track 11, so that the motor drive 22 engages the outside surface 15 of the rail. The work piece, not shown in FIGURE 1, is seated movably or rigidly on a fixture or pallet plate 23. (In some instances the work piece may be mounted to a subplate, which is connected to or seated on the pallet plate 23, in known manner.) This pallet plate 23 is removably secured to the carrier by suitable means, not shown, and projects from the carrier body 21 across the top of the rail 15 into the interior of the loop. The fixture 23 may be provided with one or more apertures as at 24 through which a piston or other lifting mechanism at a work station may engage the underside of the work piece. The fixture or pallet plate 23 itself does not comprise the invention, and may be of a type known in the art, for example as shown in previously identified Patent No. 3,039,176, to which reference is hereby made.

The body 21 of carrier 20 comprises a top plate 26, a bottom plate 27, and a pair of spaced vertical bars or side posts 28 and 29. Machine screws 31 and roll pins 32 secure and align side posts 28 and 29 between the top and bottom plates 26 and 27, as shown in FIGURE 5. All of these members 26, 27, 28 and 29 may be formed of steel bar or plate stock.

The top plate 26 and bottom plate 27 may be of similar outline and dimensions, except that the top plate has a pair of shoulders 33 which, when the body 21 is supported on the monorail, overlie the rail top surface 14, as shown in FIGURES 1 and 5. Each shoulder 33 mounts a roller or supporting wheel means (see FIGURE 3) which includes a shank 35 threaded into the shoulder 33 and carrying a ball bearing roller 36 on its outer end. These rollers 36 ride on the top surface 14 of the monorail 11 and thereby support or suspend the carrier 20; rollers for engaging the bottom edge 17 of the rail are ordinarily unnecessary.

A pair of outside upper guide rollers 37, 37, and a pair of outside lower guide rollers 38, 38 (see FIGURES 3, 4 and 6) are mounted to opposite surfaces of top plate 26 and bottom plate 27 respectively. These rollers 37 and 38 may be similar to the suspending rollers 36 previously described and are secured to the plates to rotate about vertical axes. The respective members of the pairs of rollers 37 and 38 may be mounted in vertical alignment, and are preferably so positioned that when the centerline of the suspending rollers 36 is in alignment with the centerline of the monorail edge 14, rollers 37 and 38 engage the outer surface 15 of the rail, as shown in FIGURE 6, so as to track along it as the car moves on the rail. It will be seen that rollers 37 and 38 limit the proximity of the carrier to the surface 15 of the rail.

The opposite or inside surface 16 of rail 11 is engaged by pairs of inside upper guide rollers 39, 39 and inside lower guide rollers 40, 40. The respective rollers of the pairs 39 and 40 are in vertical alignment with one another, and are spaced from the corresponding outside guide rollers 37 and 38 by substantially the width of the rail 11 (see FIGURE 6) so as to define the transverse position of the carrier with respect to the rail and to restrict canting or tipping of the carrier about suspending rollers 36.

In contrast to outside rollers 37 and 38, the pairs of inside rollers 39 and 40 are mounted so that each is vertically movable or shiftable with respect to the top and bottom plates. Each lower roller 40 has a shaft 41 which

is threaded into a barrel or cylinder 42, and the cylinder is slidably received in a bore 43 in bottom plate 27. Cylinder 42 is provided with a pair of spaced circumferential grooves or tracks 46 and 47 which are alternately engageable by a spring-loaded ball or detent 48. The ball detent resides in a bore 49 in bottom plate 27 and is urged toward cylinder 42 by a spring 51 in bore 49 adjustably compressed therein by an adjusting screw 52.

Groove 47 on cylinder 42 is so located that, when detent ball 48 is engaged in it, the lower roller or guide wheel 40 is vertically positioned to track along the lower portion of rail surface 16, as shown in FIGURE 6. Groove 46 is so positioned that when the detent is engaged in it, roller 40 and the projecting stub shaft thereof are below the lower edge of rail.

The inside upper guide wheels 39 are generally similar to the lower rollers 40, with the exception that they are spring biased downwardly with respect to top plate 26, toward the position shown in FIGURE 6. Each upper roller 39 is mounted on a shaft 53 which is threaded into a cylinder 54. The top plate 26 has a bore 55 in which the cylinder 54 is vertically slidable, a flange 56 on the cylinder limiting its downward movement at a position at which roller 39 is vertically aligned with the outside upper guide rollers 37, see FIGURE 6. Cylinder 54 is counterbored and a spring 57 in the counterbore urges the cylinder downwardly. The upper end of the spring 57 bears against the end of a bore 58 formed on the underside of pallet plate 23. Bore 58 is sized to permit cylinder 54 to be moved upwardly in it a distance sufficient that the lower end of roller shaft 53 will clear the top edge 14 of rail 11. Thus, when the lower inside guide wheels 40 are pushed downward so that detents 48 are engaged in grooves 46 and when inside upper guide wheels 39 are manually lifted by compressing springs 57, clearance is provided so that the carrier 20 can be moved transversely, to the left in FIGURE 6, to remove it from the track.

The motor drive 22 is preferably of the stallable torque motor type, geared to produce a suitable carrier velocity along the rail. Motors of this type possess the advantage that when movement of the carrier is arrested, the motor can be stalled indefinitely without damage even though power continues to be supplied to it.

The motor 22 drives a vertical shaft 60 (see FIGURES 2 and 3) which is parallel to the track surface 15. Shaft 60 is coupled to a frictional drive wheel 61. A rubber rim or tire 62 of diameter larger than that of the motor itself is mounted to wheel 61 for engaging the rail surface 15 along an area of contact which preferably overlaps or is closely adjacent the path of contact of rollers 37 and 39 (see FIGURE 4), closely below the upper rail edge 14. A semi-circular cutout or recess 63 is provided in the top plate 26 to provide clearance for the motor shaft.

The motor 22 is mounted for radial swinging movement about a vertical axis 64. The motor housing includes a vertical flange 66, to which is secured a bar 67 mounted to a vertical tubular bearing or pivot 68. An axle 69 is mounted by body portion 21 at its upper and lower ends in bores formed in top plate 26 and bottom plate 27. A washer 71 is provided at the base of axle 69 to take the downward thrust of bearing 68 which is received on the axle 69. A spring 72, connected between the housing of motor 22 and post 29, constantly urges the motor shaft 60 and tire 62 toward engagement with monorail surface 15. From FIGURE 3 it can be seen that this permits the motor shaft 60 to swing closer to and farther from rail surface 15 to account for manufacturing or track irregularities, the effect of wear on rubber tire 62, and so on.

Electric power is supplied to motor 22 through a pair of current-carrying conductors or bus bars 76 and 77 which are mounted to the monorail outside surface 15 by an insulator 78. Sliding contact between the carriage 20

5

and the fixed conductors 76 and 77 is made through spring-loaded brushes shown at 79 and 80, respectively, which are received in insulating sleeves in body post 28. Leads 81, 82 provide conduction paths to motor 22.

A bar 73 is secured beneath the carriage bottom plate 27, parallel to and in alignment with the rail 11. This bar 73 extends beyond the leading and trailing edges of carrier body 21, and at one end mounts a block 86 for actuating a limit switch or other control mechanism associated with a work station. Adjacent this block 86 the side surface of bar 73 may be inclined to form a cam surface or ramp 87 to provide a lead-in path for means for frictionally engaging the bar 73 to reduce the rate of travel of the carriage. At its other trailing edge, bar 73 is provided with a rubber bumper or cushion 88 partially received within a bore 89 formed in the bar. This bumper cushions the impact of a following carrier which may bump into carrier 20 when the latter is stopped. As seen in FIGURE 3, the side edge of bar 73 has a ramp 90 generally corresponding to the ramp 87 at the leading end, for easing the disengagement of the bar with slow-down means.

By this construction, it can be seen from FIGURES 2, 3 and 7 that the transverse dimension B of the carrier is sufficiently small that the operator can conveniently reach over the carrier to the work piece, and at the same time, the height C of the carrier is such that the pallet plate is at a convenient working level (A+C) for the operator. The motor neither extends above the top nor below the bottom of the carrier, and hence dimension C is the maximum height of the carrier.

Having described our invention, what we claim is:

1. A motorized carrier for conveying a work piece between work stations spaced along a rail, said rail having two opposite side surfaces, an upper edge and a lower edge, said carrier comprising,
a body presenting a top member, a bottom member, and means inter-connecting said top and bottom members, said top and bottom members being spaced sufficiently by said interconnecting means to accommodate said rail between them,
an electric drive motor mounted to said body for engaging one of said side surfaces of said rail to propel said carrier along said rail,
suspending roller means mounted by the top member of said body for engaging the upper edge of said rail to support said carrier therefrom,
first guide means mounted to said body for bearing on said one side surface of said rail,

6

and second guide means mounted to said body for bearing on the other of said side surfaces of said rail, said second guide means being spaced transversely from said first guide means by substantially the dimension between said side surfaces and comprising, at least one upper roller connected to said top member by vertically slidable means permitting said roller to be shifted vertically as a unit to a position above the upper edge of said rail, and at least one lower roller mounted to said bottom member by vertically slidable means permitting said lower roller to be shifted vertically as a unit to a position below the bottom edge of said rail, thereby permitting said carrier to be removed from said rail.

2. The carrier of claim 1 wherein one of said upper and lower rollers is spring biased vertically toward a position for bearing on said other of said side surfaces.

3. The carrier of claim 1 wherein one of said upper and lower rollers is engageable by a detent in two positions, in one of which said roller is in position for bearing on said other of said side surfaces, and in the other of which said roller will clear the adjacent edge of said rail.

4. The carrier of claim 1 wherein said motor is mounted to said body between said top and bottom members.

5. The carrier of claim 1 wherein a pair of longitudinally spaced upper rollers are provided, each being spring biased vertically toward a position for bearing on said other of said side surfaces,

and further wherein a pair of longitudinally spaced lower rollers are provided, each lower roller being cooperable with a detent which holds said roller alternately in position for bearing on said other side surface and below said lower edge.

6. The carrier of claim 5 wherein said first guide means comprises four rollers, each positioned to engage said one side surface of said rail at a position opposite to the respective upper and lower rollers.

References Cited

UNITED STATES PATENTS

2,756,689	7/1956	Hinsken et al.	-----	105—145
3,246,609	4/1966	Westfall	-----	105—145

ARTHUR L. LA POINT, *Primary Examiner*.

H. BELTRAN, *Assistant Examiner*.

U.S. Cl. X.R.

105—30, 141, 144