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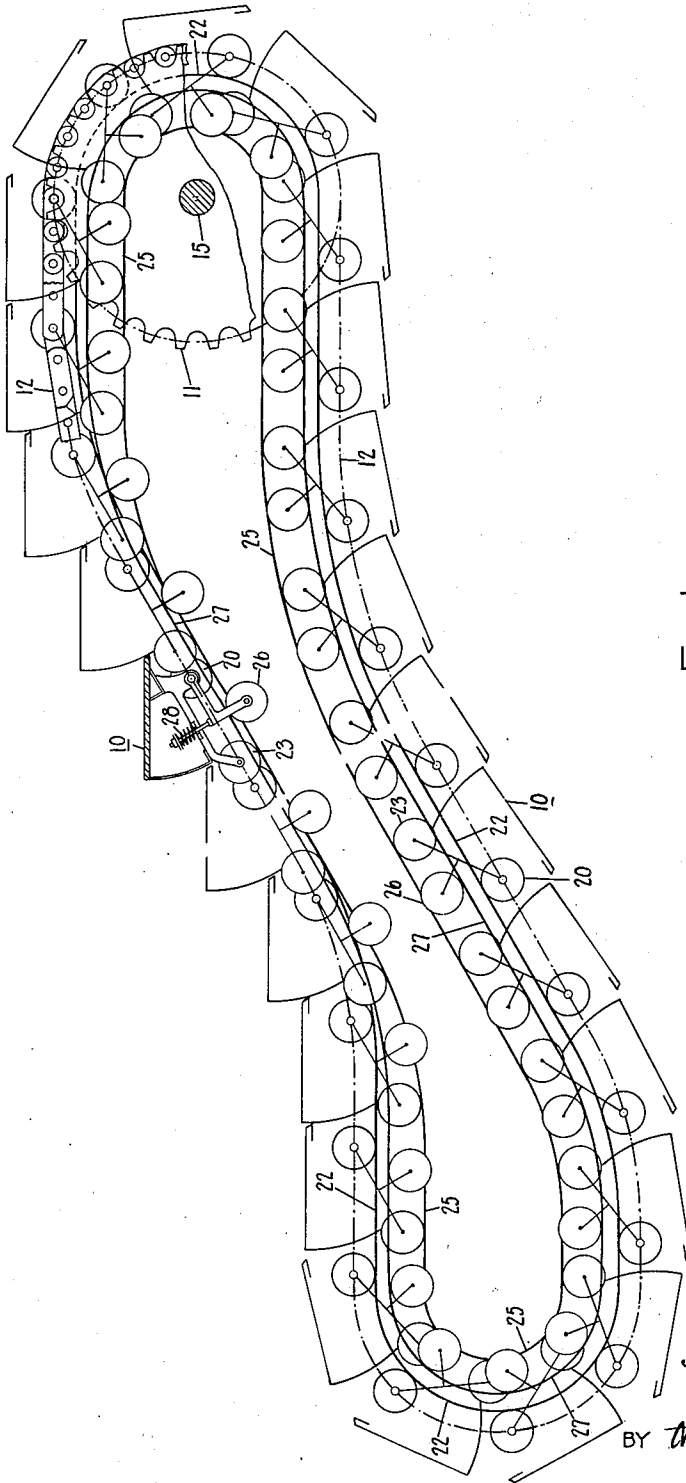
S. G. MARGLES

2,163,693

MOVING STAIRWAY

Filed May 20, 1937

7 Sheets-Sheet 1



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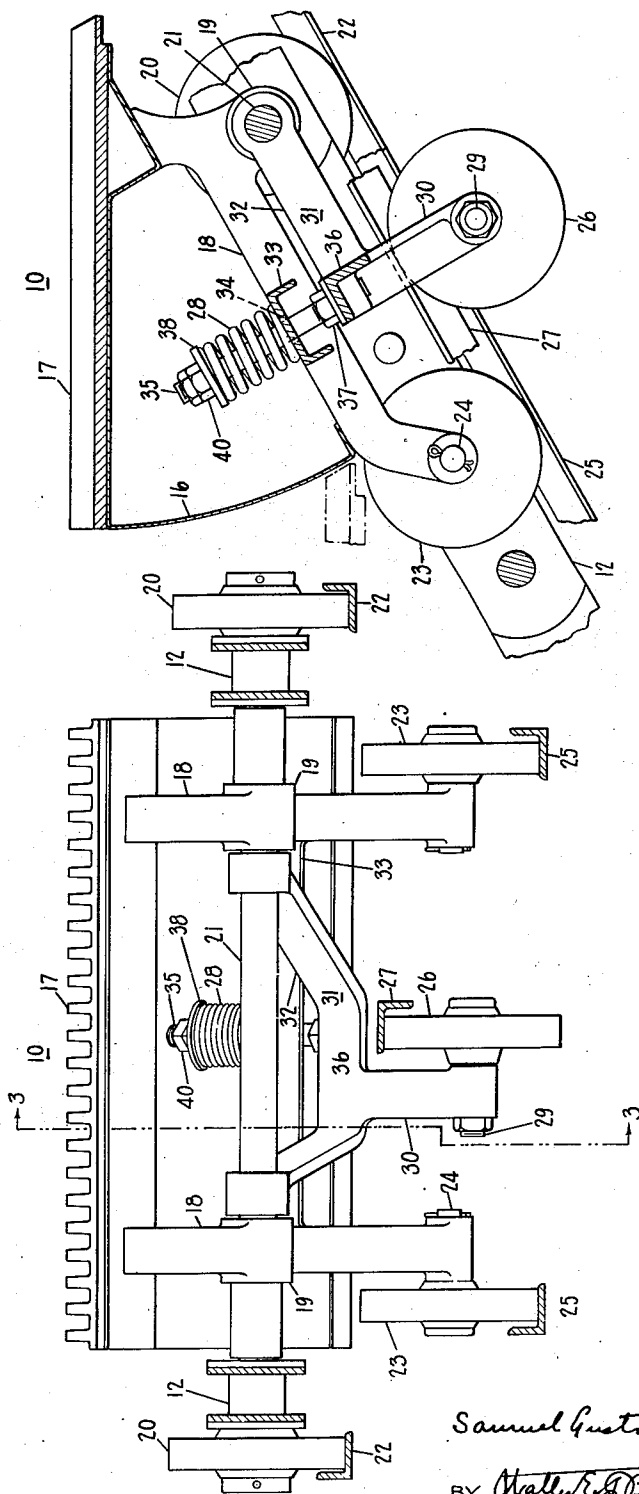


FIG. 3

FIG. 2

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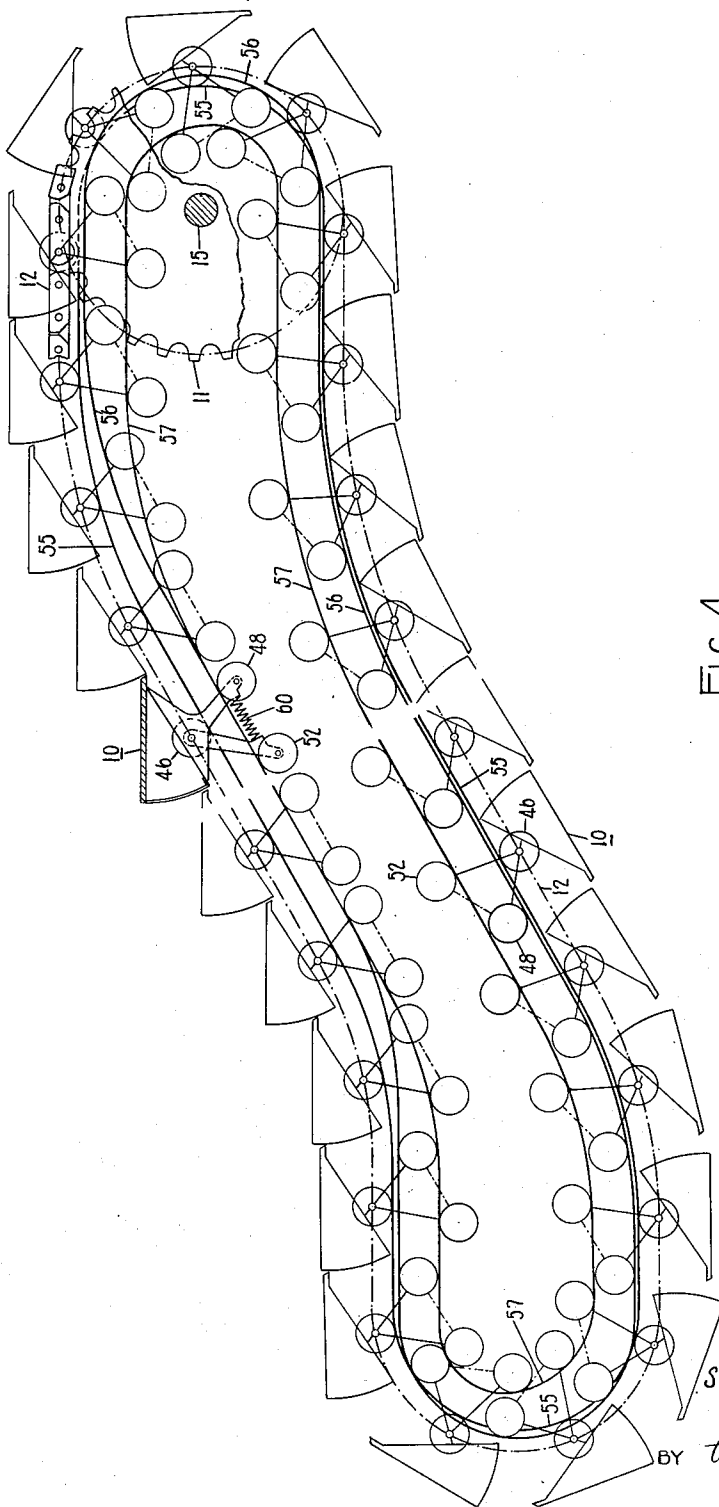


FIG. 4

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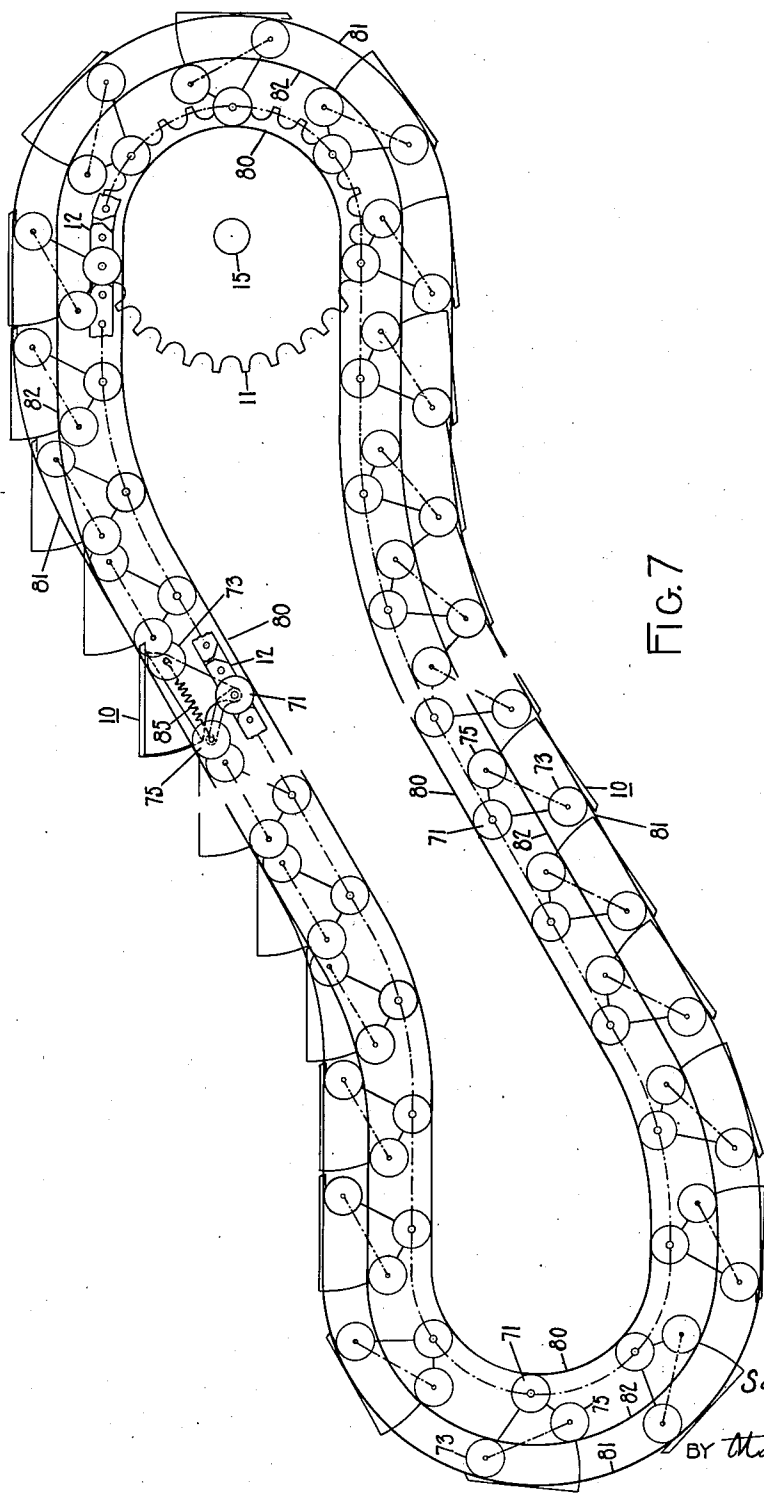


FIG. 7

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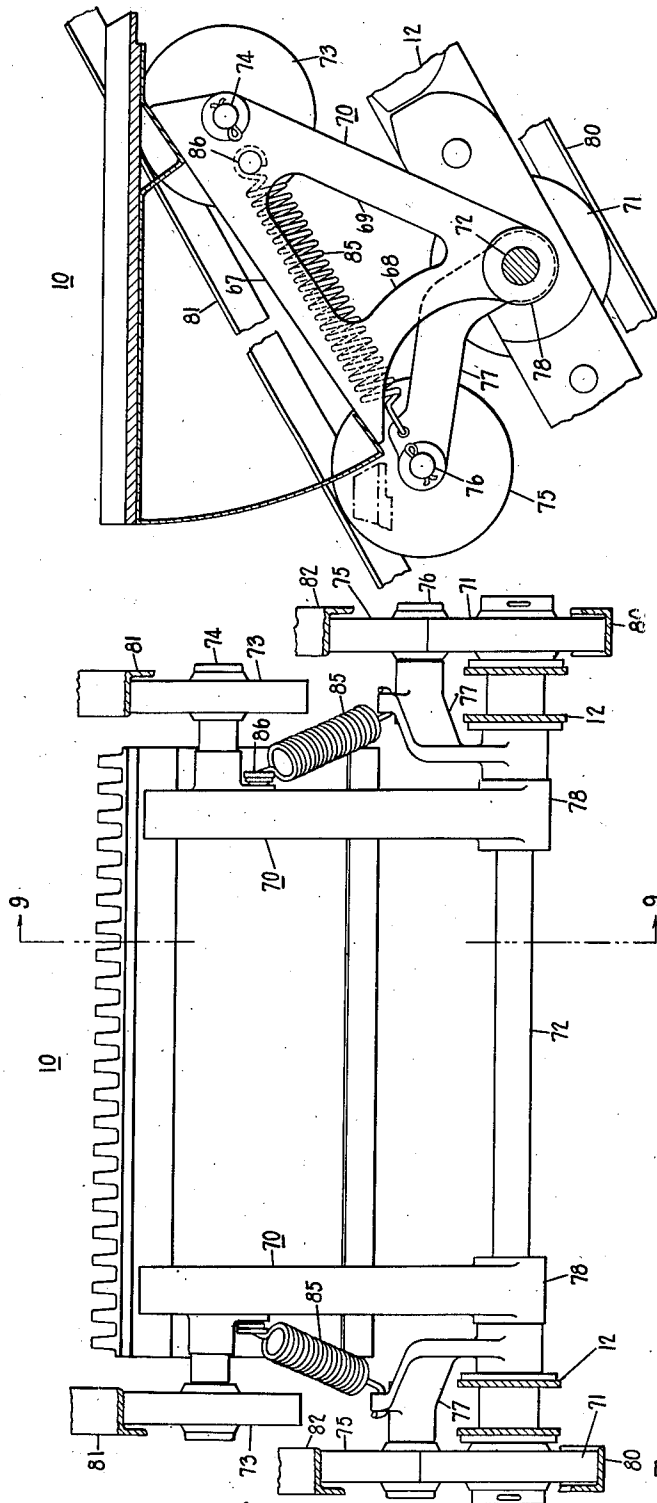


FIG. 9

FIG. 8

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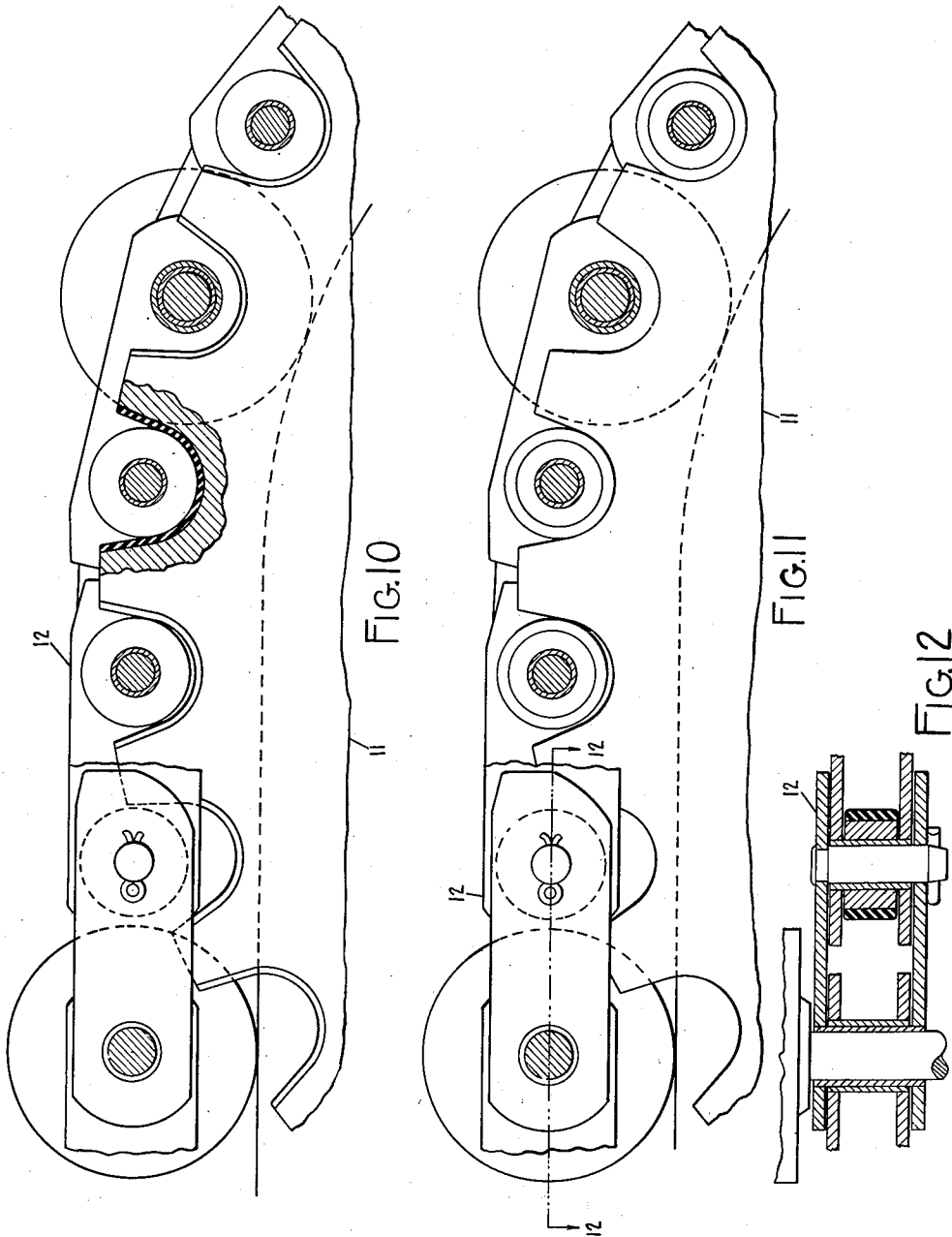
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MOVING STAIRWAY

Filed May 20, 1937

7 Sheets-Sheet 7



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2,163,693

MOVING STAIRWAY

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Application May 20, 1937, Serial No. 143,652

9 Claims. (Cl. 198—16)

The invention relates to moving stairways.

Moving stairways comprise an endless series of steps which are moved from one landing to another for the purpose of conveying passengers.

5 The steps are connected together by means of sprocket chain, known as running gear chain. It has been the practice for a considerable number of years to provide a running gear chain on each side of the stairway and to drive these chains by means of sprocket wheels at the upper end of the stairway. The steps are supported on each side by wheels which run on tracks. Sprocket wheels may be provided at the lower end of the stairway for the chains to carry the steps around the bend or the steps may be supported in passing around the bend solely by curved tracks for the supporting wheels of the steps. It is desirable that moving stairways operate as smoothly and noiselessly as possible. Many improvements have been made with the view of aiding in accomplishing this purpose. One of the problems has been the bringing of the steps smoothly and noiselessly around the bends at the ends of the stairway.

25 The object of the invention is to eliminate noise incident to the transfer of the steps from one run to the other at the ends of the stairway.

The invention involves the provision of a plurality of wheels for each step and a track system having a continuous track for each wheel, and maintaining all of these wheels at all points in the travel of the step in contact with their tracks. Several arrangements will be described as illustrative of modes of carrying out the invention. In each arrangement described, each step is provided on each side with two wheels, one of which is associated with the running gear chain. Continuous tracks are provided for these wheels. Each step is provided with one additional wheel common to the two sides of the stairway or with two additional wheels, one for each side of the stairway. A continuous track is provided for each additional wheel. Each additional wheel is mounted for relative movement with respect to the other wheels, a resilient connection being provided between the additional wheel and the step for exerting a force between the additional wheel and the other wheels which acts to maintain all the wheels in engagement with their tracks at all times.

As another aspect of obtaining quiet operation of the stairway as the steps pass around an end of the stairway at which the chains mesh with sprocket wheels, sound deadening material is utilized to deaden the sound of contact of the

rollers of the running gear chains with the teeth of the sprocket wheels.

Features and advantages of the invention will be apparent from the following description and appended claims.

In the drawings:—

Figure 1 is a diagrammatic representation in side elevation of a moving stairway showing one arrangement for maintaining the wheels of the step in continuous engagement with their tracks;

Figure 2 is an enlarged rear view of one of the steps of the moving stairway of Figure 1;

Figure 3 is a view taken along the line 3—3 of Figure 2;

Figure 4 is a diagrammatic representation in side elevation of a moving stairway showing another arrangement for maintaining the wheels of the step in continuous engagement with their tracks;

Figure 5 is an enlarged rear view of one of the steps of the moving stairway of Figure 4;

Figure 6 is a view taken along the line 6—6 of Figure 5;

Figure 7 is a diagrammatic representation in side elevation of a moving stairway showing another arrangement for maintaining the wheels in continuous engagement with their tracks;

Figure 8 is an enlarged rear view of one of the steps of the moving stairway of Figure 7;

Figure 9 is a view taken along the line 9—9 of Figure 8;

Figure 10 is an enlarged fragmental detail showing one arrangement of employing sound deadening material to deaden the noise of contact of chain rollers with a sprocket wheel;

Figure 11 is an enlarged fragmental detail showing another arrangement of employing sound deadening material to deaden the noise of contact of chain rollers with a sprocket wheel; and

Figure 12 is a detail in section taken along the line 12—12 of Figure 11.

In each of the arrangements illustrated, the stairway comprises an endless series of steps driven at the upper end of the stairway by means of sprocket wheels through running gear chains, a sprocket wheel and chain being arranged on each side of the stairway. A sprocket wheel and running gear chain are illustrated for one side of the stairway. The sprocket wheels are mounted on and driven by the main drive shaft, driven in turn by driving mechanism (not shown).

Referring to Figures 1, 2 and 3, each step comprises a step frame upon which the tread

is mounted. The frame is mounted on elongated brackets 18, one on each side of the stairway, extending underneath the frame. A chain wheel 20 and a trailer wheel 23 is provided for each step on each side thereof. The chain wheels are mounted on an axle 21 extending across the stairway through opposite chain links in the running gear chains, the chain wheels being outside the links of the chains. The axle is supported by bearings 19 in the brackets. Each of the trailer wheels 23 for the step is mounted on a stub axle 24 supported by the other end of the step bracket 18.

A track 22 is provided on each side of the stairway for the chain wheels. A track 25 is also provided on each side of the stairway for the trailer wheels. Each of these tracks comprises an upper run portion and a return run portion joined at the ends by curved end portions to form a continuous track. These tracks are positioned and shaped to give the proper position to the steps at the various points in their travel. Mechanism is provided for maintaining the wheels in continuous contact with their tracks, without which the wheels, in passing around the bend from the upper run to the return run at an end of the stairway, would leave their tracks and would remain off the tracks until the transition from the return run to the upper run is made at the other end of the stairway.

In the form illustrated in the figures being described, this mechanism comprises for each step an additional wheel 26, a track 27 for this wheel and a spring 28 acting oppositely on the additional wheel and the chain and trailer wheels to exert the forces maintaining these wheels on their respective tracks. The track 27 for the additional wheel is arranged intermediate the sides of the stairway and is shaped to maintain the same relative positions of the wheels regardless of where the step may be in its travel. The additional wheel runs on the inside of its track as distinguished from the chain and trailer wheels, which run on the outside of their tracks.

The additional wheel 26 is supported on a stub shaft 29 carried by an arm 30 of lever 31. This arm forms an extension at right angles from a U-shaped portion 32 which is pivotally mounted on axle 21 between brackets 18. A channel shaped member 33 extends between the brackets and is apertured at 34 to slidably receive a stud 35. This stud is secured to the yoke 36 of the U-shaped portion 32 by lock nut 37. The spring 28 is arranged on the stud and is held in a state of compression between the channel member 33 and a washer 38 on the outer end of the stud by adjustable lock nuts 40. Lever 31 is constructed so as to locate wheel 26 intermediate the chain and trailer wheels as viewed in Figure 3. Likewise the channel shaped member 33 is intermediate these wheels. As spring 28 is in a state of compression, it acts through washer 38, nuts 40 and stud 35 to exert a force to maintain wheel 26 in engagement with its track surface. In so doing the spring acts through channel member 33 and brackets 18 to exert a force to maintain the chain and trailer wheels on their respective track surfaces. The channel member 33 being intermediate these wheels, causes this force to be exerted equally on the chain and trailer wheels. With this construction, the wheels are maintained in rolling engagement with their respective track surfaces regardless of the position of the step in its travel, as may be seen from Figure 1, in which the steps are illustrated at various

points of step travel. Thus any noise incident to the wheels passing around the bends at the ends of the stairway is eliminated.

It is preferred not to provide rollers in the running gear chain where the chain wheel axles extend through the chain. This obviates any noise incident to meshing of chain wheel rollers with the sprocket wheels which might otherwise occur, particularly after wear of the chain wheels has taken place. Also, a certain amount of clearance is provided between lock nut 37 and channel member 33. This insures spring 28 being effective to maintain the wheels on their respective tracks after wear of the wheels has taken place.

Referring now to the arrangement shown in Figures 4, 5 and 6, the step frame is mounted on brackets 45, one on each side of the stairway. Each of these brackets is formed with a cross member 49 and an arm 51, somewhat in the nature of a T except that the arm is at an acute angle to the cross member in the direction of movement of the stairway while ascending. A wheel 46 is provided for each step on each side thereof. These wheels are mounted on an axle 47 extending across the stairway, preferably midway of the step tread. This axle extends through opposite chain links in the running gear chains, the wheels being outside the links of the chain. The axle is supported by bearings 44 in the cross members 49 of the brackets. The wheels 46, being associated with the chains, will be termed chain wheels.

In addition to the chain wheels, each step is provided on each side thereof with two additional wheels. One of these wheels, designated 48, is mounted on a stub axle 50 supported by the end of arm 51 of bracket 45. The other wheel, designated 52, is mounted on a stub axle 53 supported by the end of a lever 54 pivotally mounted on axle 47 between bracket 45 and the running gear chain. The lever 54 is arranged at an angle to arm 51 of bracket 45 as indicated in Figure 6.

A track 55 is provided on each side of the stairway for the chain wheels. A track 56 is also provided on each side of the stairway for the bracket wheels 48. Likewise, a track 57 is provided on each side of the stairway for wheels 52. Each of these tracks comprises an upper run portion and a return run portion joined at the ends by curved end portions to form a continuous track. The chain wheels run on the outside of their tracks, whereas wheels 48 and 52 run on the inside of their tracks. The tracks are positioned and shaped to give the proper position to the steps at the various points in their travel. In the construction illustrated, the track surface for wheels 52 on each side of the stairway may be aligned with that for wheels 48 for the inclined portion of the upper run of the stairway, as illustrated in Figure 4. If desired, the construction may be such that for this portion of the run a common widened track may be used on each side of the stairway.

The wheels of each step are maintained on their respective track surfaces by means of springs 60, one on each side of the stairway. The construction for each side of the stairway is the same. The spring is a compression spring and is positioned between oppositely disposed lugs 61 and 62 provided on lever 54 and arm 51 respectively. The spring is arranged on a stud 63 threaded into an aperture in lug 61 and secured thereto by a lock nut 64. The stud slidably extends through an aperture 65 provided in the other lug 62. Lock nuts 66 on the outer end of

the stud limits the amount of spread of the wheels.

As spring 60 is in a state of compression, it acts through the lugs to exert a force to maintain wheels 48 and 52 in engagement with their respective track surfaces. In so doing, it spreads the lever 54 and arm 51 of the bracket apart to draw the chain wheel 46 into engagement with its track surface. Thus, with this construction also, the wheels of the step are maintained in rolling engagement with their respective track surfaces, regardless of the position of the step in its travel, as may be seen from Figure 4, so that any noise incident to the wheels passing around the bends at the ends of the stairway is eliminated.

In this arrangement also it is preferred to omit the rollers in the running gear chain where chain wheel axles extend through the chain, to obviate noise incident to the meshing of chain wheel rollers with the sprocket wheels. Also, a certain amount of clearance is provided between lock nuts 66 and lugs 62 to insure springs 60 being effective to maintain the wheels on their tracks after wear of the wheels has taken place. It is preferred to employ springs that are strong enough to maintain the wheels on their track surfaces when the weight on the step is concentrated on the right hand side of the tread as viewed in Figure 6.

Referring now to the arrangement shown in Figures 7, 8 and 9, the step frame is mounted on brackets 70, one on each side of the stairway. Each of these brackets has a portion 67 extending beneath the step frame and an angular portion depending therefrom and having two arms 68 and 69, thereby forming a triangle, arm 69 being at an acute angle to portion 67 in the direction of movement of the step while descending. A wheel 71 is provided for each step on each side thereof. These wheels are mounted on an axle 72 extending across the stairway, preferably midway of the step tread. This axle extends through opposite chain links in the running gear chains and the wheels are outside the links of the chain. The axle is supported by bearings 78 in the brackets at the point of joinder of arms 68 and 69. These wheels, being associated with the chains, will also be termed chain wheels.

In addition to the chain wheels, each step is provided on each side thereof with two additional wheels. One of these wheels, designated 73, is mounted on a stub shaft 74 supported by the upper end of the bracket as viewed in Figure 9. The other wheel, designated 75, is mounted on a stub shaft 76 supported by a lever 77 pivotally mounted on axle 72 between bracket 70 and the running gear chain. Lever 77 is at an angle to arm 69 of the bracket. With this arrangement, the wheels 73 and 75 are outside the chain and chain wheels, whereas in the arrangement of Figures 4, 5 and 6 the wheels 48 and 52 are inside the chain and chain wheels.

A track 80 for the chain wheels, a track 81 for wheels 73 and a track 82 for wheels 75 are provided on each side of the stairway. Each of these tracks comprises an upper run portion and a return run portion joined at the ends by curved end portions to form a continuous track. The chain wheels run on the outside of their tracks whereas wheels 73 and 75 run on the inside of their tracks. The tracks are positioned and shaped to give the proper position to the steps at the various points in their travel. As in the arrangement of Figures 4, 5 and 6, the track sur-

face for wheel 73 on each side of the stairway may be aligned with that for wheel 75 for the inclined portion of the upper run of the stairway, as illustrated in Figure 7. If desired, the construction may be such that for this portion of the run a common widened track may be used on each side of the stairway.

The wheels of each step are maintained on their respective track surfaces by means of springs 85, one on each side of the stairway. The construction for each side of the stairway is the same. The spring is a tension spring and is secured at one end to a pin 86 secured to bracket 70 near stub shaft 74 and at the other end to the lever 77 near the stub shaft 76. As the spring is in a state of tension, it acts to exert a force to maintain wheels 75 and 73 on their respective track surfaces. In so doing, it pulls lever 77 and arm 69 of the bracket toward each other to push the chain wheel 71 into engagement with its track surface. Thus, with this construction also, the wheels of the step are maintained in rolling engagement with their respective track surfaces regardless of the position of the step in its travel, as may be seen from Figure 7, so that any noise incident to the wheels passing around the bends at the ends of the stairway is eliminated.

In this arrangement also it is preferred to omit the rollers in the running gear chain where the chain wheel axles extend through the chain, to obviate noise incident to the meshing of the chain wheel rollers with the sprocket wheels. Inasmuch as springs 85 are tension springs, they remain effective to maintain the wheels on their respective track surfaces after wear of the wheels has taken place. It is preferred to employ springs that are strong enough to maintain the wheels on their track surfaces when the weight on the step tread is concentrated on the right hand side of the tread as viewed in Figure 9.

In the arrangement of Figures 1, 2 and 3, a pair of wheels for each step, one on each side of the stairway, each mounted on a separate lever and having a separate spring for acting between it and the chain and trailer wheels on that side of the stairway, may be employed in lieu of wheel 26, lever 31 and spring 28, common to both sides of the stairway. Likewise, one wheel, lever and spring, common to both sides of the stairway, may be employed for each step instead of the wheel 52, lever 54 and spring 60 of Figures 4, 5 and 6 or the wheel 75, lever 77 and spring 85 of Figures 7, 8 and 9 for each side of the step. It is to be understood that other arrangements may be provided to cause all of the wheels of the step to be maintained on their tracks at all points in their travel. Also, the invention may be applied to other forms of moving stairway construction, that shown being chosen for convenience of illustration. In other words, the construction of the track system and the mechanism for maintaining the wheels of the step on their track surfaces may be arranged to suit the particular installation. Not only does the maintaining of all the wheels of the step on their tracks improve the operation of the stairway from the standpoint of quietness in operation but also minimizes wear of the wheels.

For the purpose of further improving the quietness of operation as the steps pass around an end of the stairway at which the chains mesh with sprocket wheels, sound deadening material may be employed to deaden the sound of contact as meshing of the chain rollers with the sprocket.

wheels takes place. Arrangements of this character are disclosed in Figures 10, 11 and 12. In the arrangement of Figure 10, the sides and bottom of the grooves between the teeth of the sprocket wheel are faced with sound deadening material, whereas in the arrangement of Figures 11 and 12 the chain rollers are provided with tires of sound deadening material. Various sound deadening materials may be employed for this purpose. Rubber has been illustrated. The rubber is preferably secured to the sprocket wheel or chain rollers by vulcanizing. Synthetic rubber is particularly suitable owing to the fact that the wheels of the step are subject to oil. With either arrangement, as the chain runs on to the sprocket wheels, the chain rollers, in meshing with the sprocket wheel, are seated silently in the grooves between the teeth of the sprocket wheel so that any noise incident to the meshing of these rollers with the sprocket wheel is eliminated. In each of these figures, the rollers of the chain where the chain wheel axles extend through the chain have been omitted. It is to be understood, however, that rollers may be provided at this point if desired, particularly where sound deadening material is employed. If desired, sound deadening material may be used to deaden the sound of contact of the chain rollers with the sprocket wheels in moving stairways of constructions other than those shown in Figures 1 to 9 inclusive.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:—

1. A moving stairway comprising; a series of steps; a step frame for each step; running gear chain; a chain wheel for each step mounted on the step frame for that step and connected to said chain; an additional wheel for each step mounted on the step frame for that step; a third wheel for each step; a continuous track for each of said wheels of the steps; means for each step for mounting said third wheel for that step for relative movement with respect to said step frame for that step; and resilient means for each step acting between said step frame and said mounting means for said third wheel for that step to exert opposing forces thereon, with said mounting means for the third wheel positioning that wheel with respect to said chain wheel and additional wheel for that step to cause one component of said force exerted by the resilient means on the step frame to be applied to the chain wheel in a direction toward its track and another component thereof to be applied to the additional wheel in a direction toward its track, thereby causing the chain wheel and additional wheels to be maintained on their respective tracks at all points of step travel.

2. A moving stairway comprising; a series of steps; a step frame for each step; running gear chain; a chain wheel for each step mounted on the step frame for that step and connected to said chain; an additional wheel for each step mounted on the step frame for that step; a third wheel for each step; a continuous track for each of said wheels of the steps, said chain wheel for each step rolling on the outer surface of its track and at least one of the other wheels for that step

rolling on the inner surface of its track; a spring for each step; and means for each step for mounting said third wheel for that step for relative movement with respect to said step frame for that step and for connecting one end of said spring for that step to said step frame and the other end to said mounting means for the third wheel with the relationship of the third wheel with respect to said chain wheel and additional wheel for that step such as to cause the spring to exert force on the chain wheel to maintain it on its track, to exert force on the additional wheel to maintain it on its track, and to exert force on the third wheel to maintain it on its track, regardless of the position of the step in its travel.

3. A moving stairway comprising; a series of steps; a step frame for each step; running gear chain; a chain wheel for each step; an axle for each chain wheel mounted on the step frame for that step and connected to said chain; an additional wheel for each step; an axle for each additional wheel mounted on the step frame for that step; a third wheel for each step; a continuous track for each of said wheels, said chain wheel for each step rolling on the outer surface of its track and at least one of the other wheels for that step rolling on the inner surface of its track; a lever for each step pivotally mounted on the chain wheel axle for that step; a spring for each step connected at one end to the step frame of the step and at the other end to said lever for that step biasing the frame and lever for movement in opposite directions about the chain wheel axle; and means mounting said third wheel for each step on the lever for that step in such relationship with respect to said chain wheel and additional wheel for that step to cause forces exerted by the spring for that step to act to maintain the chain wheel, the additional wheel and the third wheel on their respective tracks, regardless of the position of the step in its travel.

4. A moving stairway comprising; a series of steps; running gear chain; a chain wheel for each step; a trailer wheel for each step; an axle for each of said wheels for each step; means for mounting said axles on said steps, the axle for the chain wheels for each step passing through links of said chain, thereby connecting said steps together; an additional wheel for each step; a lever for each step pivotally supported by the chain wheel axle for that step; an axle for each additional wheel mounted on the lever for the step for which the wheel is provided; a continuous track for each of said wheels of each step for guiding them during movement of the step; and a compression spring for each step acting between said lever and said mounting means for the axles of the chain and trailer wheels for that step at a point intermediate such axles to exert forces to maintain all of said wheels for that step on their respective tracks, regardless of the position of the step in its travel.

5. A moving stairway comprising; a series of steps; a chain wheel for each step; a second wheel for each step; means for mounting each chain wheel on the step for which it is provided underneath the step and midway between the front and back of the tread thereof; means mounting each second wheel on the step for which it is provided so that when the step is on the incline of the upper run of the stairway the wheel is below and toward the top of the stair-

way from the chain wheel for that step; a lever for each step pivotally secured thereto; an additional wheel for each step mounted on the end of said lever for that step, said lever extending below said step when the step is on the incline of the upper run in such direction that the wheel is toward the bottom of the stairway from the second wheel for that step; a continuous track for each of said wheels of each step for guiding them during movement of the step; and a compression spring for each step acting between the end of said lever and said mounting means for the second wheel for that step to maintain said second and additional wheels for that step on their respective tracks and in so doing to pull said chain wheel for that step onto its track.

6. A moving stairway comprising; a series of steps; a chain wheel for each step; a second wheel for each step; means for mounting each chain wheel on the step for which it is provided underneath the step and midway between the front and back of the tread thereof; means mounting each second wheel on the step for which it is provided so that when the step is on the incline of the upper run of the stairway the wheel is below and toward the top of the stairway from the chain wheel for that step; a lever for each step pivotally secured thereto; an additional wheel for each step mounted on the end of said lever for that step, said lever extending below said step when the step is on the incline of the upper run in such direction that the wheel is toward the bottom of the stairway from the second wheel for that step; a continuous track for each of said wheels of each step for guiding them during movement of the step, the chain wheels rolling on the outside surface of their track while the second and additional wheels roll on the inside surfaces of their respective tracks; and a compression spring for each step acting between the end of said lever and said mounting means for the second wheel for that step to spread said second and additional wheels for that step apart and thus maintain them on their respective tracks and in so doing to pull said chain wheel for that step toward said second and additional wheels and thus maintain it on its track.

7. A moving stairway comprising; a series of steps; a chain wheel for each step; a second wheel for each step; means for each step for mounting said chain wheel and second wheel for that step on the step so that when the step is on the incline of the upper run of the stairway the second wheel is above and toward the top of the stairway from the chain wheel; an additional wheel for each step; means for each step for mounting said additional wheel for that step for relative movement with respect to the other wheels of that step and so that when the step is on the incline of the upper run the additional wheel is above the chain wheel and toward the bottom of the stairway from both the chain wheel and second wheel for that step; a continuous track for each of said wheels of each step for guiding them during movement of the

step, the chain wheel rolling on the outside surface of their track while the second and additional wheels roll on the inside surfaces of their respective tracks; and a tension spring for each step acting between said mounting means for the additional wheel and said mounting means for the chain and second wheels for that step to pull said second and additional wheels for that step toward each other and thus maintain them on their respective tracks and in so doing to push said chain wheel for that step away from said second and additional wheels and thus maintain it on its track.

8. A moving stairway comprising; a series of steps; a sprocket wheel at an end of the stairway; running gear chain driven by said sprocket wheel; a plurality of wheels for each step, one of which is a chain wheel; an axle for each of said wheels for each step; means for mounting said axles on said steps, the axles for said chain wheels passing through certain links of said chain in place of chain pins, thereby connecting said steps together; track for each of said wheels of each step for guiding them during movement of the step, each track comprising an upper run and a return run joined at their ends by curved end tracks to form a continuous track; and a spring for each step acting through said mounting means for said axles for said wheels of that step to exert forces to maintain all of said wheels for that step on their respective tracks, the running gear chain being provided with rollers between the links on the pins joining the links but not on the axles for said chain wheels, the chain being supported at these points when in mesh with the sprocket wheel by said chain wheels rolling on the curved end portion of their track at the end of the stairway at which said sprocket wheel is located.

9. A moving stairway comprising; a series of steps; a sprocket wheel at an end of the stairway; running gear chain driven by said sprocket wheel; a plurality of wheels for each step; an axle for each of said wheels for each step; means for mounting said axles on said steps, the axle for a certain one of said wheels for each step passing through certain links of said chain in place of a chain pin, thereby connecting said steps together; track for each of said wheels of each step for guiding them during movement of the step, each track comprising an upper run and a return run joined at their ends by curved end tracks; and resilient means for each step acting through said mounting means for said axles for said wheels of that step to maintain all of said wheels for that step on their respective tracks, the running gear chain being provided with rollers on the pins joining the links but not on the axles for said certain wheels, the chain being supported at these points when in mesh with the sprocket wheel by said certain wheels rolling on the curved end portion of their track at the end of the stairway at which said sprocket wheel is located.

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