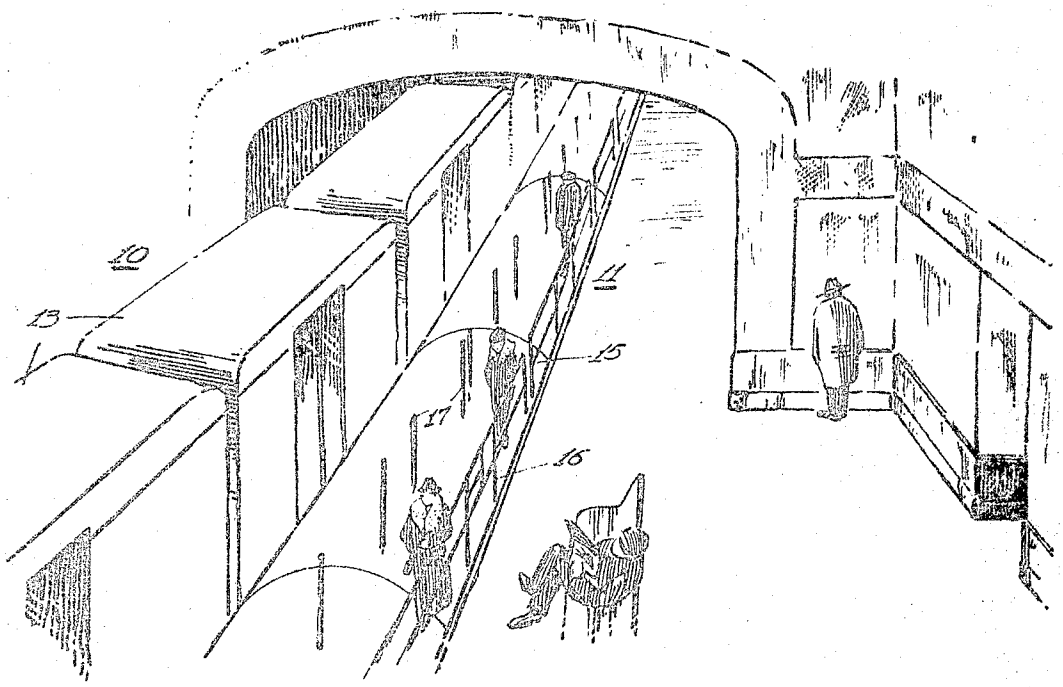
June 16, 1936. N. W. STORER 2,044,134

TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 1

Fig. 1.



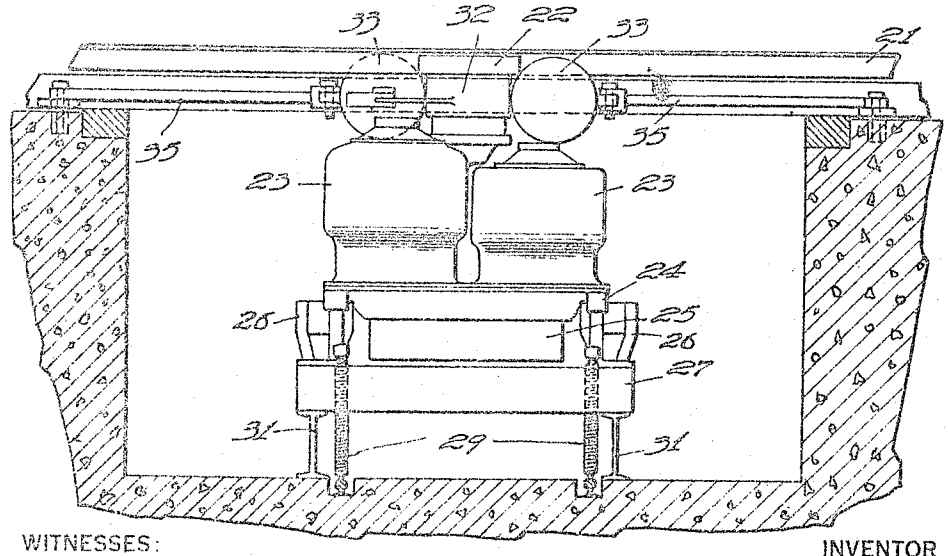


Fig. 4.

WITNESSES:

E. C. Kiting.

H. S. Whitcomb

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June 16, 1936. N. W. STORER 2,044,134

TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 2

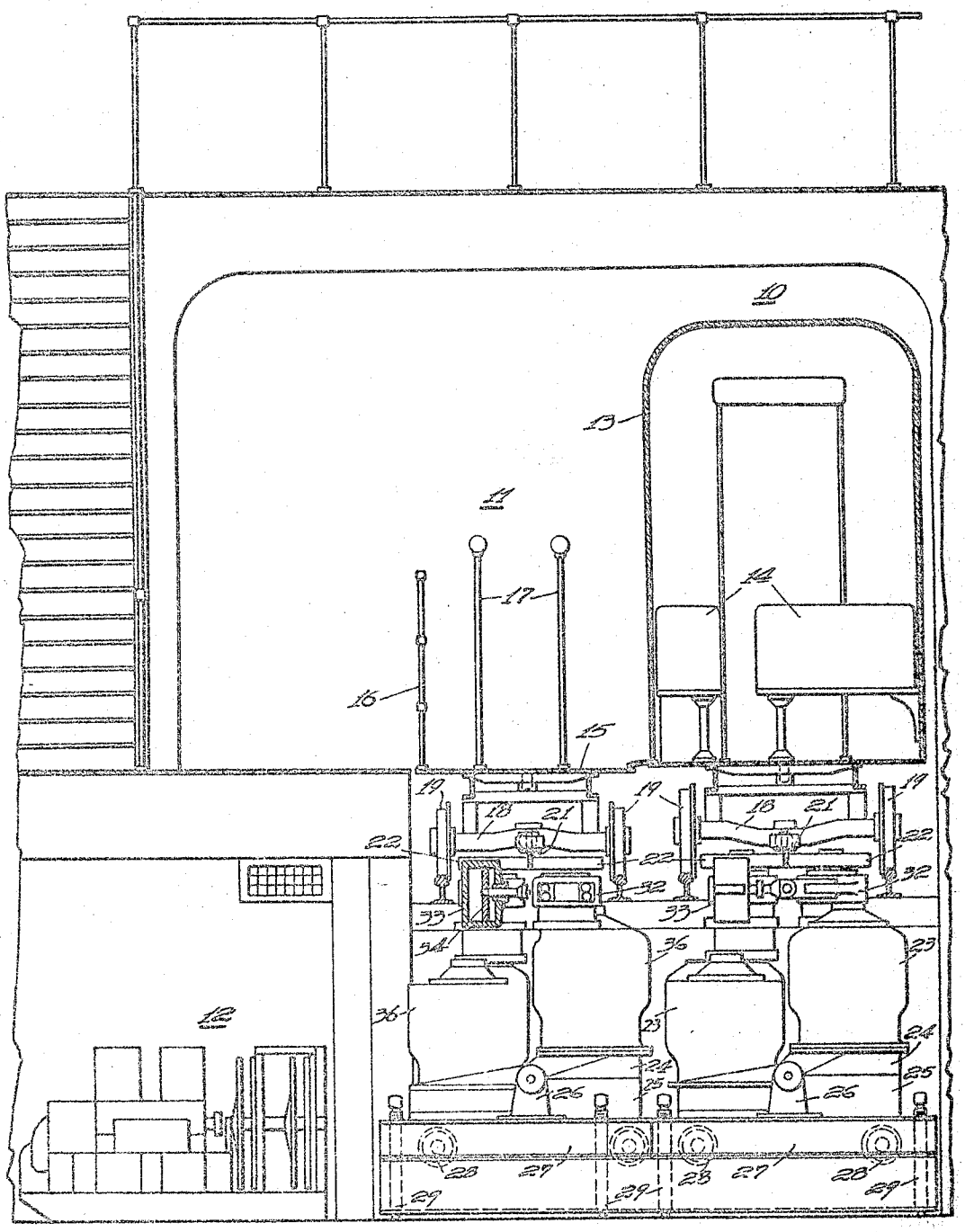


Fig. 2.

WITNESSES:

E. F. Liding.

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June 16, 1936. N. W. STORER 2,044,134

TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 3

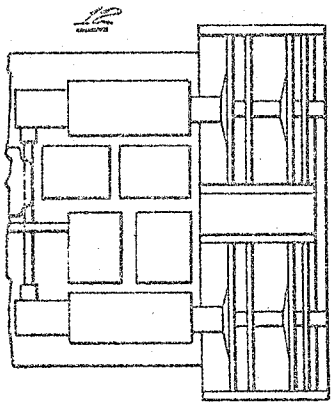
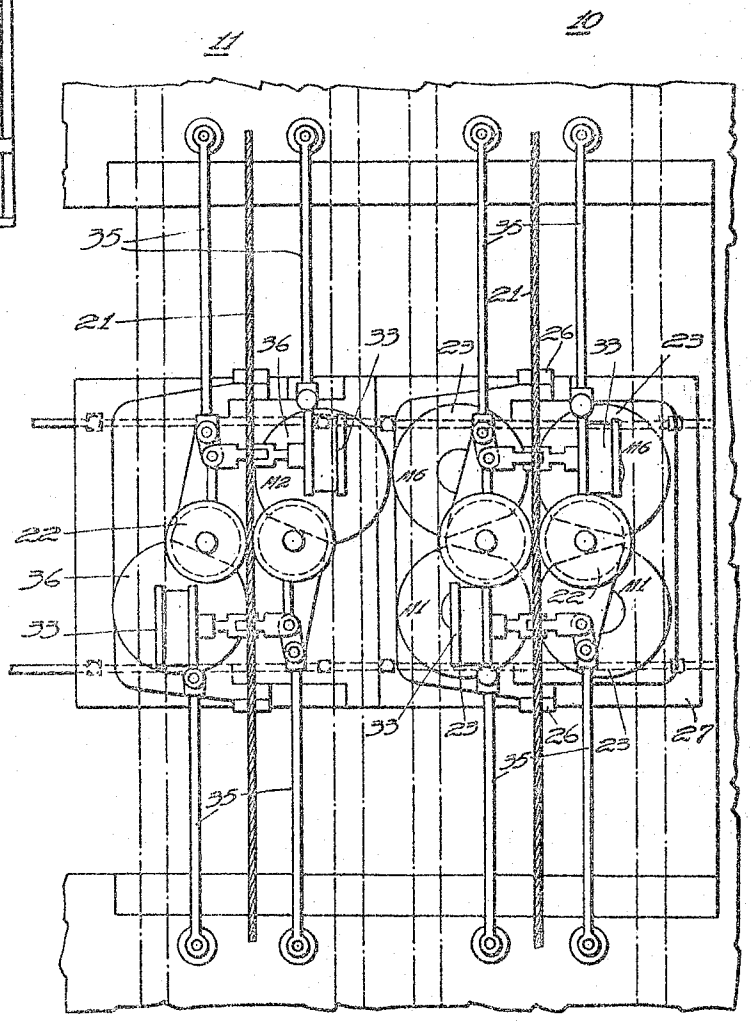


Fig. 3.



WITNESSES:

E. E. Leiding.

H. E. Hickcox

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June 16, 1936. N. W. STORER 2,044,134

TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 4

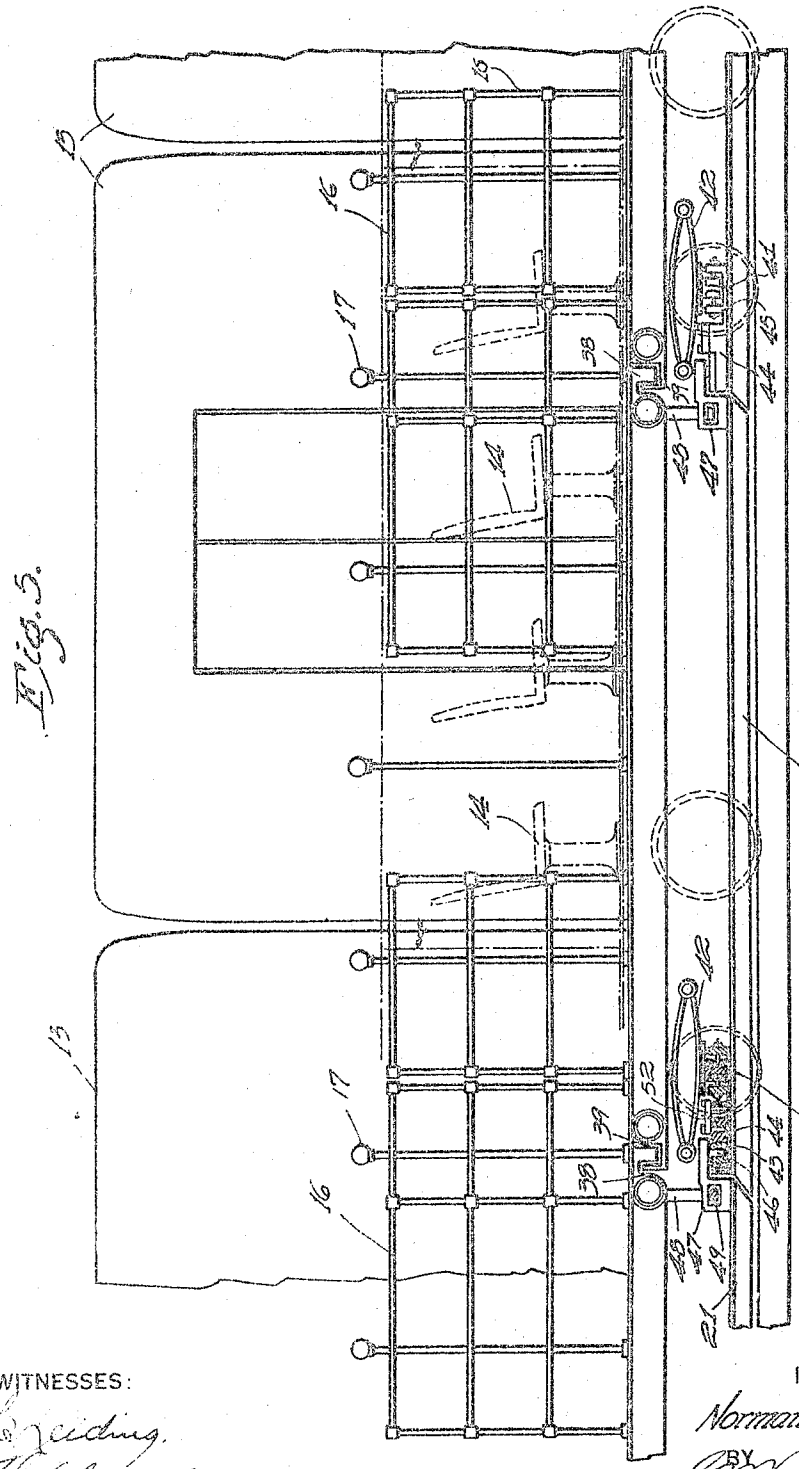


Fig. 5.

WITNESSES:

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TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 5

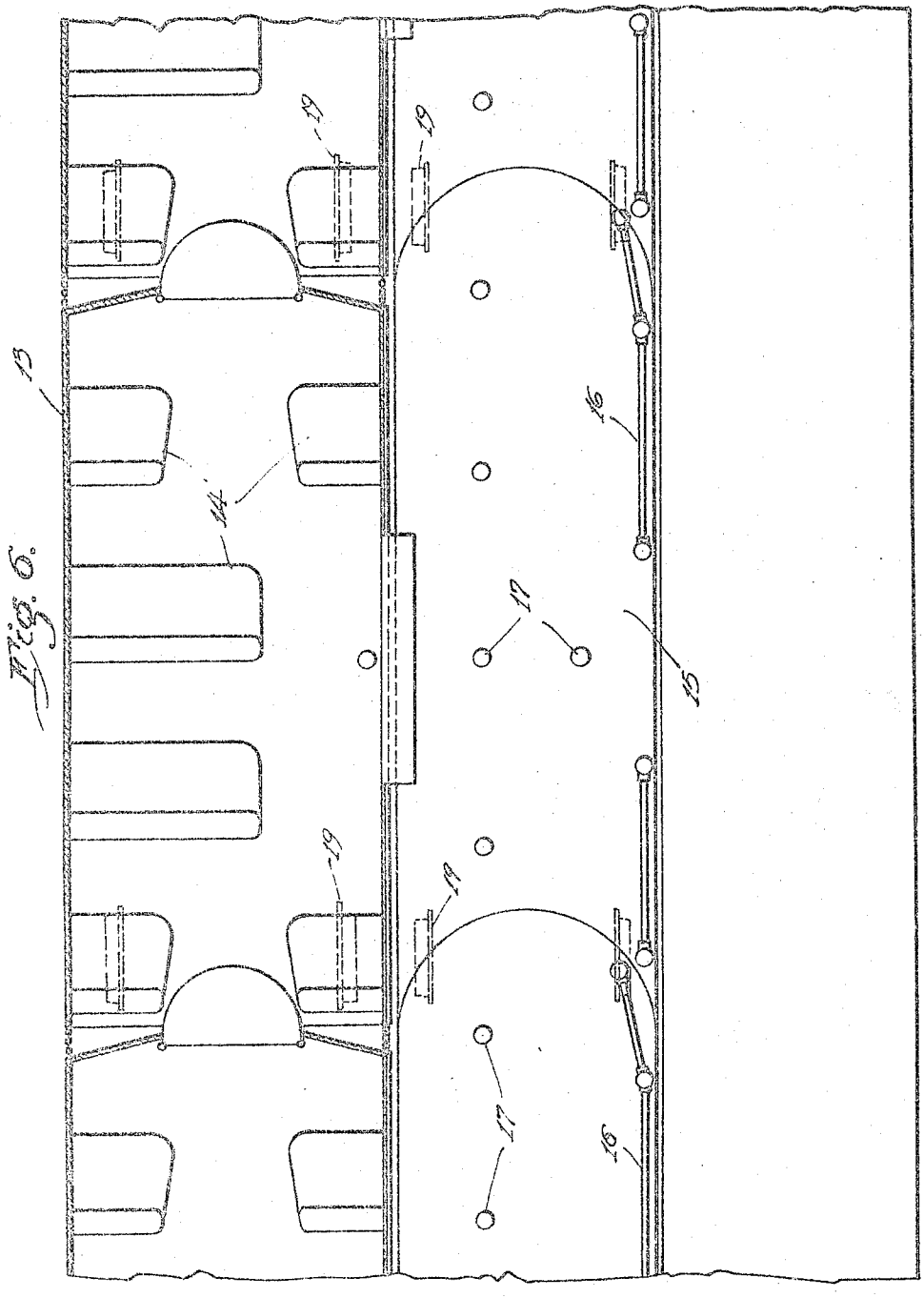


Fig. 6.

WITNESSES:

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TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 6

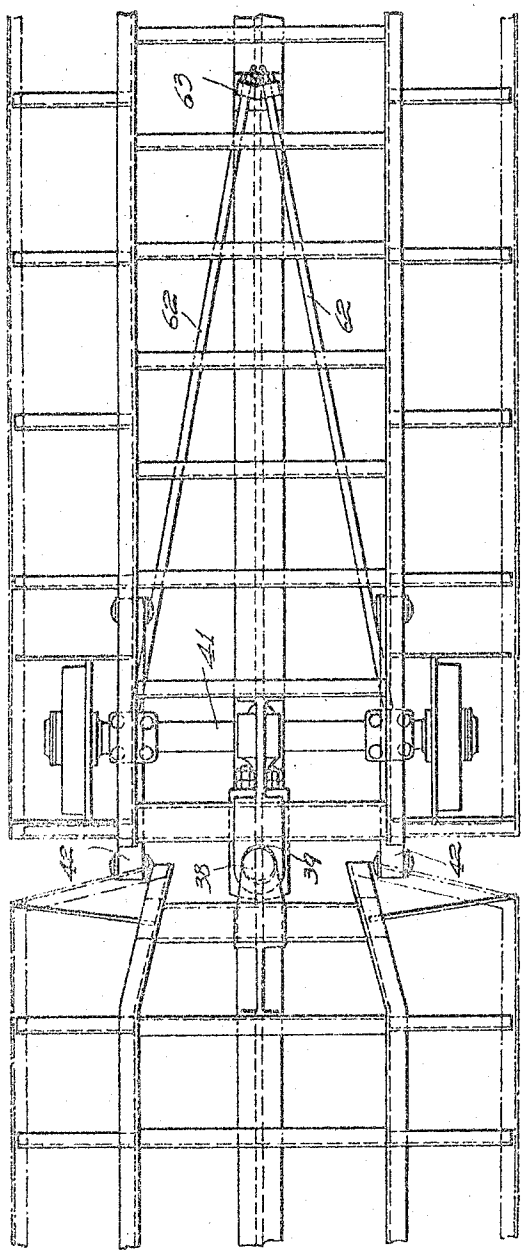


Fig. 7.

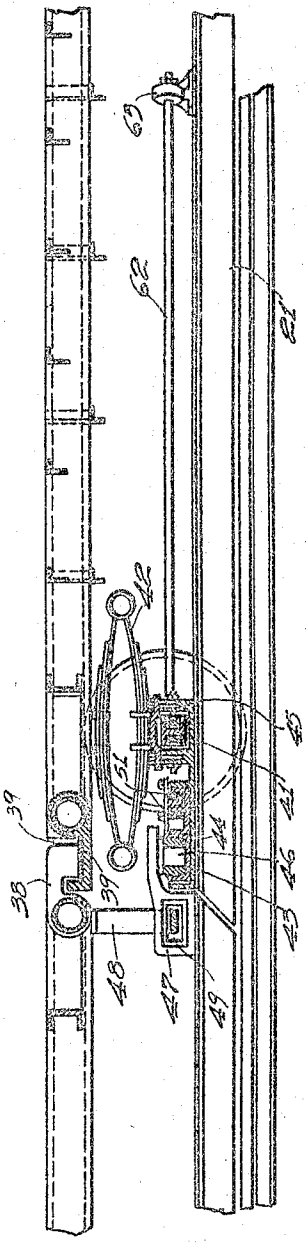


Fig. 8.

WITNESSES:

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TRANSPORTATION APPARATUS

Filed Oct. 29, 1932 7 Sheets-Sheet 7

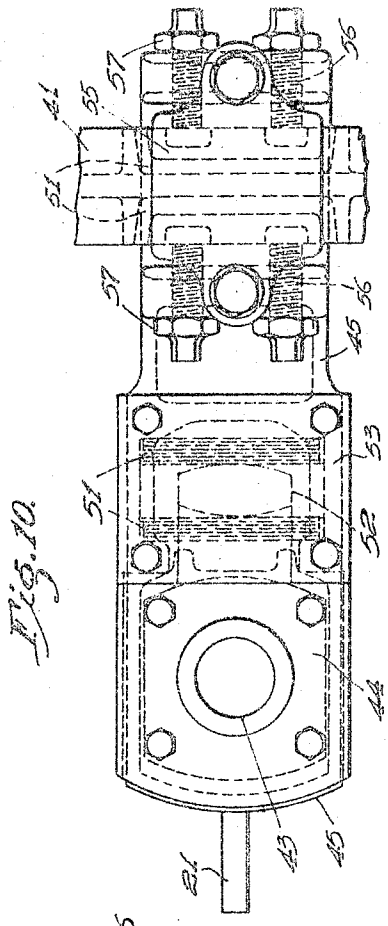


Fig. 10.

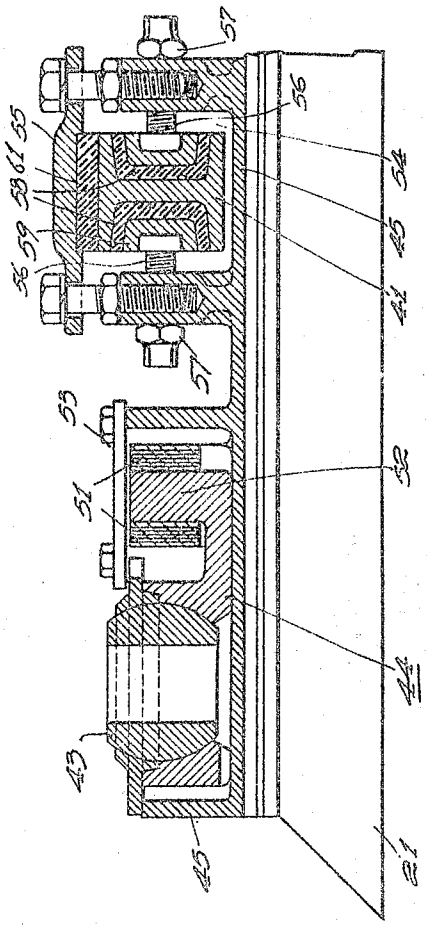


Fig. 12.

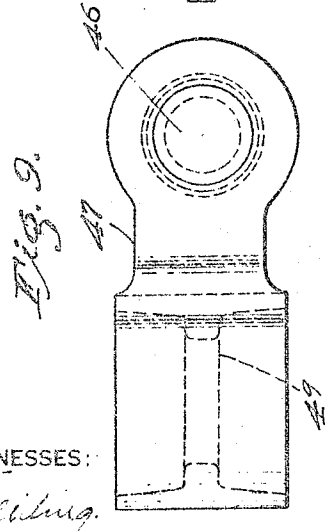


Fig. 9.

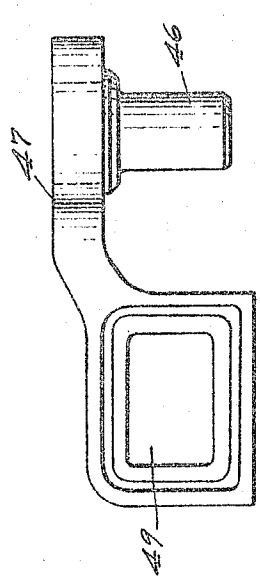


Fig. 11.

WITNESSES:

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ATTORNEY

Patented June 16, 1936 2,044,134

UNITED STATES PATENT OFFICE

2,044,134

TRANSPORTATION APPARATUS

Norman W. Storer, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 29, 1932, Serial No. 640,161

18 Claims. (Cl. 104—25)

My invention relates, generally, to transportation apparatus and more particularly to apparatus suitable for use in transportation systems commonly known as moving platforms such as described in my copending application Serial No. 612,014, filed May 18, 1932 and assigned to the Westinghouse Electric & Manufacturing Company.

The above-mentioned copending application describes a transportation system in which two or more continuous, parallel platforms or trains are provided, one of which operates continuously at a high average speed, but not a constant speed, while the speed of the other platform varies in cycles between standstill, or a very slow speed, and a maximum speed which is equal to the minimum speed of the high-speed platform. Passengers are permitted to board the slow-speed platform while it is at a standstill. It is then accelerated while the high-speed platform is decelerated and when the two trains reach substantially the same speed, they run at substantially the same speed for a definite time to permit the interchanging of passengers between the two platforms. The high-speed platform is then accelerated to its maximum speed and the slow-speed platform is decelerated to its minimum speed, at which it remains for a definite period to permit the loading and unloading of passengers. The slow-speed platform is then accelerated and the cycle of operation is repeated, as described in my copending application, Serial No. 612,014.

An object of my invention, generally stated is to provide means for propelling the vehicles of a continuous transportation system which shall be simple and efficient in operation and which may be economically manufactured and installed.

A more specific object of my invention is to provide for propelling the vehicles of a continuous transportation system by stationary motors mounted independently of the vehicles.

Another object of my invention is to provide for transmitting the power of the propelling motors to the vehicles of a continuous transportation system through a frictional drive.

Still another object of my invention is to provide a coupling for the vehicles of a continuous transportation system.

Other objects of my invention will be described fully hereinafter or will be apparent to those skilled in the art.

According to my invention, the vehicles of a continuous train are propelled by an adhesive or roller drive which comprises a flanged rail fastened to the under side of a fixed axle on each platform and two vertical shaft rollers, one on each side of the web of the flanged rail. The rollers drive the rail through adhesion developed by air pressure applied to roller bearings beneath the driving rollers. The shafts which drive the rollers are geared to vertical shaft motors located in pits underneath the track. The motors are mounted on trunnions, permitting them to move laterally a small amount as the driving rail on the drive varies its position. Each motor unit, consisting of two or four motors, is assembled complete and mounted on a truck in order that the complete unit may be quickly removed from its position beneath the track without interfering with the operation of the train.

For a fuller understanding of the nature and scope of my invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view in perspective, showing the trains of a continuous transportation system operating in a subway;

Fig. 2 is a view, partly in section and partly in elevation, showing the propelling motors located underneath the tracks which support the trains;

Fig. 3 is a top plan view of Fig. 2 showing the driving rollers and the propelling motors;

Fig. 4 is a view, partly in section and partly in side elevation, showing the manner of supporting the motors in the operative position;

Fig. 5 is a view, partially in side elevation and partially in section, showing the structure of the moving platforms and the cars;

Fig. 6 is a top plan view of Fig. 5;

Figs. 7 and 8 are plan and sectional views, respectively, showing the manner of coupling the cars together and of attaching the driving rail to the axle of a car;

Figs. 9, 10, 11 and 12 are enlarged views showing details of the construction of the coupling device.

Referring to the drawings, and particularly to Figs. 1 to 4, inclusive, the reference numeral 10 designates a continuous platform or train which moves continuously at a high average speed, but not at a constant speed, and the reference numeral 11 designates a transfer or slow-speed platform, the speed of which varies in cycles between standstill, or a very slow speed, and the minimum speed of the high-speed platform. The cycle of operation and the manner of controlling the operation of the trains by means of control

apparatus 12, shown in Fig. 2, are fully described in my copending application Serial No. 612,014 and, therefore, will not be described in detail in this application.

The high speed or carrying platform 10 may preferably consist of a continuous train of enclosed cars 13, provided with seats 14, or it may be constructed in any other desired form. The slow-speed or transfer platform 11 may consist of a continuous train of open vehicles 15, as the passengers remain on this platform only during a short interval when transferring to and from the high-speed train. The slow-speed platform is provided with a guard railing 16 for the protection of the passengers and a plurality of posts 17 to assist the passengers in supporting themselves during the acceleration of the train. The cars are provided with doors which are automatically opened at the proper time to permit the transfer of passengers, as described in my copending application Serial No. 612,014.

As shown in Fig. 2, the cars are mounted upon axles 18 having wheels 19 which run on roller bearings. Each car is provided with only one axle which is under one end of the car; the other end of the car is carried on the axle end of the next car, as shown in Fig. 5. A T-rail 21, which is fastened to the under side of the axles on each car, runs between pairs of rollers 22 which are driven by electric motors disposed in pits underneath the tracks.

The rollers 22 are mounted upon vertical shafts and drive the rail 21 through adhesion developed by air pressure applied to ball or roller bearings on the shafts beneath the driving rollers. The propelling motors are located in driving stations which may be spaced at suitable intervals throughout the entire system in accordance with the power required to operate the platforms. Inasmuch as the equipment in all stations is the same, that in one station only will be described.

The shaft of each roller 22 of a pair of rollers that drive the high-speed platform 10 is geared to two vertical shaft motors 23 which are mounted upon a base plate 24, as shown in Figs. 2 and 4. The same base contains bearings for the motors and for the driving shaft. A gear case 25 is bolted underneath the base plate. The gears run in oil which may be circulated through the roller bearings in the base.

The motors are mounted on trunnions 26, thereby permitting them to move laterally a small amount as the driving rail 21 varies its position. The trunnion supports are mounted upon a truck frame 27 which is provided with wheels 28. A complete motor unit consisting of four motors for the high-speed platform, or two motors for the slow-speed platform, may be readily rolled out of place in case of a fault in one of the motors and another unit connected in its place. When the unit is in the proper position underneath the track the truck frame 27 may be raised by means of jack screws 29 to a position in which the rollers 22 will engage the rail 21 and then blocked in place by beams 31, as shown in Fig. 4, or by any other suitable means.

In order that sufficient adhesion may be maintained between the rollers 22 and the rail 21 to drive the cars without slippage, the rollers are firmly held against the rail by means of air pressure. A large roller or ball bearing 32 is mounted upon each shaft, underneath the driving roller. An air cylinder 33 is mounted upon each bearing and each cylinder contains a piston 34 which is connected to the bearing on the shaft of the opposite roller of each pair. By applying air pressure to the pistons in the cylinders the rollers 22 may be firmly pressed against the rail 21 to prevent slipping of the rollers on the rail. If it is necessary to remove one of the driving units the air pressure may be quickly released to disengage the rollers from the rail 21, the bars 31 may then be removed and the truck 27 lowered by means of the screws 29.

As shown in Figs. 3 and 4, tie rods 35 are also connected between the bearings 32 and the walls of the station in which the motors are located in order to overcome the reaction of the roller drive and prevent longitudinal movement of the driving rollers.

In the illustrated embodiment of the invention, a driving unit for the slow-speed platform 11 is similar to one for the high-speed platform except that only two motors 36 are provided in each unit in place of four. Each driving roller is, therefore, geared to only one motor. The motors are mounted upon a truck 27, in the same general manner as the motors of the high-speed unit, by means of trunnions 26. The truck may be raised and lowered by jack screws 29, as previously described. The driving rollers 22 are compressed against the T-rail by air pressure in a similar manner as the rollers of the high-speed unit, the shafts of the rollers being provided with ball or roller bearings 32 and air cylinders 33.

As shown in Figs. 5 and 7, each car or section of the platforms has only one axle, which is fixed, and two wheels, each running on its own roller bearings. The axle is under one end of the car and the other end is supported by the axle end of the next car. One end of the body of each car is mounted on an axle 41 by means of elliptical springs 42 and the other end is pivotally supported on the end of the next car in a manner to permit free movement in both a vertical and a horizontal direction, thereby permitting the cars to readily negotiate curves or uneven places in the track. It will be noted that the cars may be readily disconnected by lifting the end of the car to raise the coupling member or hook 38 out of the pocket 39 in which it rests.

As previously stated, the cars or platforms are driven through a T-rail 21 which is secured to the underside of the axles 41. The rail 21 is divided into sections which are the same length as the cars. One end of each section of the rail is attached to the axle of the car and the other end is supported on the end of the rail on the next car in much the same manner as the body of the car is supported. Referring to Fig. 8 it will be seen that the ends of each rail section are cut at an angle of approximately 45 degrees in order to make continuous contact with the driving rollers.

As shown, particularly in Figs. 9 to 12, inclusive, a rail coupling comprises a ball and socket joint 43, the parts of which are carried in a casting 44 which may move a small amount relative to a container casting 45 which is securely fastened to one end of a section of the driving rail 21. A pin 46, which fits into the ball 43, is secured in a casting 47 which is fastened to the other end of a rail section. Accordingly, one end of each rail section is carried by the casting 45, which is attached to the axle 41, and the other end is carried by the casting 47 and the pin 46, which fits into the ball of the ball and socket joint on the next rail, as shown in the drawings.

In order to support the one end of the rail in case the end of the car is lifted out of place to disconnect it from the train or to prevent the

rail from dropping in case the coupling breaks, a supporting member 48, Fig. 8, extends upwardly from the casting 47 to the body of the car. As shown, the lower portion of the member 48 passes through a pocket 49 in the casting 47 and the upper end is fastened to the car coupling member.

In order to permit the distance between the supports for the couplings to be adjusted with a view to adjusting the length of the cars to make the length of the train equal to the length of the track and also to provide resiliency in the driving system, a plurality of leaf springs 51 are interposed between the casting 44, which carries the ball 43, and the container casting 45, as shown in Figs. 10 and 12, in a manner to permit the casting 44 to move slightly with respect to the casting 45.

As shown, the casting 44 is provided with an upwardly-extending projection 52 which is disposed between the leaves of the springs 51 which are retained in the container casting 45 by a cover plate 53. The casting 44 is, therefore, permitted to slide back and forth a limited amount because of the flexibility of the springs 51. If it is necessary to vary the length of the cars, in order to make the length of the train equal to that of the track, one or more spring leaves may be transferred from one side to the other of the projection 52 in order to increase or decrease the length of the train.

Referring particularly to Figs. 10 and 12, it will be seen that the axle 41 of the car is retained in position in a pocket 54 in the casting 45 by means of a cover plate 55 and a plurality of adjustable set screws 56 which are provided with lock nuts 57. In order to deaden the noise and also to allow flexibility, insulating cushions 58, composed of rubber or other resilient material, are interposed between the axle and the retaining cups 59, in which the heads of the screws 56 are seated, as shown in Fig. 12. A rubber pad 61 is also interposed between the cover plate 55 and the top of the axle 41. In this manner the driving power is transmitted from the rail 21 to the axles and practically no vibration or noise is transmitted to the car bodies.

As shown in Figs. 7 and 8, the axle 41 is held at right angles to the rail 21 by means of a yoke which comprises two rods 62. One end of each rod is connected to one of the wheel bearings and the other ends are connected to the rail at 63. The rods may be adjusted to correct the position of the axle 41 with respect to the rail 21.

While I have illustrated my transportation system as being adapted for use in subways, it will be readily understood that it may be easily constructed on the surface, or it may run overhead, between or through the tall buildings in our large cities, furnishing a means of quickly and safely transporting a large number of people over any desired distance, thereby relieving the present congested condition on our city streets.

From the foregoing description, it is evident that I have provided a transportation system which is simple and economical in operation and which has a greater capacity than any of the present systems. The continuous transportation system herein described may be operated safely and quietly, and it provides a convenient means of transporting a large number of passengers through the congested districts of our large cities.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and 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.

I claim as my invention:

1. In a transportation system, in combination, a continuous mobile platform, a plurality of stationary motors disposed underneath the platform for propelling it, frictional means for transmitting the energy of the motors to the platform, and fluid-pressure means for varying the pressure on the frictional means.

2. In a transportation system, in combination, a continuous mobile platform, a flanged rail attached to the platform, a plurality of rollers for frictionally driving the rail, a plurality of motors for driving the rollers, and fluid pressure means for pressing the rollers against the flange of the rail to prevent slippage between the rollers and the rail.

3. In a transportation system, in combination, a continuous mobile platform, a flanged rail attached to the platform, a plurality of rollers for frictionally driving the rail, a plurality of motors disposed underneath the platform for driving the rollers, fluid pressure means for pressing the rollers against the flange of the rail to prevent slippage between the rollers and the rail, and means for varying the pressure exerted by the fluid pressure means upon the rollers.

4. In a transportation system, in combination, a plurality of vehicles, means including an axle for supporting each vehicle, a flanged rail attached to the axle, a plurality of rollers for frictionally driving the rail, a plurality of stationary motors for driving the rollers, and fluid pressure means for pressing the rollers against the flange of the rail to prevent slippage between the rollers and the rail.

5. In a transportation system, in combination, a plurality of vehicles, an axle disposed underneath each vehicle, a flanged rail secured to the axle, a plurality of vertical shaft rollers for frictionally driving the rail, a plurality of stationary motors disposed underneath the vehicles for driving the rollers, and fluid pressure means for compressing the rollers against the rail to prevent slippage between the rollers and the rail.

6. In a transportation system, in combination, a continuous mobile platform, a plurality of motors disposed underneath the platform for propelling it, frictional means for transmitting the energy of said motors to the platform, and means for raising the frictional means and the motors into their operative position beneath the platforms.

7. In a transportation system, in combination, a continuous mobile platform, a plurality of motors disposed underneath said platform for propelling it, frictional means for transmitting the energy of the motors to the platform, a plurality of movable trucks for supporting the motors, and means for pivotally mounting the motors on the trucks.

8. In a transportation system, in combination, a continuous mobile platform, a plurality of motors disposed underneath the platform for propelling it, frictional means for transmitting the energy of the motors to the platform, a plurality of movable trucks for supporting the motors, means for pivotally mounting the motors on the trucks, and means for raising the trucks to raise

the motors into their operative position beneath the platform.

9. In a transportation system, in combination, a continuous mobile platform, a plurality of motors disposed underneath the platform for propelling it, said motors being grouped in driving units throughout the system, frictional means for transmitting the energy of the motors to the platform, a truck for supporting the motors of each driving unit, means for pivotally mounting the motors on the trucks, and means for raising the trucks to raise the motors into their operative position beneath the platform.

10. In a transportation system, in combination, a plurality of vehicles connected into an endless train, a fixed axle for supporting one end of each vehicle, means for pivotally supporting the other end of each vehicle upon the end of the next vehicle, a T-rail secured to said axle, a plurality of rollers disposed to frictionally drive said rail, a plurality of motors for driving the rollers, and resilient means for compressing the rollers against the flange of the T-rail.

11. In a transportation system, in combination, a plurality of vehicles, an axle for supporting each vehicle, a T-rail mounted on the axle, a plurality of rollers for frictionally driving the rail, a plurality of vertical shaft motors for driving the rollers, and means for pivotally mounting the motors underneath the vehicles to permit lateral movement of the driving rollers.

12. In a transportation system, in combination, a plurality of vehicles, an axle for supporting each vehicle, a T-rail mounted on the axle, a plurality of rollers for frictionally driving the rail, a plurality of vertical shaft motors for driving the rollers, means for pivotally mounting the motors underneath the vehicles to permit lateral movement of the driving rollers, and means for preventing longitudinal movement of the rollers.

13. In a transportation system, in combination, a plurality of vehicles connected into an endless train, a fixed axle for supporting one end of each vehicle, means for supporting the other end of each vehicle upon the end of the next vehicle, a sectional T-rail for propelling the vehicles, means for resiliently mounting one end of each section of the rail on the axle of one vehicle, means for pivotally mounting the other end of each rail section upon the end of the next section, and a plurality of motors disposed to frictionally drive the T-rail.

14. In a transportation system, in combination, a plurality of vehicles connected into an endless train, a fixed axle for supporting one end of each vehicle, means for supporting the other end of each vehicle upon the end of the next vehicle, a sectional T-rail for propelling the vehicles, means for resiliently securing one end of each section of the rail to the axle on one vehicle, coupling means for flexibly and resiliently securing the other end of each rail section to the next section, and means including a plurality of motors disposed to frictionally drive the T-rail.

15. In a transportation system, in combination, a plurality of vehicles connected into an endless train, a fixed axle for supporting one end of each vehicle, means for supporting the other end of each vehicle upon the end of the next vehicle, a sectional T-rail for propelling the vehicles, means for resiliently securing one end of each section of the rail to the axle on one vehicle, coupling means for flexibly and resiliently securing the other end of each rail section to the next section, means for varying the length of said coupling means to vary the length of the train, and means including a plurality of motors disposed to frictionally drive the T-rail.

16. In a vehicle structure, in combination, a fixed axle for supporting the vehicle, wheels mounted on the axle, a rail for transmitting power to the vehicle, means for clamping the rail to the axle, and resilient means interposed between the axle and the clamping means.

17. In a vehicle structure, in combination, a fixed axle for supporting the vehicle, wheels mounted on the axle, a flanged rail for transmitting power to the vehicle, a rail supporting member secured to the rail, means for removably attaching the rail supporting member to the axle, and resilient means interposed between the axle and the last named means.

18. In a vehicle structure, in combination, an axle beam for supporting the vehicle, wheels mounted on the axle, a flanged rail for transmitting power to the vehicle, a rail supporting member secured to the top of the rail, means on the rail supporting member for engaging the web of the axle beam to secure the rail in position, and resilient means interposed between the axle and the last named means.

NORMAN W. STORER.