No. 637,005. Patented Nov. 14, 1899.

H. KNUDSEN.

ELEVATED RAILWAY.

(Application filed Feb. 7, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

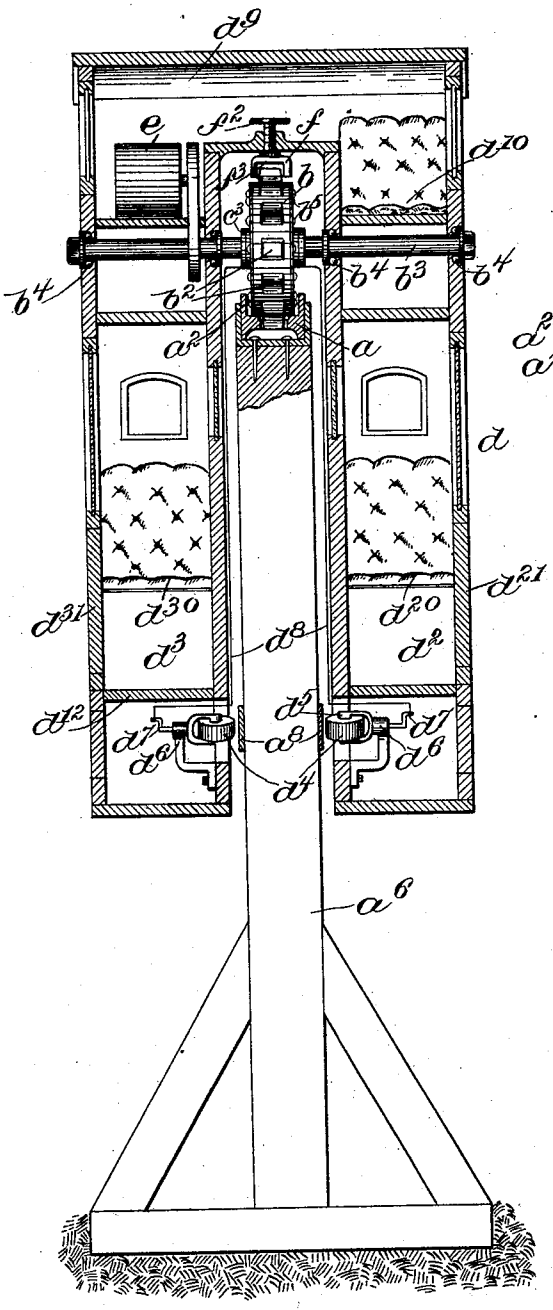


Fig. 2.

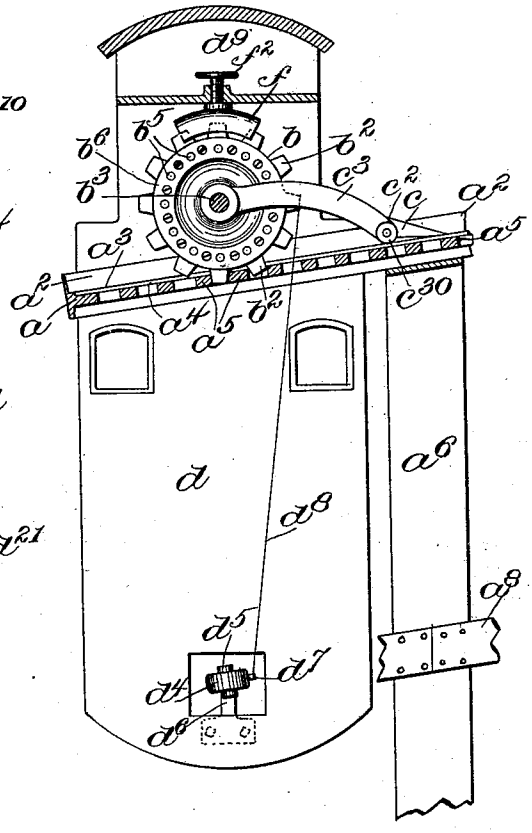
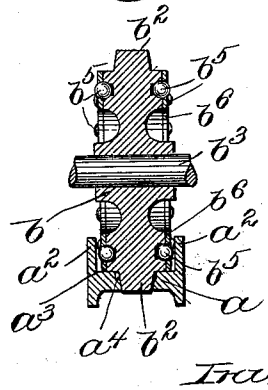


Fig. 3.



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Fig. 4.

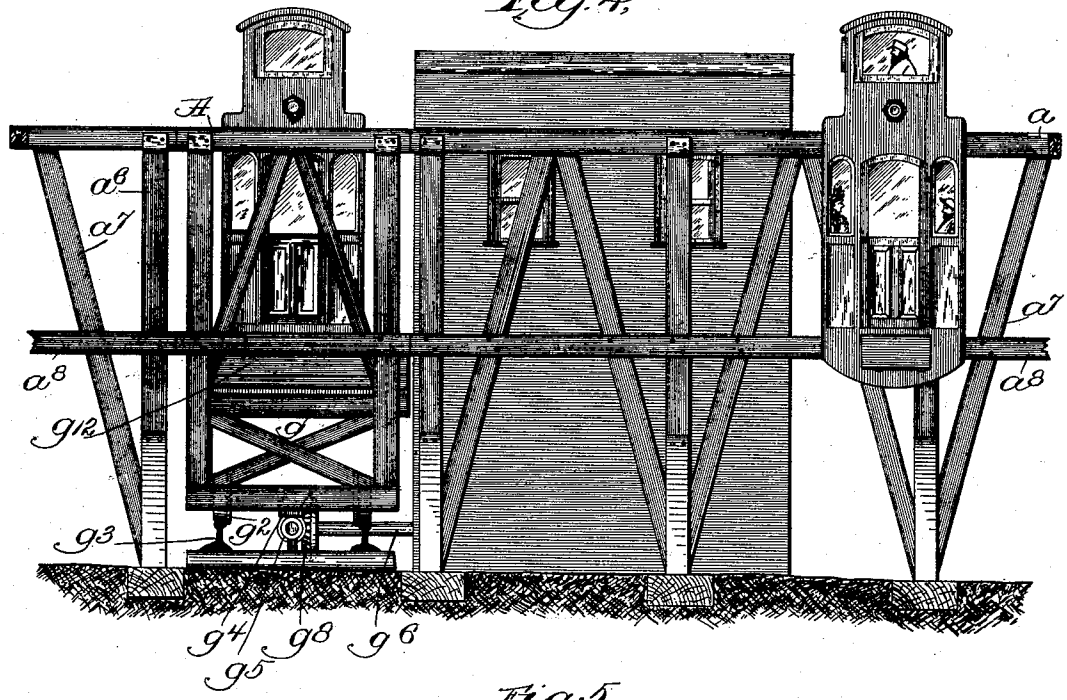
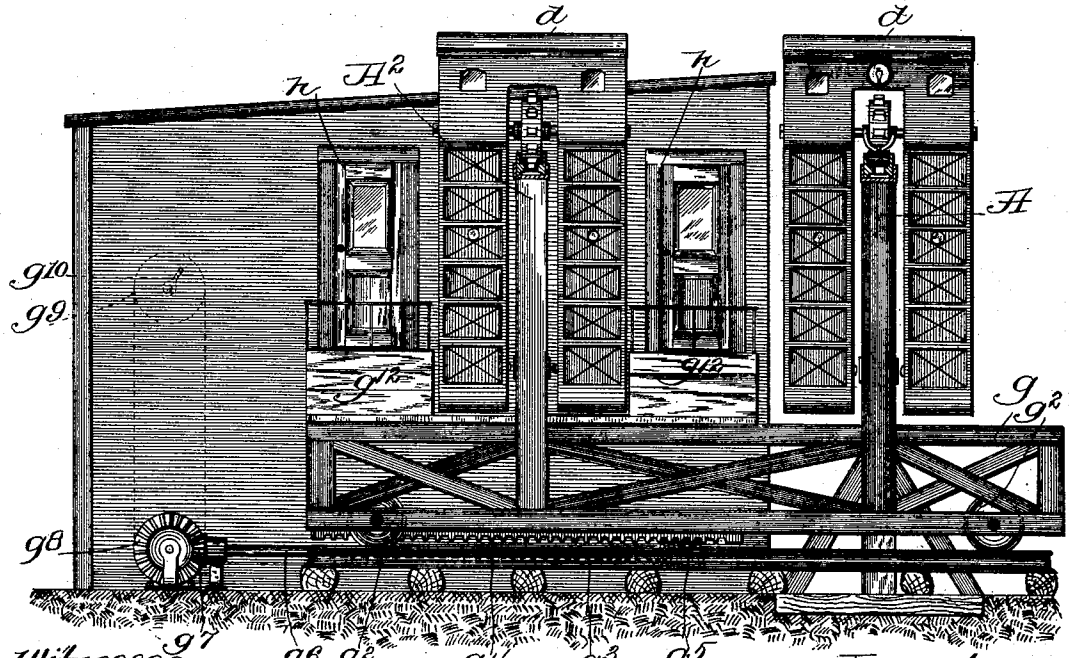


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELEVATED RAILWAY.

SPECIFICATION forming part of Letters Patent No. 637,005, dated November 14, 1899.

Application filed February 7, 1898. Serial No. 669,372. (No model.)

To all whom it may concern:

Be it known that I, HANS KNUDSEN, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Elevated Railways, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The present invention relates to an elevated railway and car to be used in connection therewith, the object of the invention being mainly to afford a practicable railway system for regions where ordinary railways are impracticable owing to steep grades and climatic conditions.

The railway itself, in accordance with the invention, comprises a single rail mounted on top of a structure of sufficient height to clear the level of any ordinary snowfall, the said rail having a flange at each side to confine the supporting-wheel for the car and being provided with cross members, between each two of which an open space is left, said cross members being adapted to coöperate with teeth on the driving-wheel of the car, which bears upon the rail at each side of said cross members. The said wheel is adapted to carry with it a plow or clearing device, projecting forward in front of the same and fitting the surface of the rail between the flanges, so as to clear away any snow which may have lodged therein, it being obvious that such snow as is not cleared away by the plow will be forced through the open spaces by the teeth of the driving-wheel, so as not to interfere with the operation thereof or become compressed beneath said wheel to lift the same above the flanges and cause derailment. The car, which is preferably small and light and only intended to transport a small amount of freight or a few passengers at a time, is hung upon the axle of the driving-wheel at a point above its center of gravity and is made in two sections, one at each side of the structure which supports the rail, the main portion of said sections being wholly below the said rail, so that the center of gravity is below the supporting-point, causing the floor and seats to remain substantially level while the car is traveling on grades and at the same time rendering it practically impossible for the car to leave the elevated structure upon which it travels. The said car may be driven by a motor of any suitable kind, such as a small steam-turbine or electromotor, which may be placed in a compartment at the top of the car, the said compartment also being large enough to accommodate an engineer or motorman to direct the car. The two depending car-sections are provided with wheels or rollers mounted on axes transverse to the direction in which the car travels, and the elevated structure has along its sides bearing-surfaces for said wheels, so that if there is greater weight at one side than at the other the car will be prevented from tipping by contact of said wheels with the said bearing-surfaces. The bearings for said wheels are rotatably mounted in an axis transverse to their own, so that when grades are encountered they may be turned to maintain the axis of the wheels transverse to the direction of the surfaces against which the wheels bear, the wheel-bearings being connected for this purpose with the plow above mentioned, which is pivotally connected with the car, and thereby constitutes a feeler to regulate the position of said wheels, as described. The said driving-wheel is further provided with a series of antifriction devices, such as balls, mounted in annular channels therein and projecting laterally therefrom toward the flanges of the rail to take up the friction due to lateral play.

The invention further consists in a novel construction and arrangement of the track to admit of the passing of cars going in opposite directions where, as would commonly be the case, only a single track is employed. The "turnout," as it may be called, consists, in accordance with the invention, of two parallel track-sections, each of which is of sufficient length to support one of the cars, the said track-sections being mounted on a staging capable of lateral movement with relation to the main track, so that a car which has been stopped on one of said track-sections may be moved laterally out of the way, while the other section is by the same movement brought into alinement with the main track and completes the track for the passage of the car in the opposite direction. These track-sections are herein shown as erected at a station, and the staging on which the sec-

tions are erected is provided with supports or platforms arranged adjacent to the doors of the car thereon, while the station-doors are in such a position that when the said platforms are adjacent thereto the track is completed by the unoccupied track-section. It is obvious that a car may be transferred to a branch line or side track in the same way, said track being arranged so that the section which supports the car may be moved into alinement therewith.

Figure 1 is a vertical transverse section of a railway and car embodying the invention. Fig. 2 is a similar section thereof, taken on a plane substantially parallel to the side of the elevated structure. Fig. 3 is a sectional detail of the driving-wheel and the rail. Fig. 4 is a side elevation of a portion of the track at the turnout; and Fig. 5, a cross-section of the track looking from the left, Fig. 4.

The track comprises a single rail a, having side flanges a^2 and bearing-surfaces a^3, between which is a depression or channel a^4, across which extend cross-bars a^5 to coöperate with teeth b^2, formed along the periphery of the driving-wheel b. The said rail is supported on any suitable elevated structure, herein shown as a line of posts a^6 and braces a^7, which preferably meet between the said posts to afford an intermediate support for the rail. Projecting forward from the driving-wheel is a clearing device or plow c, fitting between the flanges a^2 and bearing upon the continuous bearing-surfaces a^3, so as to clear away any snow that may lodge on the said rail, it being obvious that such snow as is not cleared away by the said plow will be forced through the openings between the cross-pieces a^5 by the teeth b^2 of the wheel as the car travels. The said plow c is shown as pivotally connected at c^2 to an arm c^3, which in turn is pivotally connected with the car, preferably having a bearing upon the axle b^3 of the driving-wheel b. The said arm has rollers c^{30}, which travel along the bearing-surfaces a^3. The said axle projects laterally from the wheel b, which is shown as fast thereon, and has a bearing in the car d near the top of said car, which comprises two sections d^2 and d^3, which depend from said axle, one at each side of the elevated structure. As herein shown, the said car and axle are provided with antifriction-bearings b^4. The compartments d^2 and d^3 of the car are shown as provided with seats d^{20} and d^{30} and doors d^{21} and d^{31}, opening at the sides away from the posts a^6. To prevent the car from tipping from one side to the other, if imperfectly balanced in weight or otherwise having a tendency to tip, the said car is provided at each side with a wheel d^4, shown as mounted in a bearing d^5, which has a support mounted in a bearing d^6 and provided with an arm or projection d^7, adapted to be connected, as by a wire d^8, with the plow-arm c^3, so that when the said car is on a grade, as indicated in Fig. 2, the axes of the wheels d^4 will be transverse to the direction of the rail, so that the wheels will turn easily if in contact with the side surfaces a^8, which are provided for the purpose.

To prevent excessive friction between the sides of the wheel b and the flanges a^2 of the rail, the said wheel is shown as provided with a series of antifriction-balls b^5, mounted in annular channels in the said wheel and held in place by the plates b^6, having openings through which the said balls project, as shown in Fig. 3.

To drive the car, the same is shown as provided with a suitable motor e, which may be mounted in a compartment d^9 at the top of the car, which compartment may also be provided with a seat d^{10} for the motorman or engineer. The said motor may be of any suitable or usual type, and the generator therefor may be carried in the bottom of one of the car-bodies below the floors d^{12}. The generator may be of any kind suitable for the motor to be employed and is not herein shown, since it forms no part of the present invention. The car is also shown as provided with a brake f, having an actuating-handle f^2, the said brake comprising a shoe adapted to come in contact with the periphery of the wheel b, the said shoe having a channel f^3, so as not to interfere with the teeth b^2.

As it is commonly desirable in a railway of this kind to erect only a single line of track, the "turnout," as it may be called, is of novel construction and arrangement, as herein shown, and forms a part of the present invention, the purpose of which turnout is to afford means for shifting one of the cars out of the way, so that it can be passed by another, or for shifting said car to a branch or side track. The said turnout is herein shown as situated at one of the stations, and the appliances for operating the same are arranged to be under control of the station-master or attendant.

To afford the means above mentioned for allowing one car to pass another, two parallel track-sections A and A^2 are erected on a staging g, which is laterally movable with relation to the main track, so that either of the said track-sections may be moved into alinement with the main track, so as to afford a continuous track or surface upon which a car can travel by. When, therefore, one of the cars is brought to a standstill on one of the said track-sections, as the section A^2, the staging g is moved laterally until the track-section A is in line with the main track, as shown in Fig. 5, so that the other car can pass by. The staging can then be moved in the opposite direction until the section A^2 is in line with the main track, so that the car upon said section A^2 can proceed on its way.

As herein shown, the staging g is mounted on wheels g^2, adapted to run on a track g^3, and the said staging may be provided with a rack g^4 to coöperate with a worm g^5 on a shaft g^6, so that the rotation of said shaft will

produce the proper movement of the said staging. The said shaft g^6 is shown as provided with a bevel-gear g^7, meshing with a corresponding beveled gear g^8, which is belted to a wheel g^9, having a handle g^{10} inside the station, so that it can be operated by the attendant at the station after the car has reached the same.

For convenience in loading or unloading the cars or getting into or out of the same the staging g is shown as provided with platforms g^{12}, one at each side of the track-section A^2, so that when the car stops on the said section the said platforms will be adjacent to the doors thereof, where the passengers can step directly on them from the cars.

The station-doors h are so arranged that when the staging g is moved to the left, Fig. 5, the said platforms will be adjacent to said station-doors, as shown, so that passengers can step from the car upon said platforms and then into the station, or freight may be unloaded or loaded in the same way.

It will be seen from the foregoing that a railway and car embodying the invention can be easily constructed and will afford practicable means for transporting freight or passengers through mountainous regions, where it would be practically impossible to install a railroad of any of the usual types, or in any event so costly that the expense of construction would be wholly out of proportion to the benefits derived.

The cars may be lightly constructed and are intended to be run singly, as shown, so that very steep grades can be traversed without difficulty, while it is obvious that an elevated structure of sufficient strength can be erected at but slight cost, using the timber which is usually plenty in the regions such as require transportation of this kind, so that it is necessary only to transport the rails and the cars to the place where the railway is to be built. Where there is apt to be a heavy snowfall, it is obvious that the rail can be elevated sufficiently to clear the level likely to be reached by the snow, while the only part of the structure where snow can collect to disadvantage is the top of the rail itself, which, as has been stated, has open spaces extending completely through the same for the teeth of the driving-wheel, so that such snow as is not cleared away by the plow will be forced through said openings, keeping the rail substantially clear.

It is not intended to limit the invention to the specific construction herein shown and described, since obvious modifications may be made without departing from the invention.

I claim—

1. A railway system comprising an elevated rail having upwardly-projecting flanges along the sides thereof and cross members separated by openings along the bottom thereof; combined with a car having a drive-wheel which has a bearing in the upper part of said car and is provided with teeth corresponding to the openings in said rail, and a car-body having two compartments below the bearing for said wheel, one at each side of the structure which supports the rail, whereby the floor and seats of said car will remain level regardless of the angle of the track, substantially as described.

2. A railway system comprising an elevated rail having upwardly-projecting flanges along the sides thereof and cross members separated by openings along the bottom thereof; combined with a car having a drive-wheel which has a bearing in the upper part of said car and is provided with teeth corresponding to the openings in said rail, a car-body having two compartments below the bearing for said wheel, one at each side of the structure which supports the rail, and a plow or clearing device pivotally connected with the car and adapted to slide along the rail in advance of said driving-wheel, substantially as described.

3. A railway system comprising an elevated rail having upwardly-projecting flanges along the sides thereof and cross members separated by openings along the bottom thereof; combined with a car having a drive-wheel which has a bearing in the upper part of said car and is provided with teeth corresponding to the openings in said rail, a car-body having two compartments below the bearing for said wheel, one at each side of the structure which supports the rail, a plow or clearing device pivotally connected with the car and adapted to slide along the rail in advance of said driving-wheel, wheels or rollers mounted on bearings in the car one at each side of the rail-supporting structure and adapted to cooperate with bearing-surfaces or tracks along the same, and means for connecting the supports for said bearings with said plow, said supports being rotatably mounted, substantially as and for the purpose described.

4. A railway-car adapted to travel on a rail supported on an elevated structure, said car comprising two compartments one on each side of said structure, a drive-wheel having a bearing in the car above said rail, wheels or rollers having bearings mounted in rotatable supports in said car and adapted to bear against rails or surfaces along the side of said elevated structure to prevent the car from tipping, a feeler pivotally secured to the car and adapted to travel along the surface of the main rail, and means for connecting said rotatable supports with said feeler, substantially as and for the purpose described.

5. A railway system comprising an elevated rail having upwardly-projecting flanges along the sides thereof and cross members below said flanges; combined with a car having a drive-wheel provided with teeth corresponding to the said cross members; antifriction-balls arranged in annular channels, one at each side of said wheel to bear against the said

flanges; and means for retaining the said balls in said channels and separate from each other, substantially as described.

6. In an elevated-railway system, the combination with a single rail mounted on an elevated structure, of a car provided with a supporting-wheel to travel on said rail, said supporting-wheel being mounted above the center of gravity of the car, which has two compartments below said wheel, one at each side of the said elevated structure, and a turnout comprising a pair of parallel track-sections mounted on a traveling staging movable in a direction transverse to that of the main track; whereby a car which has moved onto one of said sections from the main track can be moved to one side, and the track completed by the other track-section so that another car can pass, substantially as described.

7. In an elevated-railway system, the combination with the main track a, of the laterally-movable track-sections A and A^2, the staging g upon which said track-sections are supported, the track for said staging, means for laterally moving said track, the platforms g^{12} upon said staging, and a landing adjacent to which said platforms are adapted to be moved when one of said track-sections is moved away from the main track and the other section is brought into alinement therewith, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HANS KNUDSEN.

Witnesses:
H. J. LIVERMORE,
NANCY P. FORD.