R. E. SHEAL.

COG TRACK FOR MOVING STRUCTURES.

APPLICATION FILED NOV. 12, 1921.

1,435,341. **Patented Nov. 14, 1922.**

2 SHEETS—SHEET 1.

Fig. 1.

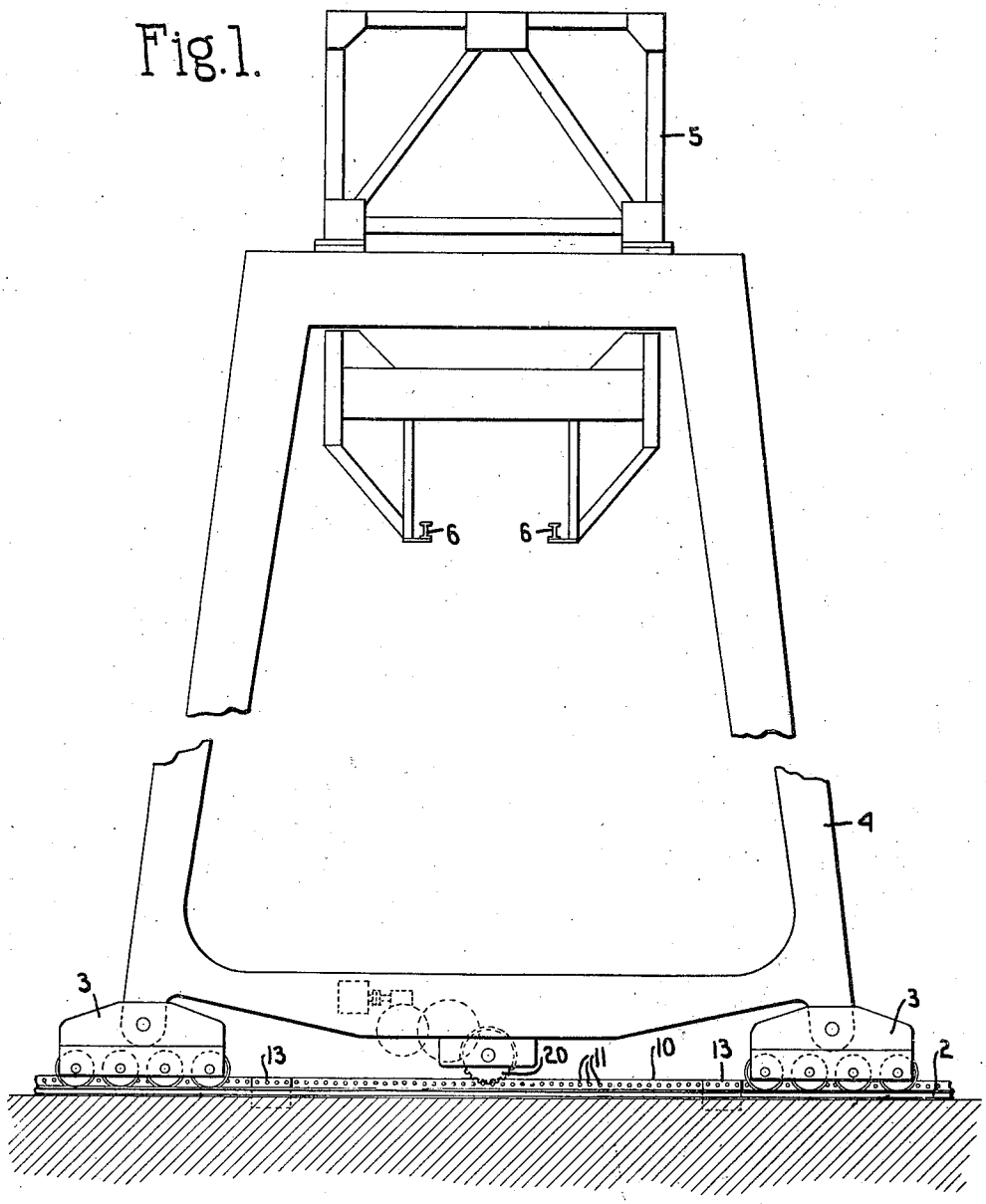
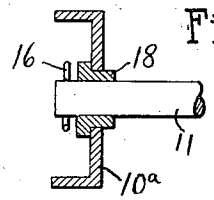


Fig. 7.



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2 SHEETS—SHEET 2.

Fig. 2.

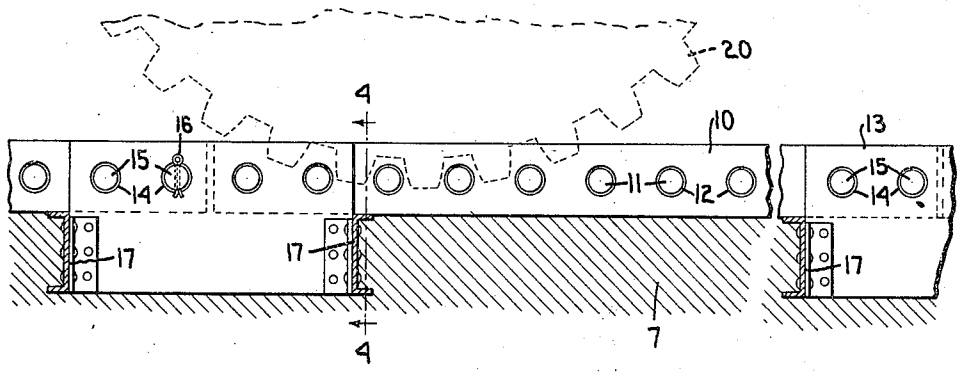


Fig. 3.

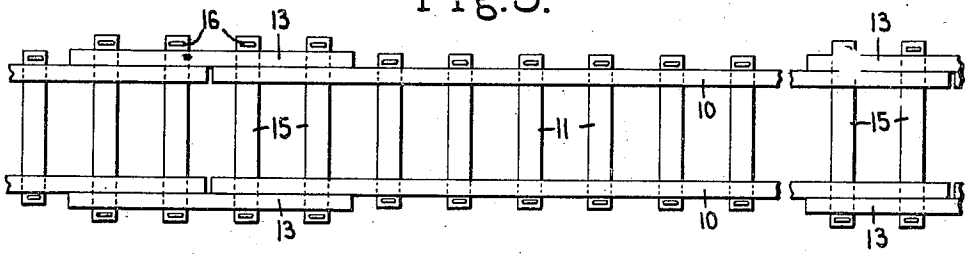


Fig. 4.

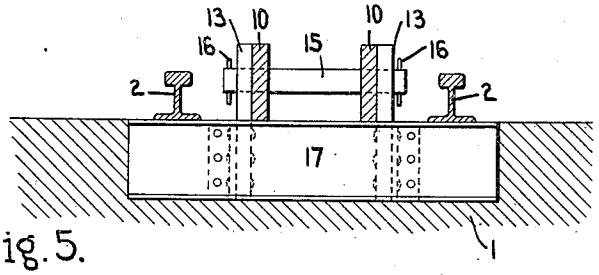


Fig. 5.

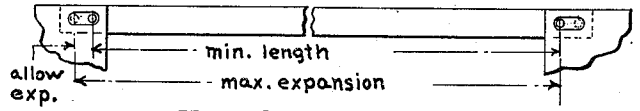
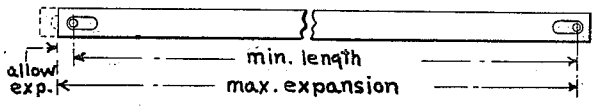


Fig. 6.



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UNITED STATES PATENT OFFICE.

ROBERT E. SHEAL, OF CLEVELAND, OHIO.

COG TRACK FOR MOVING STRUCTURES.

Application filed November 12, 1921. Serial No. 514,583.

To all whom it may concern:

Be it known that I, ROBERT E. SHEAL, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Cog Tracks for Moving Structures, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to cog tracks for moving massive structures and was developed with special reference to hoisting and conveying machinery of the traveling crane type, known as bridges, for handling bulk materials, such as ore, coal, limestone, etc., although equally applicable to cog or rack drive railroads of all types, ship towing devices, ship building cranes, or all other types of traveling structures, or apparatus of a similar nature wherein a cog or rack type of drive is used as a means of propulsion.

The objects of the invention are the provision of a rack or cog-track, which shall be inexpensive in construction, made up in sectional lengths, each section anchored or fastened at, or near, its ends to the foundations and so arranged that the parts or sections of the rack or cog-track shall always work by tension and never by compression, and wherein new and ingenious provisions are made to compensate for the thermal contraction, or expansion of these parts or sections; while further objects and advantages will become apparent as the description proceeds.

An ore handling bridge is chosen for purposes of illustration since it exhibits to a marked degree the peculiar requirements of the problem; although I do not restrict my improvements thereto since certain other structures develop the same problems in a more or less limited degree. An illustrative embodiment of my invention is diagrammatically shown in the drawings accompanying and forming a part of this application wherein Fig. 1 is an end view of an ore bridge embodying my improvements; Fig. 2 is an enlarged detail side elevation of the rack; Fig. 3 is a top plan view of the rack; Fig. 4 is a detail section corresponding to the line 4—4 in Fig. 2; and Figs. 5 and 6 are diagrammatic views; while Fig. 7 illustrates a modification.

Describing the parts by reference characters—1 represents the foundation, 2 the carrying track, 3 the trucks, and 4, one leg or tower of an ore bridge. These may be two or more in number and connected by a suitable truss 5, supporting a transverse track 6 along which runs a car or trolley (not shown). Truss 5 is sometimes as much as several hundred feet long and the bridge over one hundred feet high, while the weight of the traveling structure frequently totals many hundred tons. A plurality of tracks, on which the bridge travels, are frequently required at each leg or tower, and mounted on these tracks and supporting the bridge towers or legs, are suitable trucks which may have a number of wheels each; while the wind pressure upon a large size bridge is so enormous that notwithstanding its great weight, it is not sufficient to lock the carrying wheels, but in addition the bridge or the mechanism for traveling same must be securely anchored or locked to the foundation. Also the momentum of the bridge when once set in motion is so great that even at a very low speed of travel, it is likely to disregard all anchoring or locking provisions, should it become accidentally started.

In order to maintain a traveling structure of this nature under control and also to propel it from place to place, the suggestion has been made to employ racks or cog-tracks, one under each leg of the bridge, in combination with pinions meshing therewith. This raises the problems of strength, weight, anchorage and expansion. The tracks or runways for such bridges are usually straight, although they may be made curved if necessity demands, and may be of any length, depending upon the travel required. These tracks or runways are exposed to the extreme temperatures of both summer and winter, while the foundation structures carrying these tracks may be more or less embedded in the ground and thus protected from extreme variations of temperature; if it be attempted to propel the bridge by using the rack or cog-track in compression, a very heavy and complicated rack structure will result; whereas, if the rack be so anchored to the foundation as to always remain in tension under load, the size and weight of parts can be materially decreased, resulting in a considerable saving in cost of installation; as a matter of construction, it is desirable to manufacture these racks in convenient sectional lengths. A rack made up in sectional lengths, and which must act in tension in

carrying the loads, must necessarily be fastened at the extremities in order to prevent compression or buckling in the rack, and further one of the advantages of making the rack in comparatively short sections is, that the compensation for thermal changes of length can more easily be taken care of with less slack in the individual rack sections at their anchors than if the rack was made of great or considerable length; it is proposed that these rack sections move or shift slightly longitudinally in order to bring them into tension against their anchors as the load from bridge traveling mechanism is applied or if the direction of motion of the bridge travel is reversed.

The essence of my invention resides in constructing a rack or cog-track in comparatively short sections and securing said sections to suitable anchorages secured in the foundation, and in such a manner that each rack section shall always be secured against longitudinal motion along the track at the forward end only and loose at the opposite end; the sections being sufficiently short, as compared with the pitch of the teeth or pins in the rack, so that the maximum movement between adjacent members or sections of the rack will not prevent the gear teeth of the driving mechanism, which is attached to the bridge, from properly engaging the rack teeth as they pass from one rack section to another. In addition, I preferably afford all the teeth or pins in the rack a limited amount of play so that unavoidable outdoor variations, or inaccuracies, due to installation of racks, or otherwise, may be compensated.

For example, I make the rack in sections, preferably of plain steel side bars 10 of rectangular section, here shown about 2 inches thick and about 9 inches wide by about 40 feet in length. However, the thickness, width or length of these side bars may be varied to suit the required conditions, or the side bars may be made up of several bars placed side by side instead of the single bars shown. Also other types of side bars, such as rolled angle or channel shapes may be used in place of rectangular bars, if so desired. These side bars are shown set on edge, arranged in pairs a sufficient distance apart to accommodate the driving rack pinion of the bridge travel mechanism, these side bars being connected together by means of steel pins 11 of sufficient diameter to provide strength for carrying the tooth load and allowing for wear from the driving rack pinion; these pins project through registering holes 12 in the bars, each hole being made slightly larger than the diameter of the pin. The abutted ends of adjacent bars extend between spaced anchor plates 13; plates 13 being deeply embedded and anchored to the foundation 1, on which the track 2 is supported. These anchor plates are formed with holes 14, registering with holes 12; holes 14 being made somewhat larger, either circular, slotted or oblong, as for example, 4¼ inches diameter in the anchor plates and 4 inches diameter in the rack side bars; these anchor plates receive the cross pins 15 of the rack, which are the same diameter as the other pins, the only difference being that they are longer in order to project through the anchor plates. All of the cross pins are provided near their ends with pins 16, or other means whereby endwise movement of the rack pins is limited. I have shown the anchor plates 13 as riveted to cross members or ties 17, but any suitable construction or fastening may be employed for properly distributing the loads from the rack anchors into the foundations on which the structure travels.

I have shown adjacent holes 12 and 14 as about 9 inches apart between centers, which represents the pitch of the rack, also a pinion 20 carried by the bridge or other movable structure, having a similar distance or pitch between adjacent teeth. The bars 10 preferably overlap the anchor plates, here shown as two holes each, and the bars are sufficiently relieved at their ends to free the adjacent bars. With the dimensions above given, each rack section, of about 40 feet length, may have a longitudinal movement, with respect to its anchor, of approximately ¼ inch, and this movement may vary, depending upon temperature changes relative to foundation and inaccuracies due to erection. In erection of the anchors 13 on the foundations, and depending upon temperature conditions at time of erection, the anchors, with their enlarged pin holes, would be usually located so that the rack sections may expand or contract, due to temperature, and still allow looseness or freedom of rack pins in the anchor holes at opposite end of each section from that which carries the load, the rack section being in tension under the applied load from the bridge travel mechanism.

Whichever way the rack section be moved, it will always be in tension, and the distance between the centers of the anchor holes must at all times exceed the distance between the end pins of the rack sections. This excess will be a minimum when the temperature is maximum and vice versa. In order to enable such a movement of the rack as always to enable it to act in tension under load the lost motion at each end of each rack section must be equal to at least the maximum thermal expansion of that section. This is diagrammatically indicated in Fig. 5. In case the end rack pins are tightly fitted in the anchors and the lost motion for taking care of temperature is provided in the rack sections by means of slotted or enlarged holes

in same, then the conditions are reversed and the distance between the centers of the anchor pins must exceed the distance between the centers of the slots or enlarged holes in the ends of the rack sections by the amount stated, and as indicated in Fig. 6.

As the moving structure travels and the driving pinion moves into engagement with each new rack section, the first effect is to tend to draw this section over the foundation slightly so as to bring it into tension, this occurring before the pinion teeth have finally left the preceding rack; so that the action is without shock or inequality in travel of rack pinion as it rolls in the rack; if the moving structure be reversed in travel, the first effect will be to tend to slide the rack section lengthways so as to bring it under tension in the opposite direction against its anchor, which is forward of the travel of the structure.

In order to prevent excessive wear on the rack pins 11 and 15 and driving pinion 20, which is attached to the moving structure, and also to simplify the construction, installation and maintenance or repairs to rack or cog track, I construct the rack or cog track so that the rack pins 11 and 15 may be free to revolve in the side bars 10 of the rack when the rack pins are under load from the driving pinion 20; the rack pins being confined from movement endwise by means of suitable devices, such as cotter pins 16, or otherwise. In order to accomplish this and permit the rack pins to revolve slightly in the rack side bars, I make the holes in the side bars slightly larger than the diameter of the pins; in case the rack side bars are not of sufficient thickness to provide sufficient bearing against wear of the rack pins as shown at 10^a in Fig. 7, I enlarge the holes in such side bars and insert bushings 18 of hardened steel or other suitable material, properly pressed or otherwise secured in place in the rack side bars. Any suitable provisions for lubricating the rack pins where they revolve within the bushings or side bars may be employed.

I do not restrict myself to uses, designs or arrangements, except as recited in my claims.

Having thus described my invention what I claim is:

1. In a device of the character described, the combination, with a movable structure and a driving device carried thereby, of a foundation supporting said structure, and a rack carried by said foundation and meshing with said device, said rack and foundation having unequal thermal expansion and said rack being made of relatively movable sections, and means for anchoring each end of each section to said foundation, there being a lost-motion connection between each section and each of its anchors which permits a range of movement greater than the maximum thermal change in length of said section relatively to said foundation, said sections and anchors being so arranged that each section always operates by tension.

2. In a device of the character described, in combination, a foundation, a movable structure supported by said foundation, a rack parallel to the course of movement of said structure, a driving device carried by said structure and engaging said rack, said rack being made of relatively movable sections, and means for anchoring each end of each section against longitudinal movement, there being a lost motion connection between each section and each anchor, and such connections being so arranged that the longitudinal movement of each section due to the driving device is limited solely at the end toward which said structure is moved.

3. In a device of the character described, in combination, a runway, a movable structure supported by said runway, a rack parallel to the direction of movement of such structure, a driving device carried by said structure and engaging said rack, said rack being made of a plurality of individual sections, and means for securing each section to said runway at its opposite ends, said means being so arranged that only one end of any section shall be secured at any given time, the end so secured being the one toward which said structure is being moved.

4. In a device of the character described, the combination, with a movable structure and a driving pinion carried thereby, of a foundation, a runway carried by said foundation supporting said movable structure, a rack supported by said foundation parallel to the course of movement of said structure and meshing with said driving pinion, said rack comprising a plurality of segments, anchoring members rigidly secured to said foundation at longitudinally spaced points, said rack segments lapping by said anchoring members and fastened thereto, and means overlapping the adjacent ends of said segments and connecting them together.

5. In a device of the character described, the combination, with a movable structure and a driving pinion carried thereby, of a foundation supporting said movable structure, and a rack supported parallel to the course of movement of said structure, said rack including side bars and cross pins, and bushings rigidly seated in said bars and rotatably receiving said pins the length of said bushings being greater than the thickness of said side bars.

6. In a device of the character described, the combination with a movable structure and a driving pinion carried thereby, of a foundation, a runway carried by said foundation supporting said movable struc-

ture, a rack supported by said foundation parallel to the course of movement of said structure and meshing with said driving pinion, said rack comprising a plurality of apertured side bars arranged end to end in pairs and transverse pins located in said apertures, and apertured tie plates overlapping the ends of said side bars and securing the same together, certain of said tie plates being rigidly anchored to said foundation.

7. In a device of the character described, the combination with a movable structure and a driving pinion carried thereby, of a foundation, a runway carried by said foundation supporting said movable structure, a rack supported by said foundation parallel to the course of movement of said structure and meshing with said driving pinion, said rack comprising a plurality of apertured side bars arranged end to end in pairs and tie plates overlapping the ends of said side bars having registering apertures, and transverse pins located in all said apertures and constituting teeth for said rack and fastenings for the segments thereof, certain of said tie plates being rigidly embedded in said foundation.

8. In a device of the character described, the combination with a movable structure and a driving pinion carried thereby, of a foundation, a runway carried by said foundation supporting said movable structure, a rack supported by said foundation parallel to the course of movement of said structure and meshing with said driving pinion, said rack comprising a plurality of apertured side bars arranged end to end in pairs and transverse pins located in said apertures, and apertured tie plates overlapping the ends of said side bars and securing the same together, certain of said tie plates being rigidly anchored to said foundation and the apertures in the anchored tie plates being larger than the apertures in said side bars to allow for thermal expansion.

In testimony whereof, I hereunto affix my signature.

ROBERT E. SHEAL.