A. G. McK. JACK.

SUSPENSION TRANSPORTER ARRANGEMENT.

APPLICATION FILED DEC. 8, 1919.

1,417,070.

Patented May 23, 1922.

4 SHEETS—SHEET 1.

Fig. 9.

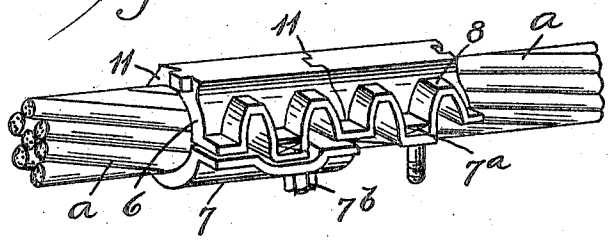


Fig. 1.

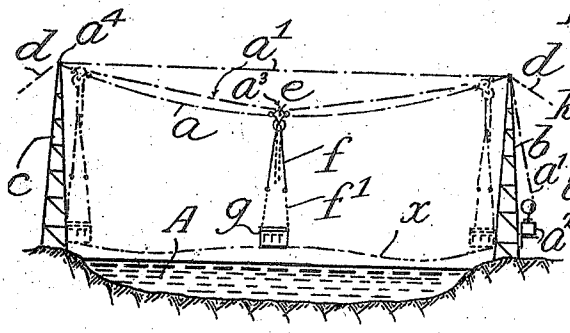


Fig. 3.

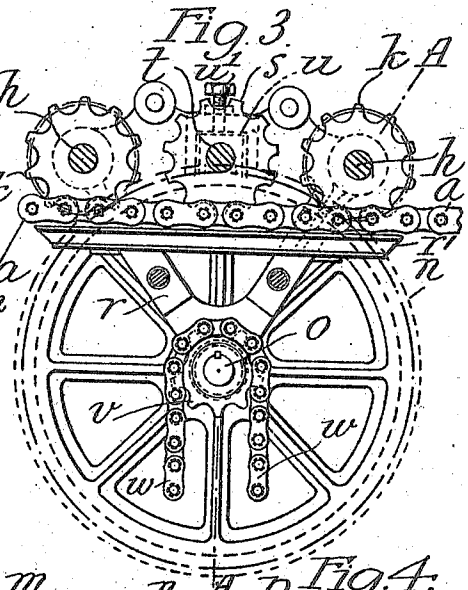


Fig. 2.

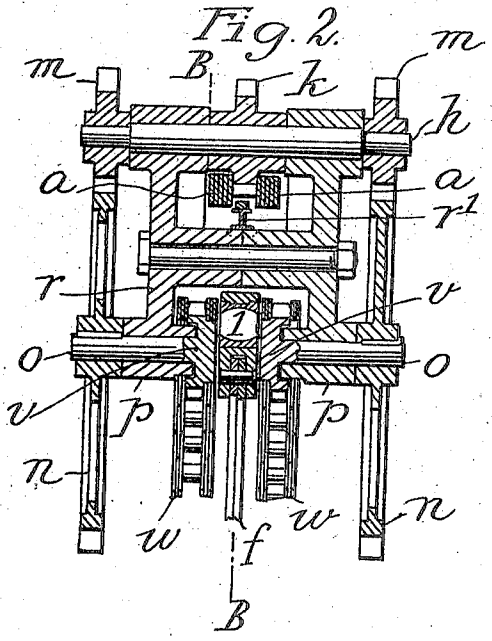
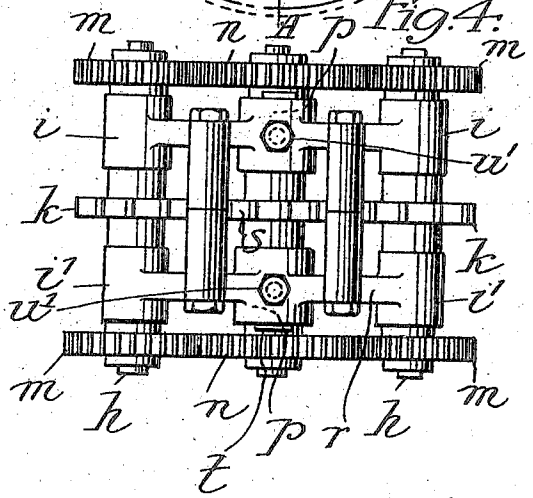


Fig. 4.



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4 SHEETS—SHEET 2.

Fig. 10.

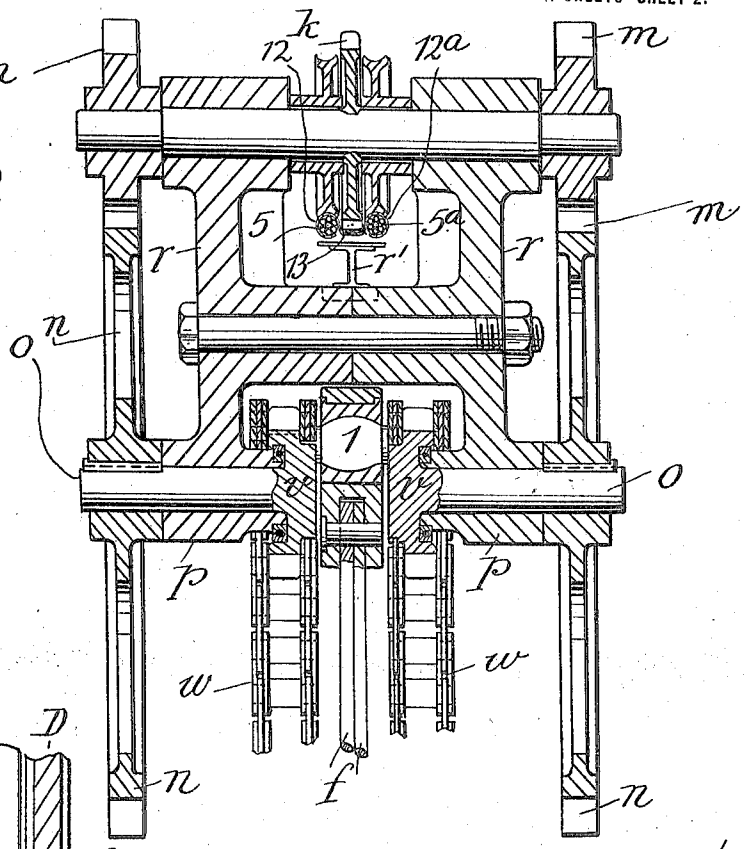


Fig. 7.

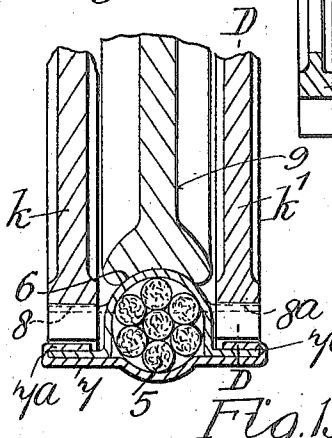
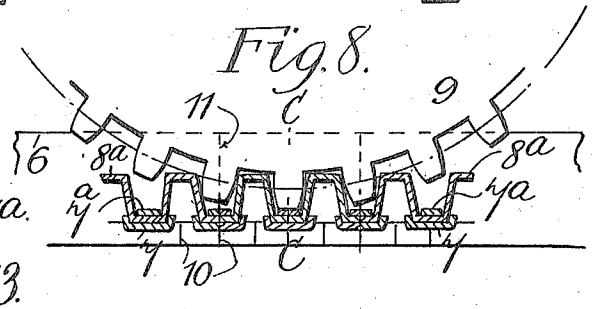


Fig. 13.

Fig. 8.



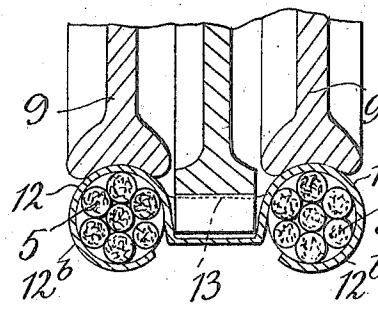
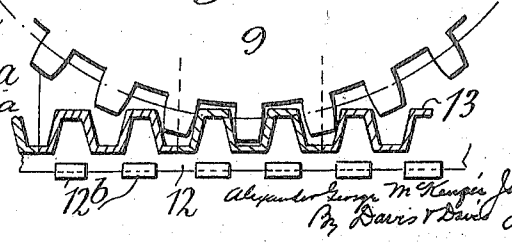


Fig. 14.



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Fig. 11.

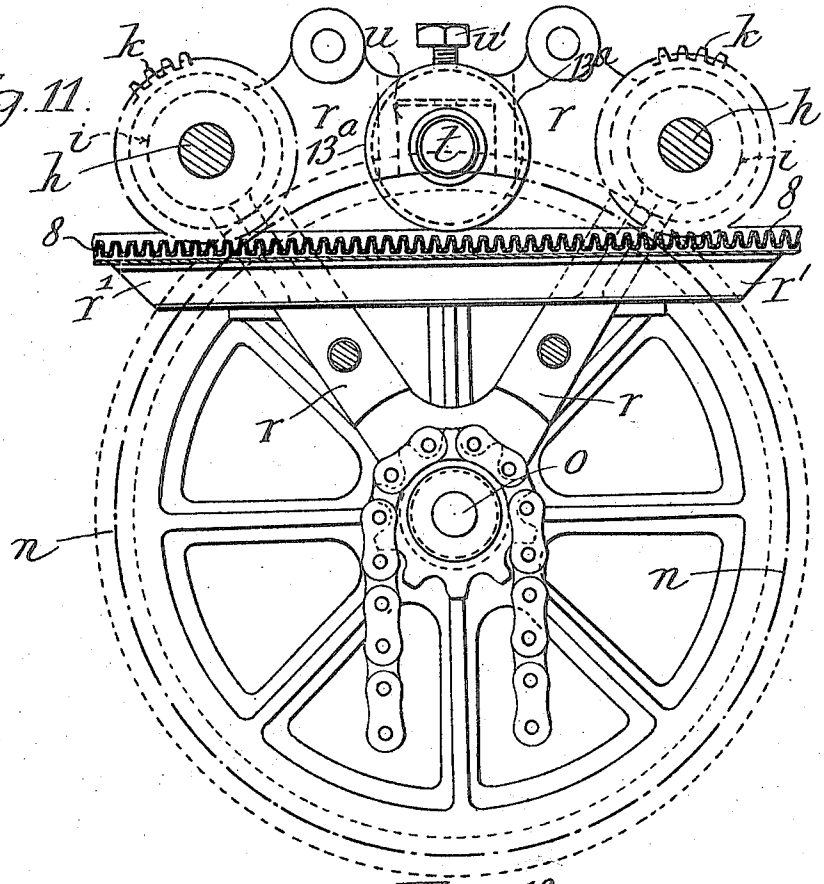
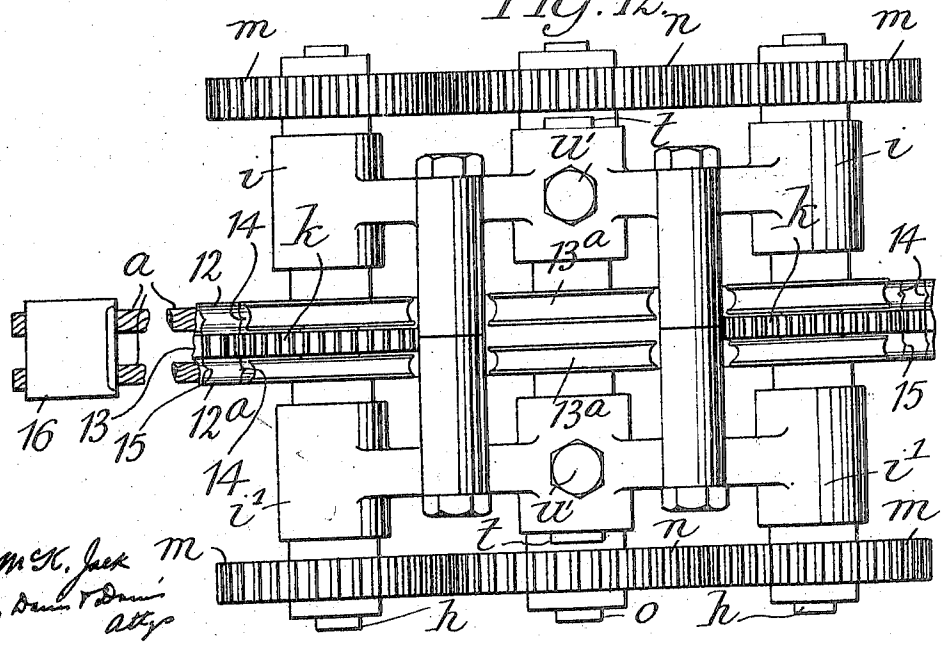


Fig. 12.



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SUSPENSION TRANSPORTER ARRANGEMENT.

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4 SHEETS—SHEET 4.

Fig. 15.

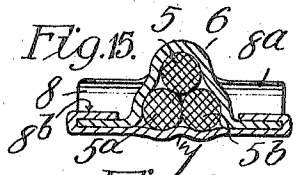


Fig. 16.

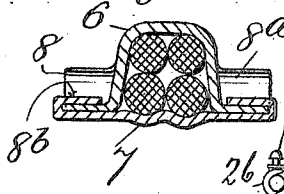


Fig. 21.

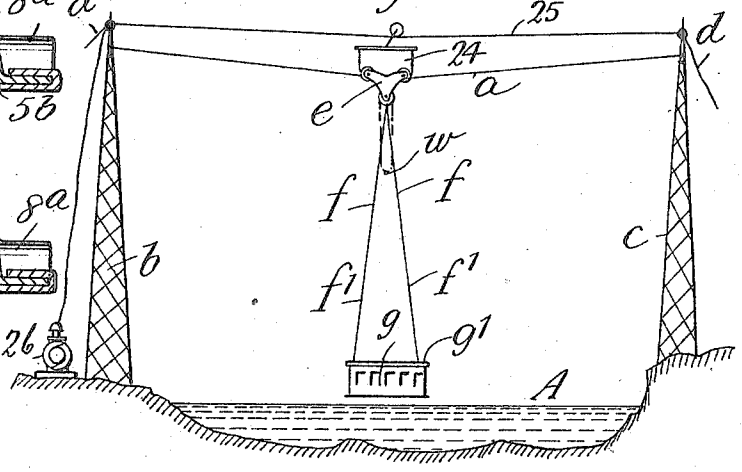


Fig. 17.

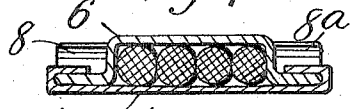


Fig. 18.

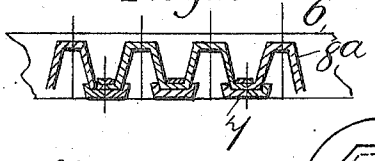


Fig. 5.

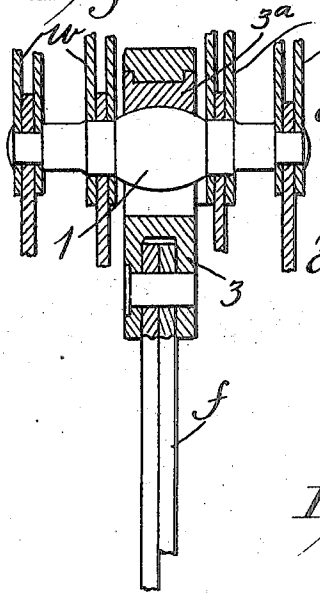
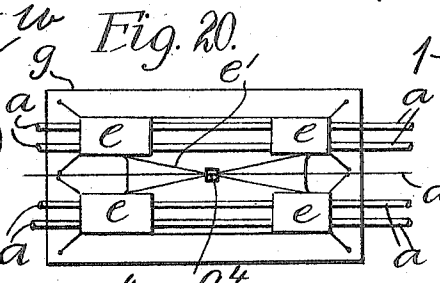


Fig. 20.



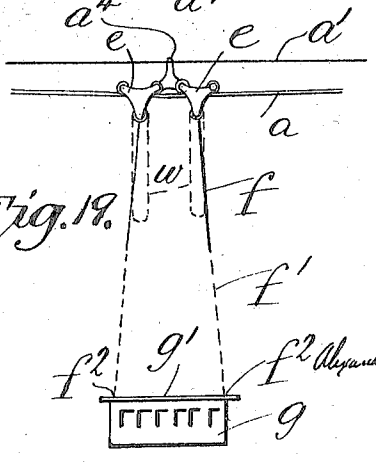


Fig. 19.

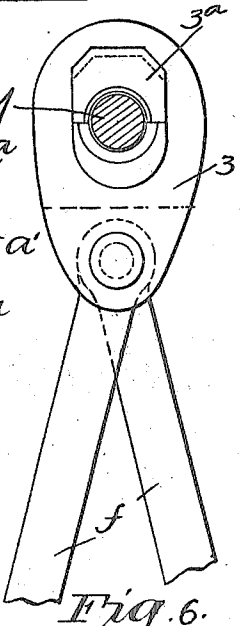


Fig. 6.

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UNITED STATES PATENT OFFICE.

ALEXANDER GEORGE McKENZIE JACK, OF SHEFFIELD, ENGLAND.

SUSPENSION TRANSPORTER ARRANGEMENT.

1,417,070. Specification of Letters Patent. Patented May 23, 1922.

Application filed December 8, 1919. Serial No. 343,439.

To all whom it may concern:

Be it known that I, ALEXANDER GEORGE McKENZIE JACK, a subject of the King of Great Britain and Ireland, residing at Sheffield, in the county of York, England, have invented Improvements in or Relating to Suspension Transporter Arrangements, of which the following is a specification.

For transporting persons, and also vehicles and goods of various kinds, across rivers in places where low level bridges cannot, for navigation purposes be used, or where ferry boats are not suitable, it is common to provide a transporter bridge comprising an overhead girder carried by suspension chains supported by piers or standards and provided with a traveller from which is suspended by means of ropes, a platform, frame or cage to carry persons, vehicles, goods and so forth, the traveller being traversed along the girder from one end thereof to the other by a motor mounted upon it, or by one or more ropes worked by a stationary engine at one side of the river. Transporter arrangements of this kind are necessarily very heavy, and are expensive to construct, erect, maintain and work and for this reason are impracticable in many places where a transporter system is desirable.

Transporter suspension arrangements comprising a chain, cable or rope suspended from the upper ends of a pair of piers or standards at opposite sides of a river and carrying a traveller that can be traversed from one end of the chain or equivalent (hereinafter referred to generically as flexible suspension means) to the other by a rope or ropes and from which a platform, frame or cage (hereinafter referred to generically as a platform) is suspended by chains, ropes or the like, are sometimes used for carrying articles or goods of various kinds across a river, particularly in the initial construction of ordinary road bridges. Such a transporter arrangement is not however suitable for use in many places, owing to the fact that as the flexible suspension means hangs in the form of a catenary, the platform suspended from the traveller thereon, falls and rises through a considerable height during the motion of the traveller from end to end of the flexible suspension means, in accordance with the varying gradient or curve of the suspension member, so that if the platform started and terminated its journeys at ordinary ground level, that is to say, without the use of inclined approaches, which are objectionable, it would, except at times of low tide, have to pass through the river. Consequently, although such a suspension transporter arrangement is a comparatively light structure and is much less costly to construct, erect, maintain and work than the heavy rigid overhead transporter bridge arrangement first herein referred to, its use is limited to tidal rivers, and to certain periods of the day, for transporting only certain classes of goods and is quite inapplicable, as heretofore constructed and operated, for use in cases where it is desired that the starting and stopping places shall be at ordinary ground levels in order that heavy articles or bodies, for instance motor cars, lorries and other vehicles and loads, can be run on to the platform without having to raise them, and afterwards run off the platform without having to lower them, or without having to provide inclined approaches to the starting and stopping places, and where the platform shall not, during its to and fro journeys, rise and fall to any considerable extent by reason of the suspension chain hanging in the form of a catenary.

Now the present invention has for its object so to adapt or construct a suspension transporter arrangement of the general kind referred to, that the platform shall be suspended from flexible suspension means in such a manner that during its to and fro journeys across the river over which the arrangement operates, it will rise and fall only through a very small height so that the starting and stopping places at the sides of the river can be at the ordinary ground level of the banks of a navigable river across which passage is desired.

For attaining this object in a suspension transporter arrangement according to the present invention, the flexible suspension means employed is adapted to serve as a flexible rack and the movable platform used therewith is supported therefrom through supporting and traversing means comprising a traveller (hereinafter called the controller) provided with mechanism adapted to gear with and be operated by the flexible suspension means when the controller is hauled or moved from one end thereof to the other, and compensating lowering and raising mechanism, automatically operated or controlled from the controller mechanism and from which the platform is suspended by one or more depending rods, chains,

cables or the like (hereinafter called for brevity and distinction the supporting chain or chains). The construction and operation of the said lowering and raising mechanism are such that although the controller will, during its travel, rise and fall to an extent depending upon the versed side of the catenary curve of the flexible suspension means used, the point or points of support for the platform from the lowering and raising mechanism will fall and rise only to a very small extent so that the platform will travel in a nearly horizontal or in a slightly waved path.

To enable this result to be attained, the point or each point of connection of the supporting chain or each supporting chain, carrying the platform, to the lowering and raising mechanism operated by the controller, is so arranged and operated that it will raise the platform when the controller is descending one portion of the flexible suspension means and will lower the platform when the controller is ascending the other curved portion of the said flexible suspension means, with the result that, in relation to a horizontal plane, the said point of connection will remain nearly level and at the same height during the whole journey of the traveller along the catenary curve. The flexible suspension means may be provided with two controllers, each having a point of suspension for a supporting chain as described. Also, in some cases the overhead flexible suspension means may comprise two or more members arranged side by side and at a suitable distance apart and each provided with one or two controllers.

The flexible supporting means may comprise one or more link chains. In order to provide flexible suspension means suitable for the purpose set forth but of less weight than a link chain or chains, so as to admit of the invention being more readily and economically applied in the construction of suspension transporter arrangements of the kind referred to, of greater length or span, say of the order of magnitude of one thousand feet and upwards, than can be done when one or more link chains are used, the flexible suspension means used may advantageously comprise one or more lengths of flexible metal provided with projections or teeth adapted to engage with and operate gear wheels on the controller, when the controller is moved from one end of the said flexible suspension means to the other end thereof. Such flexible suspension means can be variously constructed. Thus, it may advantageously comprise one or more strong steel ropes or cables (hereinafter called ropes) of circular or substantially circular section, provided along its length with teeth adapted to gear with the teeth of the gear wheels on the controller and rotate such wheels when the controller is traversed over them. Conveniently, the teeth may be formed in one or more longitudinal sets on a large number of metal sleeves arranged end to end, and adapted to be suitably fixed to the wire rope or ropes.

With a view to preventing relatively endways movement between the ropes and sleeves, due to temperature changes, these parts may advantageously be formed of metal having the same co-efficient of expansion. Also, with a view to reducing weight, the teeth may be made hollow.

In flexible suspension means constructed as just described, it will be understood that as the wire rope or ropes is or are covered by the sleeves, it or they will not be subjected to friction with the controller and will therefore have a long life. Also, as the rope or ropes will become coated with oily or greasy matter from the controller it or they will not be subject to oxidation. Also, the sleeves can, when necessary, be easily renewed.

Or, in lieu of using one or more wire ropes of round or substantially round shape in section, as the flexible suspension means for carrying the rack or racks, a length of flat wire rope may be used for carrying the rack or racks.

With a suspension transporter arrangement according to this invention, the advantages of an overhead suspension transporter bridge, namely, that it is a light structure, cheap to construct, erect, maintain and work in comparison with the heavy rigid overhead transporter bridge arrangement commonly used, and is safe and reliable in operation, can be obtained without the disadvantages of the known constructions of overhead suspension transporter bridges as heretofore constructed and operated.

Overhead suspension transporter bridge arrangements according to the invention, and adapted to act in the manner set forth, can be constructed in various forms.

In the accompanying illustrative drawings, Fig. 1 shows diagrammatically, a transporter bridge arrangement embodying the invention. Fig. 2 is a section on the line A A of Fig. 3, Fig. 3 is a section on the line B B of Fig. 2 and Fig. 4 is a plan, showing one construction of controller with compensating lowering and raising mechanism according to the invention, combined with flexible suspension means consisting of a link chain. Fig. 5 shows in vertical section and Fig. 6 in side elevation, portions of the lowering and raising mechanism shown in Fig 2.

Fig. 7 is a cross section on the line C C of Fig. 8 and Fig. 8 is a cross section on the line D D of Fig. 7, showing a modified arrangement in which the flexible suspension means comprises a wire rope with sleeves

and two sets of teeth forming flexible racks. Fig. 9 shows in side view, a modification of the arrangement shown in Figs. 7 and 8.

Figs. 10, 11 and 12 are similar views to Figs. 2, 3 and 4 respectively but showing flexible suspension means comprising two wire ropes with sleeves and a single flexible rack. Figs. 13 and 14 show the two ropes and associated parts in cross section and longitudinal section respectively and to a larger scale than Figs. 10, 11 and 12. Figs. 15 and 16 show in cross section modified constructions of flexible suspension means. Figs. 17 and 18 show in cross section and side elevation, a further modified construction of such suspension means. Figs. 19, 20 and 21 are diagrammatic views showing further modified arrangements hereinafter more particularly described.

According to the example shown in Figs. 1 to 5 inclusive, the flexible suspension means comprises a chain *a* carried by the upper ends of a pair of openwork piers, standards or trestles *b* and *c* suitably supported at opposite sides of a river A, the chain being composed of links or plates and pins forming what is known as a pitch chain. The ends of the chain rest on the piers, standards or trestles, and are secured by stays or guys *d* that extend downward at an angle to the ground to which they are anchored in the usual way.

Associated with the suspension chain *a* is a controller with hoisting and lowering mechanism, marked collectively *e* in Fig. 1, from a point of which are suspended links *f* and chains or wires f^1 for use in carrying a platform *g* below. The controller is provided at its upper part with two transversely arranged driving shafts *h* each provided at its central portion, between two bearings *i*, i^1, with a chain or sprocket wheel *k* adapted to gear with and be operated by the suspension chain *a* when the controller moves over it. To each of the outer ends of each of the driving shafts *h* is fixed a toothed wheel *m* that gears with and drives another and larger toothed wheel *n* fixed to the outer end of a short transverse counter shaft *o*, the two counter shafts being mounted in bearings *p* in the controller frame *r* below the shafts *h*.

For the purpose of relieving the shafts *h* and sprocket wheels *k* of part of the weight of the controller and the parts suspended therefrom, there may, as in the example shown, be arranged between the sprocket wheels *k*, an idle sprocket wheel *s* mounted to turn about a shaft *t* and to gear with the suspension chain *a*, the bearings *u* for the shaft *t* and wheel *s* being made vertically adjustable, as for example under the control of screws u^1, so that the wheel can be adjusted and set to take a considerable amount of weight off the sprocket wheels *k*.

The two counter shafts *o* are arranged coaxially with a space between their inner and adjacent ends. To the inner end of each of these countershafts is fixed a chain or sprocket wheel *y* over and with which works a freely dependent chain *w*, that may conveniently be an endless chain, though it may be an open ended chain having its free ends extending downward. When an open ended chain is used, a receptacle can be suspended from the controller frame to receive the free ends of the chain. Connected to the two freely dependent chains, say at the centre of their lengths, is a transverse supporting or suspension pin 1 (hereinafter called the supporting pin) which couples the two chains together with a space of a few inches between the two chains. To the central portion of this supporting pin is revolvably connected, in the manner shown in Figs. 4 and 5, the supporting links *f*, or chains, used for carrying the platform *g* below. The pin 1 is preferably made of the form shown in Fig. 5, large in diameter, and with a large central portion to withstand the bending strain to which it is subjected. The means used for attaching the links *f* to the pin 1 are also enlarged to afford sufficient strength to ensure an effective connection. In the example, the links *f* are jointed to a strong link 3 that encircles and is seated upon the pin 1 through the intermediary of a renewable bearing 3^a. The central portion of the pin 1 and the corresponding bearing portion of the link 3, or bearing 3^a are preferably made of spherical shape as shown to allow for any slight inequality of wear in the two supporting chains *w* to which the pin is connected.

Suitably shaped and arranged guards may be associated with the chain or sprocket wheels *v* and chains *w* to prevent any possibility of their getting out of gear with one another. In the example, this is provided for by the construction of the controller frame *r*, as will be seen from Figs. 2 and 3. r^1 is a guard fixed to the frame *r* to prevent the chain *a* coming out of gear with the sprocket wheels *k* and *s*. In the arrangement shown, the lower ends of the links *f* are connected through pairs of splayed or diverging bars or wire ropes f^1 to the platform *g* near to opposite ends thereof.

The controller *e* and with it the platform *g* may be hauled to and fro along the suspension chain *a* by a rope a^1 that extends from the winding drum of a reversible winding engine a^2 arranged at one side of the river, conveniently on a raised part of the standard *b*, over the controller *e*, to which it is suitably connected at a^3, around a sheave a^4 carried by the other standard *c* and thence back over the suspension chain, controller and first standard to the winding drum of the engine. The arrangement is such that

when the controller e is hauled by the rope a in one direction from its starting position, it will descend one curved end portion of the suspension chain a and its sprocket wheels k will be rotated by the suspension chain, and the two adjacent freely dependent chains w will be simultaneously operated in a direction to raise the supporting pin 1 between them so as to maintain the platform in such a position that it will, in relation to a stationary horizontal plane, remain nearly at the same height, this action continuing until the controller reaches the central and lowest part of the suspension chain, at which time the pin 1 will reach the highest part of its travel in relation to the pair of wheels v over which the chains w, to which it is connected, pass. As the controller commences to ascend the opposite upwardly curved portion of the suspension chain a, the pin 1 will, in turn, commence to descend on the opposite side of the pair of chain or sprocket wheels v, but in such a manner in relation to a stationary horizontal plane, that it will remain at approximately the same height, this action continuing until the controller reaches the end of its forward journey. Upon the controller making its return journey, the direction of operating the gearing will be reversed and the above described operations of the pin 1 repeated, but the pin and other mechanism will then move in the reverse direction. With the arrangement described, the platform will move in a curved path that extends slightly downward from each end and then curves slightly upward to the central portion of the path which is of upwardly convex form, as shown by the line x in Fig. 1, the platform g being at the same height, from a horizontal plane, when at each end of its travel and also at the centre of its travel.

Figs. 7 and 8 show an arrangement wherein the flexible suspension means instead of consisting of a link chain, as hereinbefore described, comprises a single steel wire rope 5 of circular section provided along its length with a number of metal sleeves, arranged end to end and adapted to be securely fixed to the rope, the sleeves being provided along their length with teeth adapted to gear with the teeth of gear wheels on the controller. In the example shown, each sleeve is divided horizontally into two parts 6 and 7 formed of sheet metal. The upper part 6 is bent or shaped, as between dies, to form a central concave portion fitting over the rope, and two side portions each of which is shaped to form a row of teeth 8 or 8^a. The central portion of the lower part 7 of each sleeve is also bent or shaped, as shown, to form a central portion fitting the underside of the rope, and two side portions that are slotted to form rows of fingers 7^a that are bent over the side portions of the upper part of the sleeve and fit into the recesses between the teeth 8, 8^a so as to tightly clamp the said side portions of the upper part of the sleeve to the lower part thereof at these points.

Each shaft h (Figs. 2 and 3) of the controller has fixed to it two toothed wheels k k^1 (see Fig. 7), to gear with the two rows of teeth 8, 8^a and carries an intermediate grooved wheel 9 arranged to run on the central convex upper surface of the sleeves 6, 7 so as to relieve the toothed wheels k, k^1 of the weight of the controller and its load. The joints 10 between adjacent lower portions 7 of the sleeves may coincide with the joints 11 between the adjacent upper portions 6 of the sleeves, as shown in Fig. 8; or the two sets of joints may be staggered. The joints between the adjacent upper portions 6 of the divided sleeves may be arranged to be slightly open so as to permit the sleeves to move angularly with reference to one another to compensate for the varying curvature or movement of the flexible rack as a whole when the controller with the load is being moved along such rack.

Fig. 9 shows sleeves similar to those shown in Figs. 7 and 8 but each made in two parts of cast metal connected together by bolts 7^a and nuts 7^b.

Instead of using a single wire rope, to form the flexible suspension means, two, three or more wire ropes may be used, grouped in any desired way and connected together sideways by the sleeves, which are adapted to suit.

Figs. 10 to 14 inclusive show a suspension transporter arrangement in which the flexible suspension means comprises two wire ropes 5, 5^a arranged side by side. In this example, double sleeves 12, 12^a are adapted to be fixed to the two ropes and carry between them a row of teeth 13, such double sleeves with intermediate teeth being formed out of a piece of sheet metal which is pressed or stamped between dies to form the row of teeth 13 and curved side portions to form the sleeves 12, 12^a which, after being placed on the ropes, are bent around the same so as to become tightly clamped thereto (see Fig. 13). To facilitate the bending of the edge portions of the piece of metal around the ropes they are slotted to form fingers 12^b that can be readily bent to the shape shown. In this case each of the shafts h of the controller has fixed to it a toothed wheel k to gear with the row of teeth 13 carried by the successive double sleeves 12, 12^a and is provided with two grooved supporting wheels 9, 9^a arranged to run on the convex upper portions of the successive double sleeves 12, 12^a. The vertically adjustable intermediate shaft t of the controller (Figs. 11 and 12) is also

provided with a pair of similar grooved wheels 13^a, 13^a arranged to run upon and bear against the successive double sleeves 12, 12^a so as to assist in relieving the toothed wheels k of the weight of the controller and its load. In other respects the controller shown in Figs. 10 to 14 inclusive corresponds to that shown in Figs. 1 to 6 hereinbefore described and it acts in the same way as that controller.

To facilitate quick and accurate assembly of the sleeves on the rope or ropes with the teeth in the longitudinal set thereof, or each longitudinal set thereof, in a row or rows, so that they will gear in an efficient manner with the gear wheels k, k^1 or k on the controller, their adjacent ends may, as shown for example in Fig. 12, be provided with corresponding inter-engaging projections 14 and recesses 15 that ensure their being placed in the correct relative positions around the rope. The inter-engaging projections 14 and recesses 15 also serve to keep the several sleeves in line and to preserve, as far as possible, an unbroken wheel track, that is to say a track in which there is not a straight transverse line of division between the upper portions of adjacent sleeves. The sleeves are held firmly against each other by larger sleeves 15 (see Fig. 12) rigidly fixed to the end portions of the wire rope or ropes near to the points of suspension of the rope or ropes from the supporting standards b, c (Fig. 1).

In order that the teeth shall gear in an efficient manner with the toothed wheels on the controller, they may advantageously be so formed and arranged, as shown in Figs. 7, 8, 13 and 14, that the pitch lines of each set thereof correspond in position, as seen in side view, with the longitudinal axis of the wire rope 5, or ropes 5, 5^a, so that the relative position of the teeth will not be materially affected when in position for use.

When three ropes are used, as in the example shown in Fig. 15, one, namely 5, may be arranged centrally above the other two 5^a, 5^b and each sleeve may be composed of an upper portion 6 adapted to extend over the upper rope and down over the sides of the two lower ropes, and a lower portion 7 adapted to fit the underside of the two lower ropes and to be connected to the upper portion of the sleeve in either of the ways hereinbefore described. The upper portion of the sleeve may be provided, at opposite sides thereof, with rows of teeth 8, 8^a and with an intermediate flat or convex track portion 8^b, the pitch lines of the teeth being well below the top of the composite rope. In the case of four ropes, they may be arranged in two superposed pairs, as shown in Fig. 16, with the sleeves 6—7 adapted to surround them, and provided with two rows of teeth 8, 8^a.

Figs. 17 and 18 show flexible suspension means comprising a flat wire rope 18, provided with sheet metal sleeves having racks 8, 8^a and an intermediate bearing surface constructed and applied as hereinbefore described with reference to Figs. 7 and 8.

Flexible racks such as described although specially advantageous for suspension transporter arrangements of long span, can of course advantageously be used for relatively short spans. Also, they are applicable for use in any case where a flexible gear chain or rack has been required, or is required, for driving purposes. Such flexible racks will form the subject of a separate application for Letters Patent.

Instead of using a single controller c with compensating raising and lowering mechanism, as hereinbefore described, two such controllers may be used on the flexible suspension member a, as shown in Fig. 19, the said controllers being connected together at a suitably fixed distance apart, as by a distance member e^1, so as to form two points 1 of suspension for two sets of links, chains or wire ropes f, f^1 for use in supporting a platform g below. With such an arrangement, the two controllers will reach the lowest part of the suspension member a one after the other. As the angle of descent on starting from either end slightly exceeds the compensating upward motion imparted by the controllers, such slight variation in the level of the platform g that might result from this arrangement, can be reduced by arranging the points f^2 of connection of the supporting chains or wires f^1 to the platform at a greater distance apart longitudinally than the distance between the centres of the two transverse supporting pins 1 on the two controllers, that is to say, between the centres of the two controllers.

When two or more suspension members a are used, each suspension member may be provided with one controller, or with two controllers, there being say two sets of supporting links or chains f in the one case and four or more supporting links or chains in the other, for carrying the platform g below, with the aid it may be, of pairs of splayed or diverging chains or wire ropes f^1 between the lower ends of the supporting links or chains and the platform. Fig. 20 shows two suspension members a each provided with two controllers e. In each of these cases the two controllers in the one case, and the four or more controllers in the other, would be suitably braced together by connections e^1 in order to maintain them in correct relative positions. Also, in each of these cases the hauling rope a^1 may be attached to a connection a^4 midway between the pair or pairs of controllers. Or a separate hauling rope could be used with each suspension member and the controller or

controllers thereon. Such arrangements will be readily understood from the foregoing description without the aid of additional drawings.

The controller or controllers instead of being hauled across the suspension chain or chains by a rope, may be fitted for instance with an electric motor 24 (Fig. 21) and driven by electric energy supplied through a cable 25 from an electric generator 26 on one of the banks of the river.

With a transporter suspension arrangement constructed and operating as hereinbefore described, the starting and stopping or landing places for the platform can be arranged at the ordinary ground level on the banks of a river, so that vehicles and other loads can readily pass on to and from the platform and, if necessary, an upper platform g' (Fig. 19) may be provided for passengers, which may be reached by stairs extending upward from the lower platform, or by stairs arranged at each of the landing places at opposite sides of the river.

The load carrying means, herein called a platform, can of course be constructed in various forms. For heavy traffic it may consist of a long box-like structure resembling a railway vehicle without wheels, that may be divided up vertically or horizontally, or both vertically and horizontally, into compartments or floors to receive and hold vehicles, goods and so forth and to accommodate passengers. Or the platform may be of square or other convenient form.

It will be obvious that transporter suspension arrangements such as herein described may, with advantage be constructed and used for carrying passengers, vehicles and goods across valleys, ravines and the like where other means of transport present much difficulty, and such use is contemplated and intended to be covered by the present invention.

The details of construction of transporter suspension arrangements according to the invention can be variously modified.

What I claim is:—

1. A suspension transporter arrangement comprising overhead flexible suspension means, standards between which said suspension means is supported, a controller carried by and adapted to travel along said suspension means, gear mechanism on said controller, said flexible suspension means being adapted to gear with and positively drive said gear mechanism when the controller is moved along said suspension means, compensating lowering and raising mechanism carried by said controller and driven from the gear mechanism thereon, and suspending means for a platform or support said raising and lowering mechanism acting to raise the suspending means when the controller descends the curved portions of the flexible suspension means and to lower said suspending means when the controller ascends the curved portions of the flexible suspension means.

2. A suspension transporter arrangement comprising overhead flexible suspension means, standards between which said suspension means is supported, a controller carried by and adapted to travel along said suspension means, gear mechanism on said controller, said flexible suspension means being adapted to gear with and positively drive said gear mechanism when the controller is moved along said suspension means, compensating lowering and raising mechanism carried by said controller, driven from said gear mechanism and including a vertically movable member and suspending means for a platform or support carried by said vertically movable member, said raising and lowering mechanism acting to raise the vertically movable member and suspending means when the controller descends the curved portions of the flexible suspension means and to lower them when the controller ascends the said curved portions of the flexible suspension means.

3. A suspension transporter arrangement comprising overhead flexible suspension means standards for supporting the same, a controller carried and adapted to travel along said suspension means, gear mechanism on said controller adapted to gear with and be positively driven by said flexible suspension means when the controller travels along the same, a pair of sprocket wheels driven from said gear mechanism and mounted to rotate about horizontal axes, a pair of pitch chains extending over and depending from said sprocket wheels and a supporting pin extending transversely between said pitch chains, said pin being raised on one side of the pair of sprocket wheels by the pair of pitch chains when the controller moves down one curved side of the flexible suspension means and reaching the top of the pair of sprocket wheels when the controller reaches the lowest part of the flexible suspension means and then descending on the other side of the pair of sprocket wheels when the controller ascends the opposite curved portion of the flexible suspension means, the motion of the pin and its dependent load being reversed when the direction of travel of the controller is reversed.

4. A suspension transporter arrangement according to claim 3, wherein the pair of sprocket wheels with which the chains carrying the supporting pin, gear, are carried by co-axially arranged shafts spaced apart axially driven by two sets of gearing from a shaft provided with a toothed wheel in gear with the flexible suspension means.

5. A suspension transporter arrangement

according to claim 3, wherein the pair of sprocket wheels with which the chains carrying the supporting pin, gear, are carried by co-axially arranged shafts spaced apart axially driven by two sets of gearing from a plurality of shafts each provided with a toothed wheel in gear with the flexible suspension means.

6. A suspension transporter arrangement comprising overhead flexible suspension means adapted to act as driving means, a controller carried by and adapted to travel along said suspension means, two sets of gear mechanism carried by said controller and gearing with the flexible suspension means, vertically adjustable supporting means carried by said controller and arranged to travel along and to be pressed against said flexible suspension means and compensating raising and lowering mechanism carried by said controller and operated by the sets of gear mechanism thereon.

7. A suspension transporter arrangement comprising overhead flexible suspension means adapted to act as driving means, a controller, a plurality of rotary shafts spaced apart sideways therein a toothed wheel on each shaft in gear with the flexible suspension means, supporting means on each shaft arranged to run upon the flexible suspension means, two co-axially arranged shafts carried by said controller and spaced apart axially, two independent sets of gearing between the rotary shafts and co-axial shafts, sprocket wheels fixed to the adjacent ends of said co-axial shaft, sprocket chains extending over and depending from said sprocket wheels and a transverse supporting pin connecting adjacent portions of said chains.

8. A controller with compensating lowering and raising means for the purpose herein set forth, comprising a controller adapted to be carried by and to travel along flexible suspension means and comprising means adapted to be driven by said flexible supporting means, a pair of sprocket wheels arranged to rotate about a common axis, a pair of chains extending over, supported by and adapted to be operated from said sproket wheels, supporting means connected to the said chains and means for rotating said sprocket wheels from the controller means adapted to be driven from the flexible supporting means.

9. A controller adapted to be carried by and to travel along flexible suspension means and comprising a framing, horizontal shafts mounted therein and each provided with a toothed wheel adapted to gear with and be rotated by said flexible suspension means, and with driving wheels and compensating lowering and raising means comprising two co-axial shafts mounted in the controller framing with a space between their adjacent ends and each provided at its inner end with a sprocket wheel and geared to the driving wheels of the controller, sprocket chains extending over and gearing with the sprocket wheels, on the coaxial shafts and a horizontal supporting pin connecting corresponding parts of the two chains.

10. A controller with compensating lowering and raising means, said controller comprising a frame, two horizontal shafts mounted therein, toothed wheels fixed on said shafts and adapted to gear with flexible suspension means, wheels mounted on said shafts and adapted to roll on and bear against said flexible suspension means, and supplementary vertically adjustable rollers mounted in said frame between said shafts and adapted to travel along and to bear against the said flexible supporting means, for the purpose set forth.

11. A controller with compensating lowering and raising means for the purpose set forth, comprising a framing having two horizontal shafts mounted therein and each provided at its central portion with a toothed wheel and at opposite sides thereof with two grooved running wheels and at its outer end with two toothed driving wheels, a vertically adjustable intermediate horizontal shaft with two grooved running wheels, two horizontal coaxial shafts mounted in said framing at a lower level than the other shafts, spaced apart and provided at their adjacent ends with sprocket wheels and at their outer ends with toothed wheels in gear respectively with the driving wheels at the outer ends of the two first mentioned shafts, sprocket chains extending over, in gear with and supported by said sprocket wheels and a horizontal supporting pin connected to and carried by said chains and adapted to carry suspending tackle.

12. A suspension transporter arrangement of the kind herein referred to, comprising flexible suspension means, a plurality of connected controllers with compensating lowering and raising mechanism carried by and operated from said flexible suspension means and a platform suspended from said mechanism.

13. A suspension transporter arrangement of the kind herein referred to, comprising flexible suspension means consisting of a plurality of ropes carrying a plurality of flexible racks, and a plurality of connected controllers mounted to travel over said flexible suspension means and compensating lowering and raising mechanism mounted on said controllers and adapted to be operated from said racks.

Signed at London England, this 25th day, of November, 1919.

ALEXANDER GEORGE McKENZIE JACK.