No. 890,947. PATENTED JUNE 16, 1908.

M. WADDELL.

LIFTING BRIDGE.

APPLICATION FILED FEB. 12, 1908.

3 SHEETS—SHEET 1.

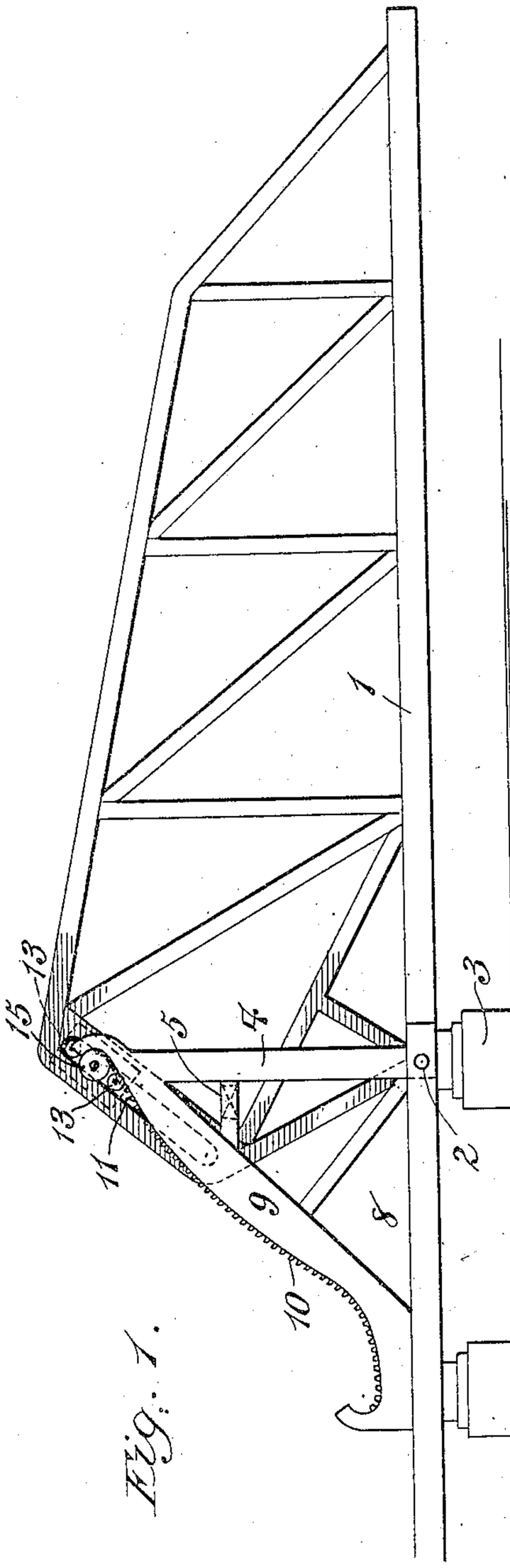

Fig. 1.

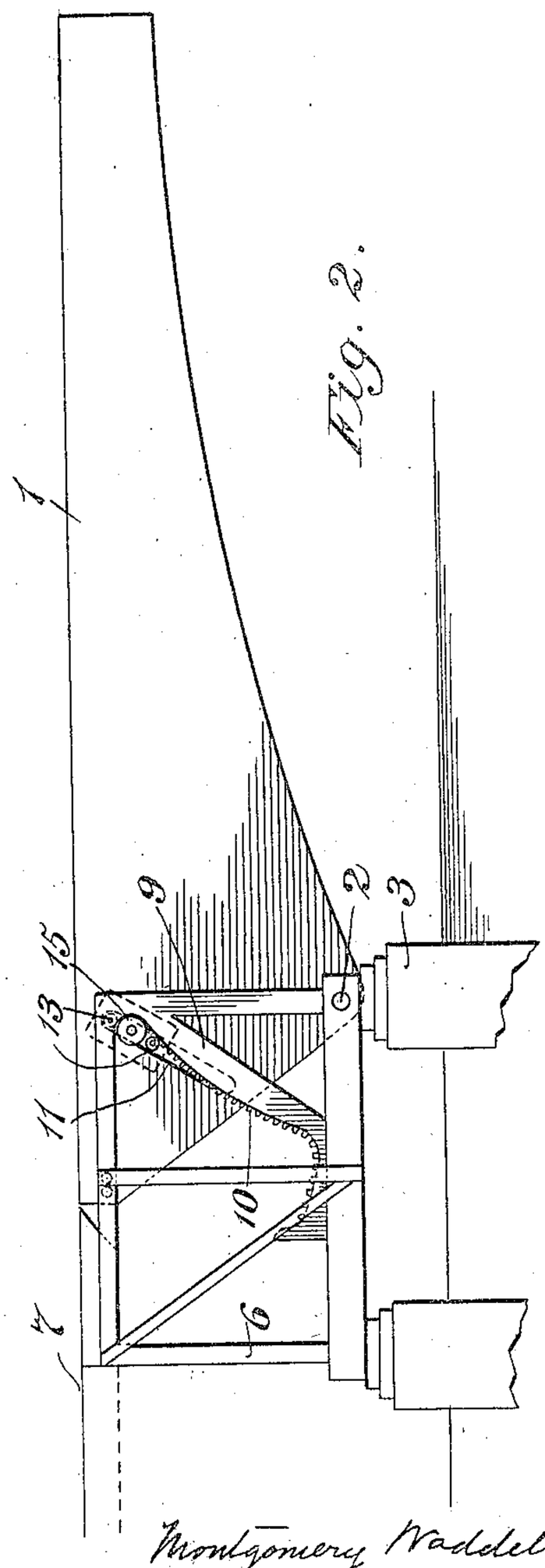

Fig. 2.

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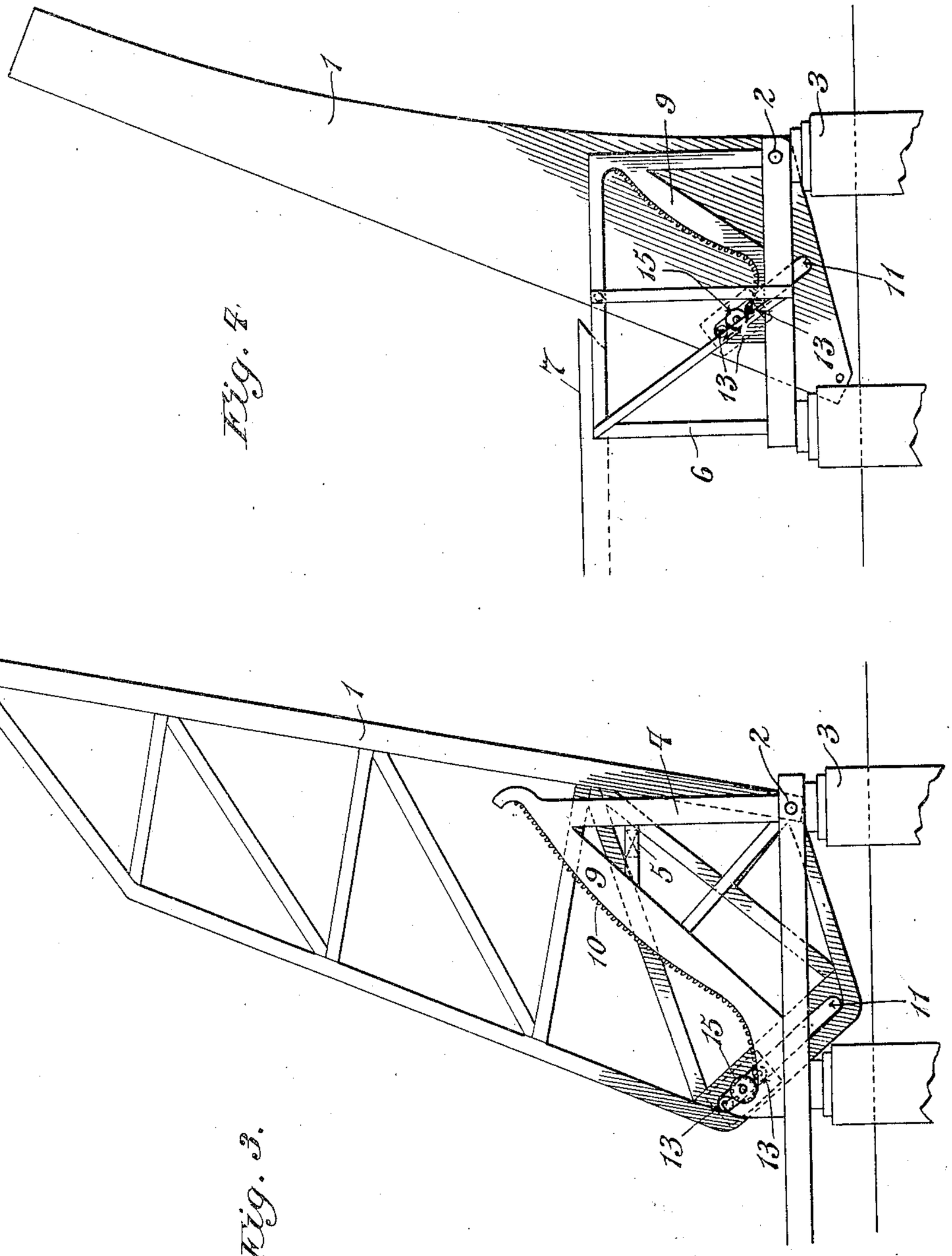

Fig. 4.

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 6.

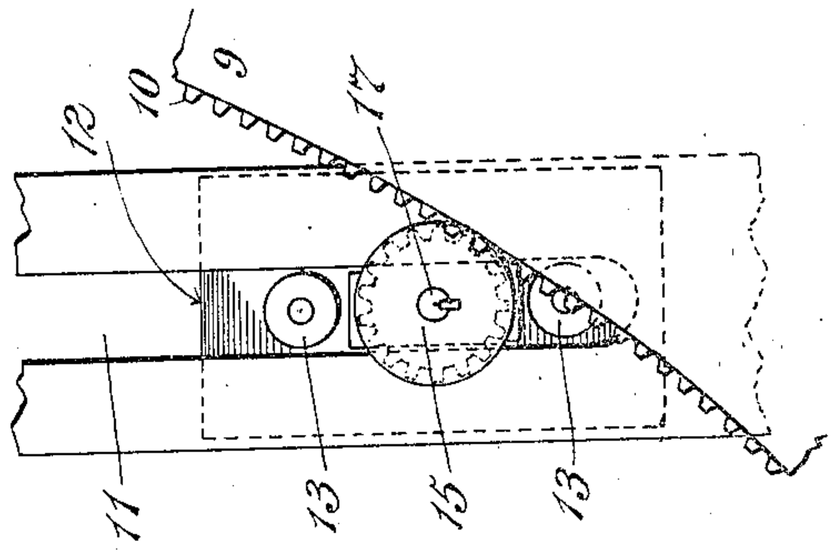
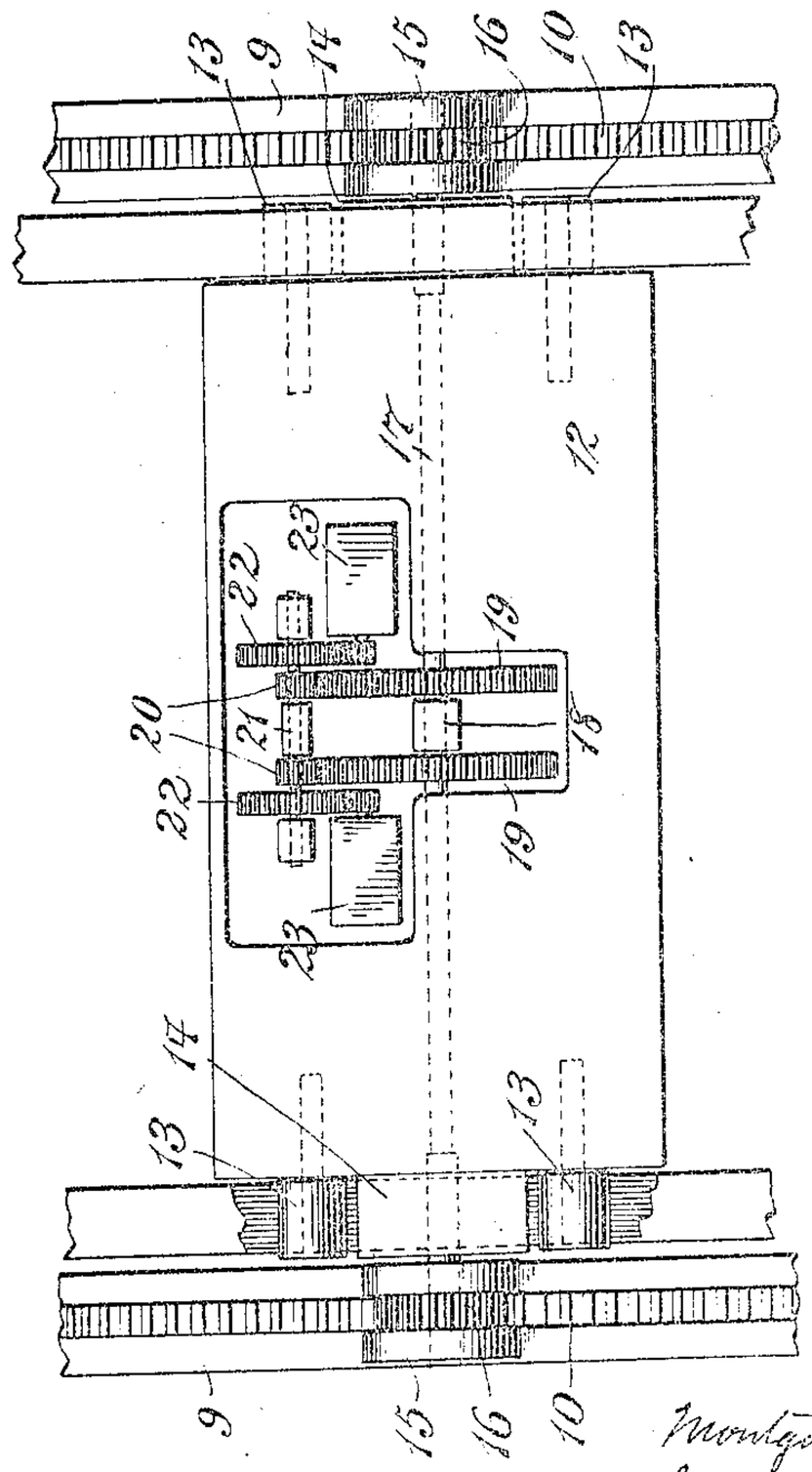


Fig. 5.



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UNITED STATES PATENT OFFICE.

MONTGOMERY WADDELL, OF NEW YORK, N. Y.

LIFTING BRIDGE.

No. 890,947. Specification of Letters Patent. Patented June 16, 1908.

Application filed February 12, 1908. Serial No. 415,530.

To all whom it may concern:

Be it known that I, MONTGOMERY WADDELL, a subject of the King of Great Britain, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Lifting Bridges, of which the following is a specification.

The present invention has relation to that type of draw-bridge wherein one or two sections of bridge are arranged to turn up out of the way of navigation around a stationary trunnion or pivot upon its abutment or pier and the principal object of the invention is the provision of improved means for so counter-balancing the bridge during its movement up or down that the rotative moment exerted by the weight of the bridge in one direction is always approximately equal to the rotative moment of a counterweight in the opposite direction, while at the same time the bridge in either extreme position is securely braced against the wind pressure in such a way that the resistance of such pressure is exerted through a long lever arm.

Another object of the invention is the provision of an improved means for causing the necessary movements of the bridge, whatever the counterweight arrangement may be.

One advantage of my invention is that the ends above named are secured by means of great strength, simplicity and reliability and without resorting to pivotal attachments of the counterweight either to the bridge itself or to exterior tower or piers.

My invention is illustrated in the accompanying drawings wherein

Figure 1 shows one form of bridge provided with my invention, in side elevation, with the lifting section in its lowered position, Fig. 2 is a similar view of another form of bridge, Figs. 3 and 4 show the same bridges, in side elevation, and in raised position, Fig. 5 is an end view showing the counterweight and preferred bridge operating means, and Fig. 6 is a side view of the apparatus shown in Fig. 5.

A bridge section of any well known form is indicated at 1, the same being pivoted at 2 to suitable foundations on the piers 3.

In Figs. 1 and 3 is shown a bridge adapted to swing between suitable side supports 4 preferably provided with lateral bracing indicated in dotted lines at 5 and uniting the supports on opposite sides of the bridge.

In Figs. 2 and 4 the bridge is shown swinging between side supports 6 of a somewhat different form, the same being braced laterally at the stationary road-way 7 whose continuation, in this form of bridge, is upon the top of the movable section. In this it is distinguished from the form shown in Figs. 1 and 3 wherein the stationary road-way 8 is continued upon the lower stringers of the bridge.

In both forms of bridges the mode of operation is the same and the following description will apply equally well to either. The side supports are provided with suitably shaped inclined guide-ways 9 extending from the upper-forward corner downward and rearwardly, as shown in the drawings. Each guide 9 is provided with a raised rack 10 placed preferably mid-way of the width of the guide as shown in Fig. 5. The in-board end of the tilting bridge section carries a movable counterweight so supported and arranged with respect to the bridge and the guide-way 9 that its weight exerts a wedging action between the bridge and guide-way tending to lift the bridge. For this purpose the opposite sides of the movable bridge section are provided with suitable slots or guide-ways 11 which may be inclined to the vertical when the bridge is down as shown in Figs. 1 and 2 or may have such form or direction as is consistent with the operation of my device in any given structure.

The counterweight 12 extends across the bridge from side to side opposite the slots 11 and is preferably constructed, as shown in Figs. 5 and 6, with rollers 13 extending into said slots and having appreciable play so that they may roll against either face of the slot, and provided with extensions 14 having a corresponding play within the slots. On the opposite sides of the counterweight 12 are pivoted two rollers 15 bearing upon the smooth portion of the guides 9, and these rollers are preferably provided with in-set gear teeth 16 meshing with the rack 10, for the purpose of moving the bridge up and down by the use of mechanism carried by the counterweight. It is to be understood, however, that my broad invention does not necessarily include the mechanism thus situated on the counterweight for moving the bridge.

In the preferred form shown the rollers 15 are united by shafting 17 extending across the counterweight to a bearing 18. Spur wheels 19 are fixed in the shafting 17 and are driven by pinions 20 which may or may not be

united by the coupling 21, and which are driven through gearing 22 by electric or other motors 23 carried by the counterweight 12.

It will be clear that, by running the motors 23 in one or another direction, the pinions 16 on the rollers 15 will tend to move along the racks 10 on the guides 9 and thus tend to make the counterweight travel along said guides. At the same time it is equally clear that any movement of the counterweight is limited by the sides of the slot 11 and that when the rollers 15 move over the guides 9 in one direction or the other the rollers 13 will be pressed against one or the other side of the slots 11 so as to exert rotative tendency upon the movable bridge section in one direction or the other.

While the member 12, shown in the Figs. 5 and 6, is preferably made heavy enough to serve as a counterweight, this is not essential to one aspect of my invention which covers the means described for moving the bridge, whether or not the support 12 serves as a counterweight.

Assuming the bridge to be in position shown in Figs. 1 and 2, if the roller 15 be given a movement of negative rotation around its center it will tend to move down the guides by virtue of the engagement between the pinions 16 and the rack 10. But the direction of the upper side of the slot 11 makes an acute angle with the surface of the guide 9 and the downward tendency due to the weight of the counterweight and the rotative action of the roller 15 will produce the effect of a wedge driven between the upper surface of the slot 11 and the guide 9, tending to widen the angle and so impart a negative rotation to the movable bridge section. The widening of the angle between the slot and the upper surface of the guide 9 is made clear by comparing Fig. 1 for instance, which represents the bridge when lowered and Fig. 6, which shows the relative positions of the slotted member of the bridge and the guide 9 when the bridge is partly raised. The angle between the slot and the guide 9 is larger in Fig. 6 than it is in Fig. 1. This wedging action is continued until the slot reaches a position at right angles to the surface of the guide 9, at which time the rollers 13 have reached or nearly reached the end of their travel within slot 11. As the bridge is further tilted upward by rotation of the rollers 15 the rollers 13 move within the slot 11 in the opposite direction, and when the bridge is fully up as shown in Figs. 3 and 4 the rollers 13 have returned to that end of the slot 11 which they occupied when the bridge was fully down as shown in Figs. 1 and 2.

Although the direction of motion of the rollers and counterweight with relation to the slot 11 is reversed after the slot reaches the right angle position with respect to the guide 9, this motion is accompanied by a continued downward movement of the counterweight tending to raise the bridge.

As the bridge approaches its limit of upward movement the distance of the counterweight 12 from the pivotal point 2 increases, so that when the bridge is finally raised the resistance to wind pressure is exerted through a maximum lever arm. Owing to my construction however the turning moment of the counterweight upon the bridge actually decreases in proportion as the center of gravity of the bridge approaches a vertical plane through the trunnions or pivots 2, and this in spite of the fact that the counterweight moves away from the pivotal point. This effect is produced by the peculiar shape of the guides 9 and the relation of the slot 11 thereto at each position of the bridge. These should be so calculated that, when the gravity of the counterweight has been resolved into components, one of which is at right angles to the slot 11 and the other at right angles to the surface of the guide 9, the turning moment of the former component should be always substantially equal and opposite to the turning moment due to the weight of the bridge.

It will be seen on inspection of Figs. 3 and 4 that, when it is desired to lower the bridge, rotation of the roller 15 in a positive direction will produce the same wedging action between the slot 11 and the guide 9 as has been mentioned above. As the bridge is always substantially counterbalanced, the roller 15 will be relied upon only to overcome the inertia and frictional and air resistances incident to movement of the bridge.

I prefer to shape the guides 9 as shown, so that the rollers 15, bearing upon one end or the other of the guides 9 when the bridge is in one extreme position, will serve as stops assisting in support of the bridge.

Various changes may be made in the embodiment of my invention without departing from the spirit thereof and I do not limit myself to the details herein shown and described.

What I claim is—

1. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member, and a counterweight resting against and adapted to travel along both of said guideways, substantially as described.

2. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member, a counterweight, and supporting means for the counterweight resting against and adapted to travel along both of said guideways, substantially as described.

3. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member, a counterweight, supporting means

for the counterweight resting against and adapted to travel along both of said guideways, and means carried by said counterweight for causing the same to move along said guideways, substantially as described.

4. A lifting bridge, comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member and a counterweight suspended so as to exert pressure upon both of said guideways simultaneously, substantially as described.

5. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member making an acute angle with the stationary guideway when the pivoted member is at one extreme position, a counterweight, supporting means therefor resting against both of said guideways, and means for causing said supporting means to exert a wedging action upon said guideways, tending to increase the angle between them, substantially as described.

6. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway on the pivoted bridge member, a counterweight, and rotary supporting means for said counterweight making mechanical engagement with one of said guideways and adapted to impel the counterweight and move the pivoted bridge member, substantially as described.

7. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway on the pivoted bridge member, and bridge moving means bearing against said two guideways and adapted to change the angle between them, substantially as described.

8. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway on the pivoted bridge member making an acute angle with said stationary guideway when the pivoted member is in one extreme position and bridge-moving means adapted to exert a wedging action upon said guideways tending to increase the angle between them, substantially as described.

9. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a rack thereon, a slot in the pivoted bridge member, rollers in said slot, a toothed roller on said guideway engaging with said rack, a common support for said rollers, and means for rotating the toothed roller, substantially as described.

10. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a rack thereon, a slot in the pivoted bridge member, a counterweight, rollers journaled on said counterweight and running in said slot, a toothed roller running on said guideway and having teeth engaging said rack, said roller also journaled on said counterweight, and means for rotating the last named roller, substantially as described.

11. A lifting bridge comprising in combination a pivoted member, a stationary guideway at each side thereof, a movable guideway on each side of said pivoted member, and a counterweight hung across the bridge upon supports extending across both guideways on both sides of the bridge, substantially as described.

12. A lifting bridge comprising in combination a pivoted member, stationary guideways at the two sides of the bridge, a movable guideway on each side of the pivoted member, a counterweight hung across the bridge upon supports extending across both guideways upon both sides of the bridge, and means for forcing said supports to move along both of said pairs of guideways so as to change the angle between them, substantially as described.

13. A lifting bridge comprising in combination a pivoted member, stationary guideways carrying racks at the two sides of the bridge, a slot in each side of the pivoted member, a counterweight hung across the bridge on supports extending into said slots, a toothed roller on each stationary guideway, a shaft extending across the counterweight and joining said rollers, and mechanism carried on the counterweight for rotating said shaft and rollers, substantially as described.

14. A lifting bridge comprising in combination a pivoted member, a stationary guideway, a guideway upon the pivoted bridge member, a counterweight, supporting means for the counterweight resting against and adapted to travel along both of said guideways, and means for causing the supporting means to move along said guideways, substantially as described.

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