No. 668,232. Patented Feb. 19, 1901.

J. B. STRAUSS.

BRIDGE.

(Application filed May 31, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

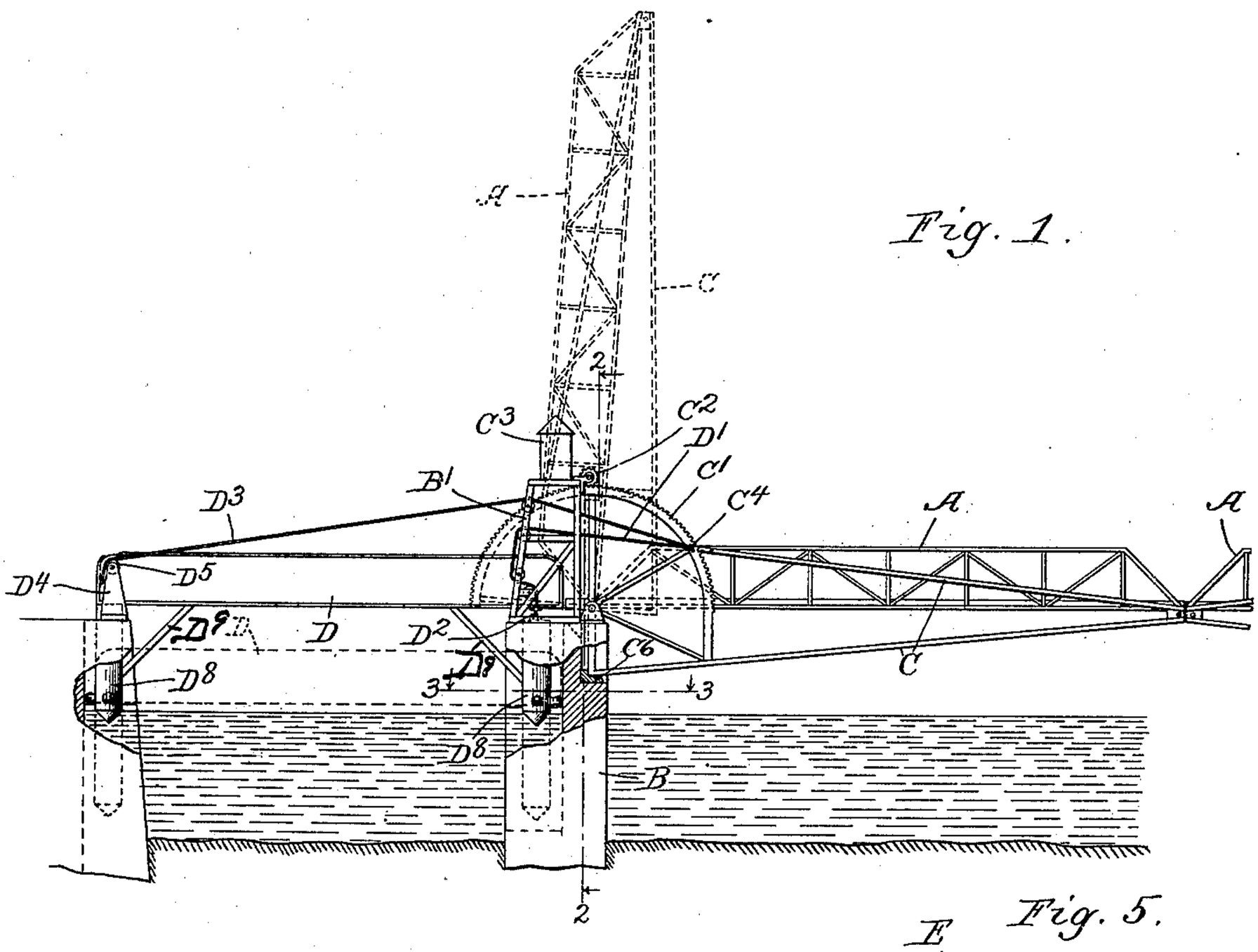


Fig. 2.

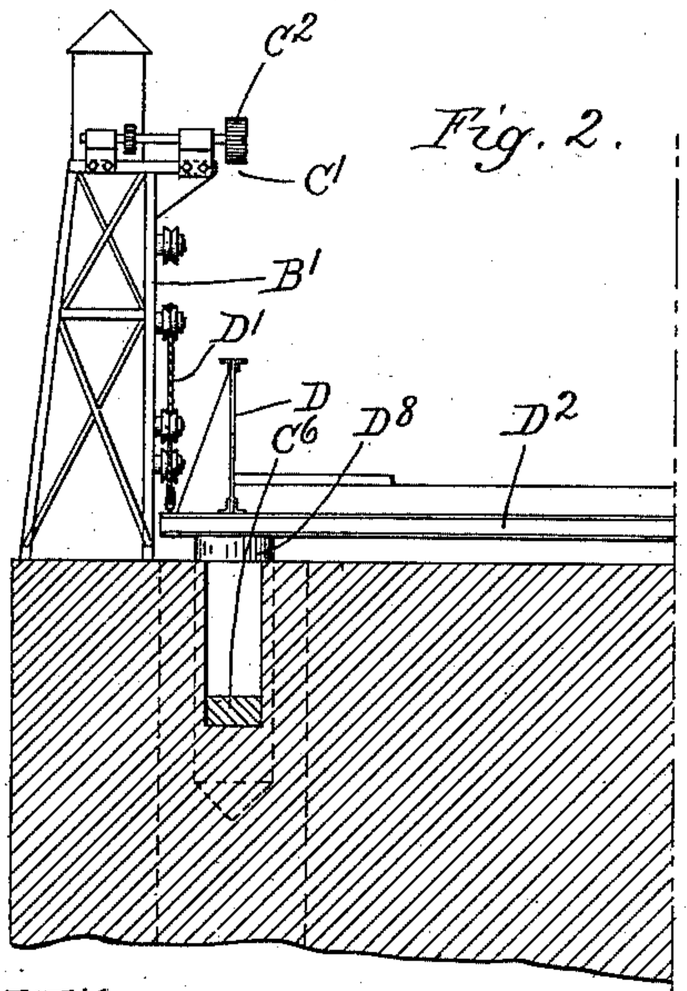


Fig. 3.

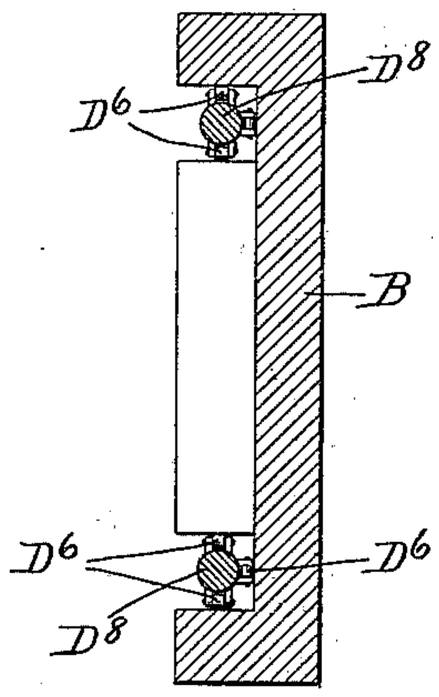
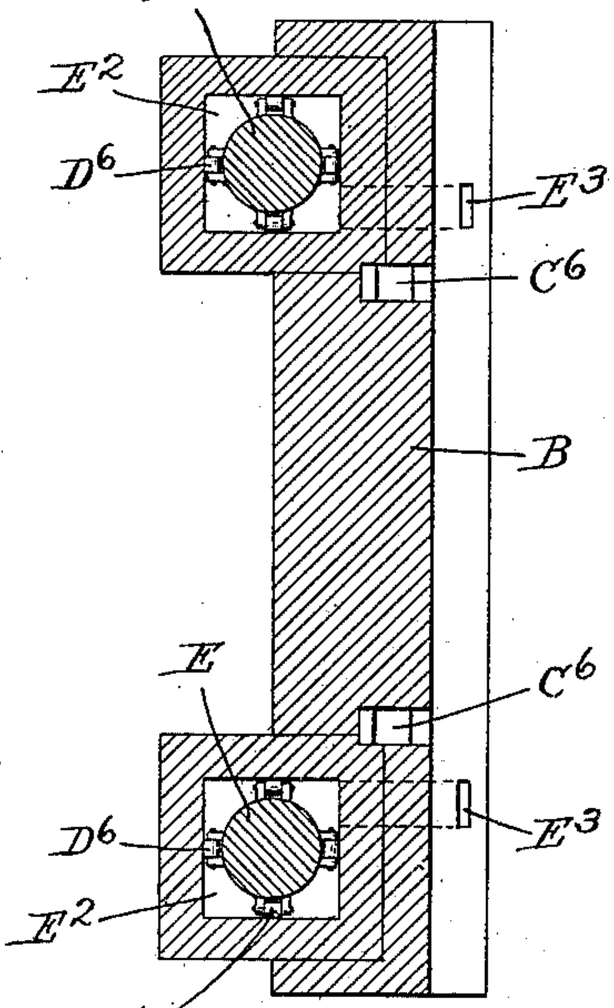


Fig. 5.



Witnesses.
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Howard L. Kraft.

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his Attys.

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2 Sheets—Sheet 2.

Fig. 4.

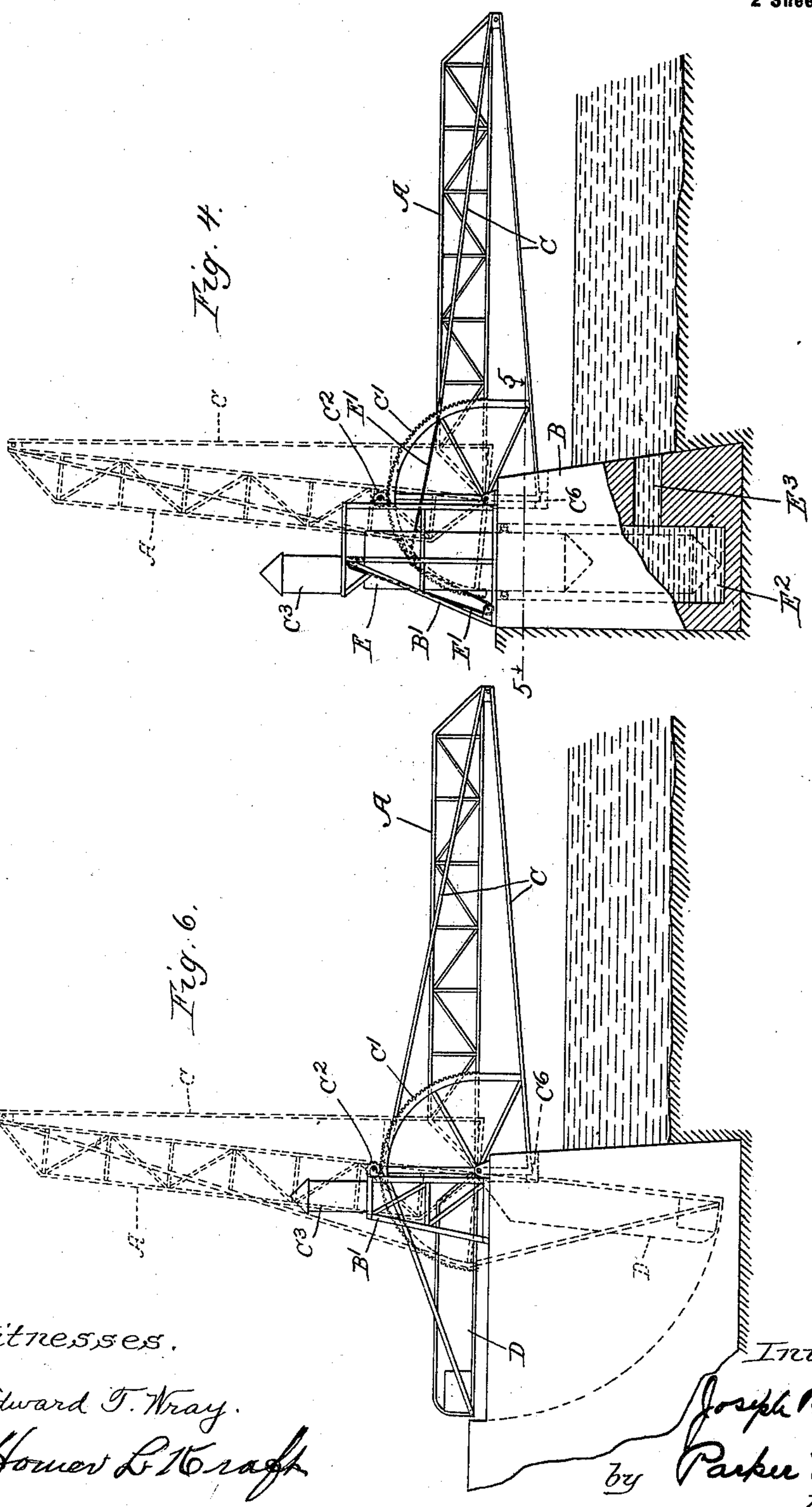

Fig. 6.

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UNITED STATES PATENT OFFICE.

JOSEPH B. STRAUSS, OF CHICAGO, ILLINOIS.

BRIDGE.

SPECIFICATION forming part of Letters Patent No. 668,232, dated February 19, 1901.

Application filed May 31, 1900. Serial No. 18,643. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. STRAUSS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Bridges, of which the following is a specification.

My invention relates to improvements in bridges, and has for its object to provide a new and improved bridge of the kind which opens up so as to leave an unobstructed passageway for boats and the like.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a view of a bridge embodying my invention. Fig. 2 is a section with parts omitted on line 2 2, Fig. 1. Fig. 3 is a section on line 3 3, Fig. 1. Fig. 4 is a view showing a modified construction. Fig. 5 is a section on line 5 5, Fig. 4. Fig. 6 is a view showing a further modification.

Like letters refer to like parts throughout the several figures.

One of the objects of my invention is to provide a lift-bridge wherein one part of the structure balances the other part either partially or wholly, thus reducing or eliminating the counterweights now used in all kinds of lift-bridges.

Another object of my invention is to arrange means for reducing the effect of the counterweight for the main span without varying its arm and in the same ratio that the arm of the main span decreases as it is lifted to open the channel for boats.

A further object of my invention is to combine these two ideas and to also provide a bridge having balancing-trusses separate from the main span, so that they can be made separately and combined when placed in position.

Referring now to the drawings, I have shown in Fig. 1 the main spans A, normally joined together at the center when the bridge is in an operative position. I have shown only one half of the bridge in this figure, as the other half is an exact duplicate. The main span A is pivotally connected to the pier B. On each side of the main span is a balancing-truss C, which is also pivotally connected to the pier B, the balancing-trusses being connected at their outer ends to the main span A. Each balancing-truss is provided with a rack C′, engaged by a gear C^2, operated from a suitable motor in the operating-tower C^3. The approach-span D is connected to the balancing-truss C at the point C^4 by a rope or other flexible device. The rope D′ passes over suitable pulleys on the framework B′ and is connected to the end of the approach-span nearest the abutment B, the connection preferably being made to the I-beam D^2. The rope D^3 passes over suitable pulleys and is connected to the land end of the approach-span, as shown, there being a suitable support D^4 at the land end which supports the pulley D^5. It will be understood that there are two ropes D′ and two ropes D^3, one on each side of the approach-span. The approach-span is provided with a suitable part or parts D^8, which may be of any suitable construction, the only essential condition being that this part or these parts, when there are more than one, are arranged so that they can pass into the water as the main span A lifts, thus displacing the water and gradually decreasing the effect of the approach-span as the arm of the main span decreases, due to its upward movement. The approach-span is supported by the ropes D^3 and D′, so that it acts either partially or wholly as a counterweight for the main span. This approach-span may be supported by placing blocks or the like under it when the bridge is in an operative position, if desired, the blocks being removed when it is desired to open the bridge, so that the approach-span is free to move downwardly as the main span is moved upwardly. In the drawings I have shown four projecting parts D^8, which work in suitable guides in the abutments, they being preferably provided with antifriction-rollers D^6. It will thus be seen that when it is desired to lift the bridge the motor in the tower C^3 is started. The gear C^2 is then rotated, and by its engagement with the rack it moves the outer end of the main span, and the balancing-trusses swing upwardly. The approach-span then moves downwardly, the parts D^8 displacing more and more water the farther the approach-span descends. The parts are so adjusted as to decrease the effect of the approach-span in the proper proportion to make it have the desired counterbalancing effect.

In Fig. 4 I have shown a construction similar to Fig. 1, with the exception that the approach-span is omitted and the main span and balancing-trusses are pivotally connected with suitable abutments at the shore. Suitable counterweights E are used, the counterweights being connected with the balancing-trusses C by the ropes E′, as shown, said ropes passing over suitable pulleys on the support B′. These counterweights are confined within suitable apartments E^2 in the abutment, as shown in Fig. 5, so that they are gradually introduced or immersed in the water as the main span rises. The apartments E^2 are connected with the water, so that they are partially filled with water, as shown. I prefer to connect these apartments with the river by means of openings E^3, as shown in Fig. 5, so that as the water is displaced by the counterweights it may be forced out through these openings.

In Fig. 6 I have shown a construction similar to Fig. 1, with the exception that the approach-span D is connected with the main span A, so as to be a part thereof, projecting rearwardly from the pivotal point. This approach-span acts either partially or wholly as a counterweight and moves downwardly as the main span moves upwardly. A suitable opening is formed in the abutment to permit this, as indicated. In some instances, when the approach-span is short, it will be necessary to add some counterweight, and this counterweight may be added in any desired manner. The parts are so adjusted that the lever-arm of the approach-span decreases proportionately with the lever-arm of the main span, so that a proper balancing effect is present in all positions. The balancing-trusses C are made separate from the main span and are connected therewith when the parts of the bridge are in position. When the bridge is in its operative position, the balancing-trusses engage the shoes C^6, so that they support the river end of the main span. When the bridge is closed, the balancing-truss acts as an arch or cantaliver to carry a portion of the load of the main span to the abutment or pier. In opening the bridge the balancing-truss acts as an operating or lifting truss, and at the same time it transmits the action of a suitable counterweight in such manner as to balance the weight of the main span as it rises and falls. This balancing-truss therefore acts as a support, as an operating-truss, and as an equalizing-arm. This construction produces a lighter and cheaper superstructure, a smaller and cheaper pier and abutments, and a larger open channelway. This construction also lessens the ground needed for approaches and the machinery necessary to operate the bridge and secures a bridge which lends itself more easily to esthetic designs.

The counterbalance, comprising a part which is introduced in a varying degree in the water or other liquid, is provided with any suitable means for simultaneously varying the portion introduced in the liquid and the arm of the main span. The degree of variation will of course depend upon the structure in connection with which the device is used and the conditions and circumstances presented. It is of course essential that the effect of the counterbalance and the arm of the main span vary simultaneously, so that the effect of the counterbalance will correspond with the downward pull of the main span. The construction herein shown is a cheap, efficient, and economical construction by means of which this result may be obtained, and it is of course evident that the various parts may be arranged in many different ways. I have only attempted to illustrate a construction which would make my invention clear.

In describing my device I have described a part which I have called the "main" span and have referred to the arm of this span. Where I use the term "arm" in this specification, I mean the moment-arm, and the term is here used in the sense in which it is usually employed in engineering construction.

I claim—

1. A lift-bridge, comprising a main span to be lifted and lowered, a counterbalance therefor comprising a part movable with relation to the main span and normally partially inserted into the water when the bridge is being operated, means for varying the portion of said part inserted in the water as the position of the main span is varied, so as to vary the effect of the counterbalance as the arm of the main span varies.

2. A lift-bridge, comprising a main span and an approach-span, a balancing-truss connected with the main span and movably connected with the approach-span, and means for moving said balancing-truss so as to lift the main span.

3. A lift-bridge, comprising a main span and a shore end or part, a movable connection between the shore end and the main span, the parts so arranged that the shore end acts partially or wholly as a counterweight for the main span in all its various positions.

4. A lift-bridge, comprising a main span and a balancing-truss independent of each other, so that they can be separately erected, the balancing-truss adapted to be connected with the main span so as to act as a lifting-arm.

5. A lift-bridge, comprising an approach-span, a main span and a balancing-truss, each independent and separate before the bridge is erected, the several parts connected together when in position so that one span acts to balance the other, either partially or wholly.

6. A lift-bridge, comprising a main span pivotally connected at one end to a support, an approach-span also connected with said support, a balancing-truss connecting the two spans, so that the approach-span acts partially or wholly as a counterweight for the

main span, and means for moving the balancing-truss so as to lift the main span.

7. A lift-bridge, comprising a main span pivotally connected at one end to a support, an approach-span also connected with said support, a balancing-truss connecting the two spans, so that the approach-span acts partially or wholly as a counterweight for the main span, an engaging device on said balancing-truss, a stationary part adapted to be engaged thereby, and means for moving said engaging device so that it will travel along the stationary part.

8. A lift-bridge, comprising a main span adapted to be lifted, a counterweight therefor, and means for varying the effect of the counterweight without varying its arm as the arm of the main span varies.

9. A lift-bridge, comprising a main span adapted to be lifted and lowered, a counterbalance therefor comprising a part adapted to be introduced in a varying degree in a liquid, and means for simultaneously varying the portion of said part introduced into the liquid and the position of the main span, so as to simultaneously vary the effect of the counterbalance and the arm of the main span.

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Witnesses:
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