(No Model.) 2 Sheets—Sheet 1.

W. HARMAN.

BRIDGE.

No. 383,880. Patented June 5, 1888.

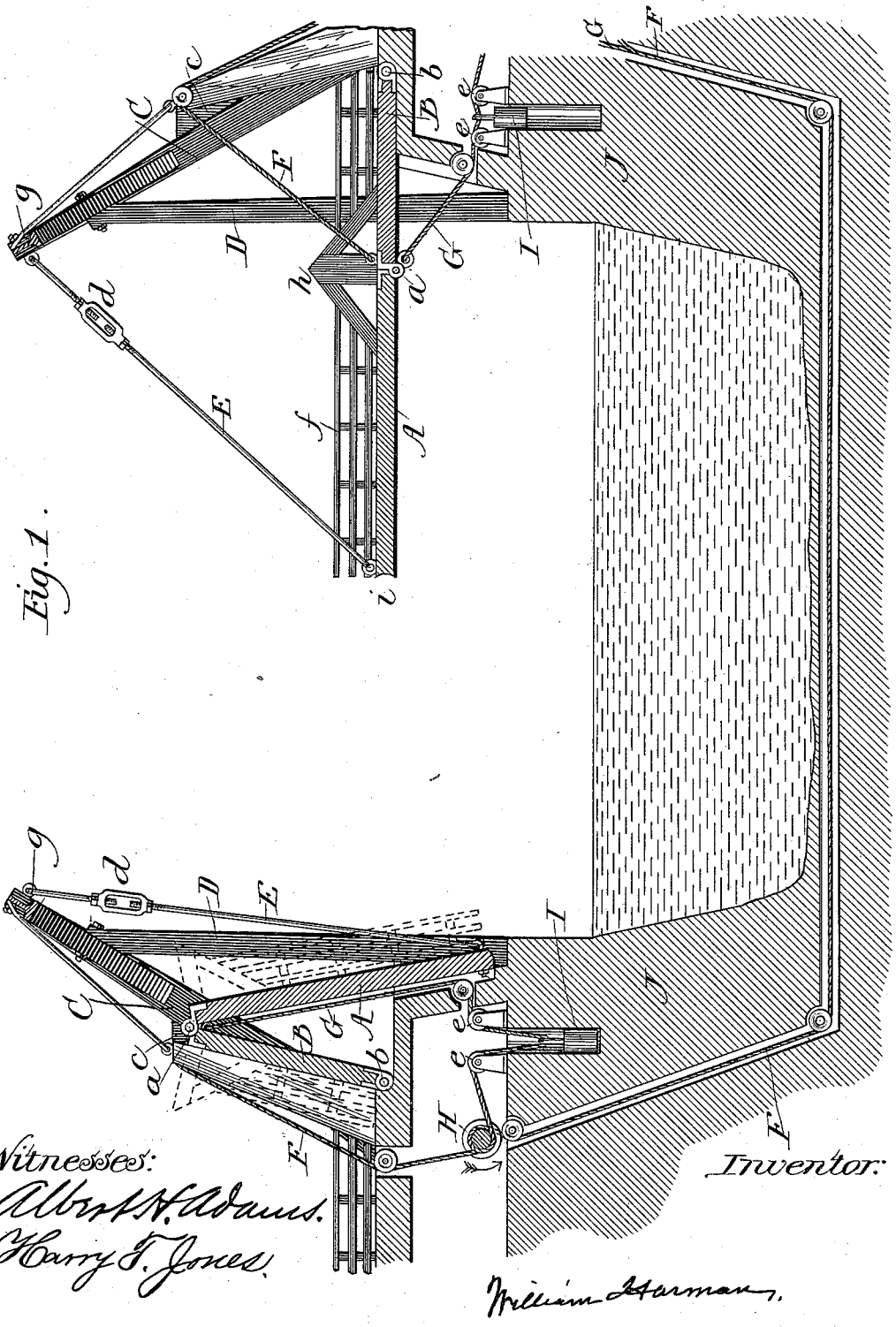

Fig. 1.

Witnesses:
Albert H. Adams.
Harry F. Jones.

Inventor:
William Harman.

(No Model.) 2 Sheets—Sheet 2.

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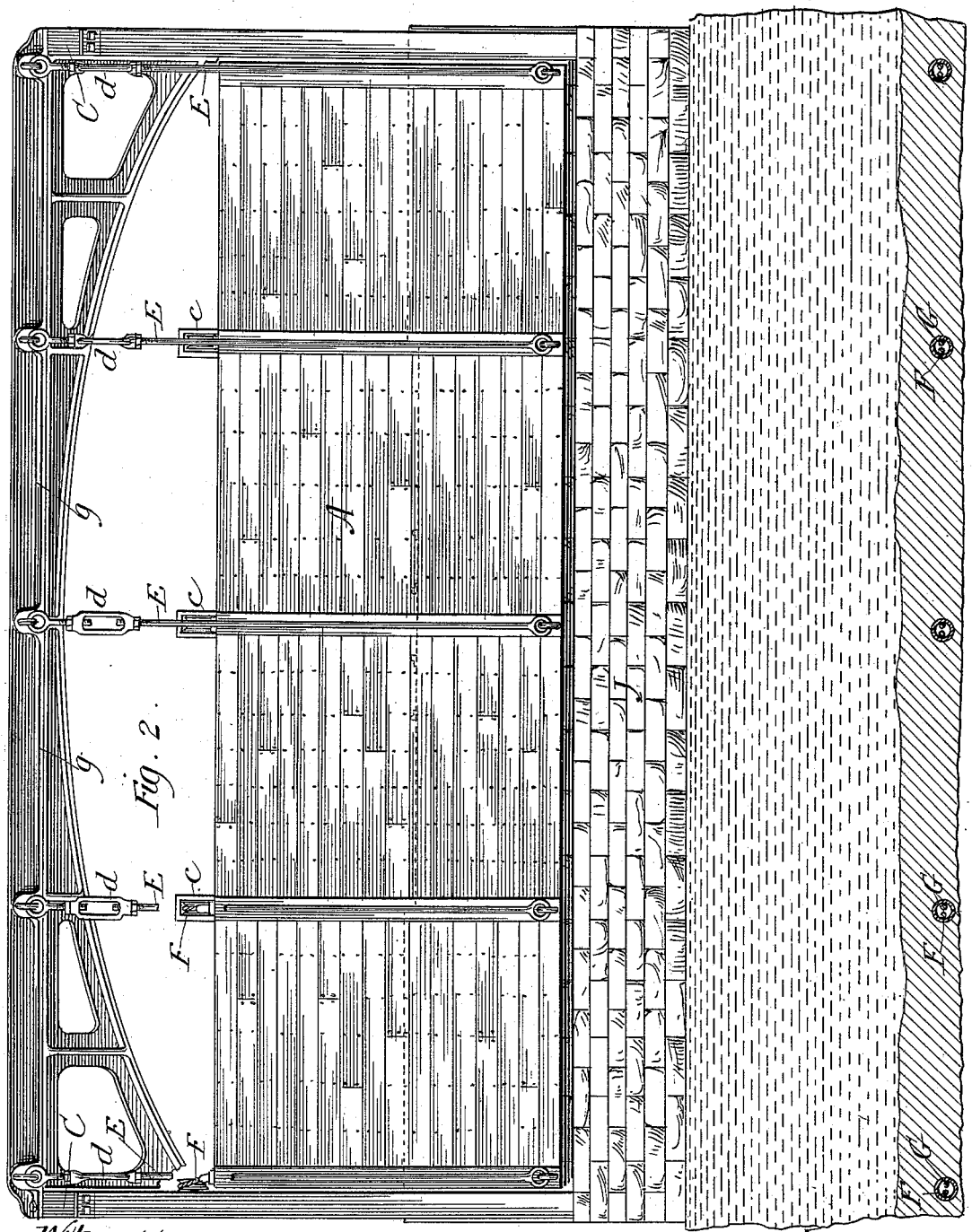

Fig. 2.

Witnesses:
Albert H. Adams.
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Inventor:
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UNITED STATES PATENT OFFICE.

WILLIAM HARMAN, OF OAK PARK, ILLINOIS.

BRIDGE.

SPECIFICATION forming part of Letters Patent No. 383,880, dated June 5, 1888.

Application filed March 19, 1888. Serial No. 267,771. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HARMAN, residing at Oak Park, in the county of Cook and State of Illinois, and a citizen of the United States, have invented a new and useful Improvement in Bridges, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section showing one half of the bridge lowered in position for crossing and the other half raised; and Fig. 2 is a view in elevation of the half shown at the left-hand side of Fig. 1, the water-way with the under passages being in section.

In cities where bridges are used for crossing navigable water-ways it is very desirable that the construction of the bridges be such as to enable them to be operated rapidly in opening and closing, and thus delay travel across the bridge for as short a time as possible, and at the same time allow a rapid movement of the vessels passing through. The bridges in general use in such places are pivot or swing bridges, or those supported by a central pier, which are objectionable on account of the time consumed in opening and closing them, it being necessary to commence to swing the bridge some time before the near approach of a vessel, and are objectionable to those navigating the water-way on account of the central pier or support on which the bridge rests occupying the center of the water-way, so that in many cases it is difficult to properly steer the boat so as not to collide with the bridge or its approaches, and many accidents occur which would otherwise not happen were the center supporting-pier not used, and there is less liability to ground, as the channel is usually deeper in the middle.

Draw-bridges are not open to the objection of obstructing the channel by their supports; but as heretofore made they have not been practical for use over any but narrow channels, as when made in either one or two sections they are too heavy, if properly constructed for city traffic, to be quickly and easily raised and lowered.

My improvements overcome these objections and produce a bridge which is strong and durable; and its nature consists in making the bridge in halves and each half in sections hinged together; in attaching the lifting-cables at or near the section-hinges, so that when the bridge is opened the inner section of each half will be raised and the other section will fold in against the under side of the inner section, and in the several parts and combinations of parts, hereinafter more specifically described, and pointed out in the claims as new.

In the drawings, A represents the outer floor-section of each half of the bridge, and B are the inner floor-sections.

C are standards.

D are brace-bars for the standards C.

E are rods extending from each section A to the standards C, or to a cross-girder, *g*, extending from standard to standard.

F and G are operating ropes or chains.

H is a winding-drum.

I is a weight.

J are the abutments.

a is a rod or shaft on which the sections A B are hinged together.

b is a rod or shaft similar to *a*, on which the inner end of each section B is hinged.

c are brackets on the standards C.

d are turn-buckles.

e e are pulleys or rollers.

f are guard-railings on the sides of the bridge.

g is a girder or cross-bar.

h are braced standards or locks to prevent sagging at the joints *a* and to relieve strain.

The bridge shown is designed for the full width of a sixty-six or eighty foot street, and for a bridge of this size the frame-work of the sections A B is made of suitable wrought-iron, and the floor-planks are attached thereto by bolts and spikes. The standards C may be made of cast-iron, or of suitable wrought-iron frame or truss work, and the cross-girders, when used, may be made of cast-iron sections, or in a continuous wrought-iron truss. The height of the standards will depend somewhat upon the length of the bridge-span; but they should be of a sufficient height to give the floor-sections an easy movement. The hinges between the floor-sections of each half are best made by providing each section with any desired number of suitable eyes located at or below the lower line of the frames and connecting them together by a continuous strong rod,

or a shaft, to which the lifting-chains are attached. For the purpose of holding the adjoining edges or ends of the halves in line when they are lowered or swing into position, the edge of one may be grooved, as at *i*, and the edge of the other provided with a corresponding bevel. If a stronger connection for this point is desired, locking-blocks or removable bolts may be added.

The rods E are adjusted by means of the turn-buckles *d*, so as to be rigid and hold the bridge firmly to prevent sagging at the middle, and when the sections A are being moved into or out of position the ends thereof will be given a firm support during such operation. The free ends of the sections A will move in the arc of a circle, which allows of the adjoining edges being made one concave and the other convex.

The ropes or chains F, which are on the same side as the drum H, pass from such drum up to and over pulleys secured on the bracket *c*, down to the point of attachment to the section B. The corresponding cables or chains F that raise the opposite section B pass from the drum H down and under the bed of the waterway through one or more suitable shafts or tunnels, up to and over pulleys secured to the brackets *c*, down to the point of attachment to the other section B.

The ropes or chains G, which are on the same side as the drum H, are connected at one end to such drum, and from thence pass over pulleys or rollers to the point of attachment to the section B. The corresponding cables or chains G, used for lowering the opposite section B, pass from the drum H, to which they are connected, to the opposite side of the waterway, passing through the same shafts or tunnels as the ropes or chains F, thence over pulleys or rollers to the point of attachment to the section B. As shown, the points of attachment of the cables or chains G to the sections B are opposite the points of attachment of the cables or chains F to the same sections.

When the shaft H is rotated in the direction of the arrow, Fig. 1, the cables or chains F will be wound thereon and draw the section in to allow vessels to pass, as will be hereinafter more fully described. When the rotation of the shaft is reversed, the cables F will be unwound and the cables G wound thereon, the effect of the winding of the cables G being to cause them to pull downward on the section B, which downward pull is continued until the sections are horizontal or in position. The sections B, when being lowered, will force the sections A into a horizontal position also, the rods E serving to support and guide them while moving into place, and when in place holding them firmly.

In closing the bridge the drum H will be rotated only sufficient to unwind enough of the ropes or chains F to permit such ropes or chains to extend, in a taut condition, from the drum to and over the pulleys in the brackets *c* to the points of attachment to the sections B. The rotation of the drum to unwind the cables or chains F will not usually be sufficient to take up all of the slack of the cables or chains G. To take up such slack, I have provided weights I, which are attached to the cables or chains G between two pulleys, *e e*, each weight being raised and lowered in suitable wells or chambers formed in the abutments J.

As shown, guard-railings *f* are secured to the sides of the bridge, which railings are of the same length as the sections to which they are secured. On the left-hand side of Fig. 1 these railings are shown in dotted lines to indicate their position when the bridge is open. It is desirable that when closed the adjoining ends of the guard-rails come closely together, and by being formed of stronger timbers or framing *h* an extra bracing or support is afforded, which prevents vibration and strengthens the bridge.

If it is not desirable or convenient to operate both sides of the bridge by means of cables passing underneath the bed of the river or other water-way, each half may be operated separately, and in such case it will not be necessary to operate the halves simultaneously, and in some cases it will not be necessary to operate more than one half to permit the passage of a vessel, or to move both entirely back when both are operated.

When the bridge is open, the sections B form effectual guards for preventing accidents by absence of mind or by runaway teams, &c.

The bridge is intended to be of the same width as the street leading to it, and is to be provided with as many rods E as desired or are necessary. As shown in Fig. 2, five are provided, which serve to divide the bridge into different divisions for foot-passengers and vehicles. The girder or cross-bar *g*, connecting the tops of the standards C, furnishes the means of attaching the upper ends of the intermediate rods, E.

It will be seen that by dividing each half of the bridge into sections and raising from the joints *a* or sections B, instead of from the outer sections, A, a much less expenditure of power is required to operate the bridge in opening or closing, and that either movement can be accomplished in much less time than is required to move undivided halves, as the arc described by the end of B will be much smaller than would be the case if the sections A were swung up in the same planes as the sections B.

The operation is as follows: Suppose the bridge to be down or in position for use and it is desired to open it. Power is applied to the drum H, which winds thereon the chains or cables F, which are each secured at one end to the drum and at the other end to the rods or shafts *a* of the section-hinges or to eyes at the forward edges of the sections B, thus raising the sections B, and as these sections are raised the sections A, which are supported by the rods E, fold down sufficiently to pass the outer edges of the abutments J, the upper portion of which abutments may be recessed or

cut away to receive and protect the sections A. The position of the sections will then be as represented by the left-hand side of Fig. 1, from which it will be seen that the bridge is entirely withdrawn from over the water-way, leaving the entire channel free for the passage of vessels. In lowering, a reverse movement is given to the drum or shaft H, and the halves are drawn back by the cables or chains G, thus giving the halves a positive movement, and preventing any sudden movements and the dropping of the floor-sections into position, which is liable to take place when partly down, owing to their being supported on the rods E and the hinges or pivots *b*. By this construction of a draw-bridge I adapt it to much wider channels than draw-bridges have heretofore been capable of spanning, and I bring the floors to a level or horizontal position, whereby the necessity of forming abutments capable of resisting pressure is avoided and the necessity of lowering the halves simultaneously overcome, as the halves may be separately lowered. I also avoid raising the outer portions of the draw-halves to a great height, do away with the necessity for high standards, the sections so nearly counterbalancing each other, and I carry so large a proportion of the weight upon the permanent structure that comparatively little power is required to move the bridge. By shortening the sections B within proper limits less moving power will be required and a more rapid movement of the parts covering the passage will take place.

Steam-power will be required to operate a bridge of the described size; but smaller wooden bridges may be operated by man-power, and for canals or other narrow channels the folding sections of one half may be used as a complete bridge.

The outside tunnels or under passages may be made large enough for foot-passengers, and in that event all of the cross operating cables or chains will be taken through such passage or passages, and when such under passages are omitted each half will require separate applications of power.

By properly adjusting the weight of the sections A B, the cables or chains F may be used for both raising and lowering, for the weight of the sections will carry them into position for use, and a brake may be applied to the shaft or drum H to prevent rapid descent; but for heavy bridges the cables or chains G are essential.

What I claim as new, and desire to secure by Letters Patent, is—

1. A draw-bridge composed of halves or two parts, each part consisting of sections, as A B, hinged together, substantially as and for the purpose specified.

2. The combination of the sections A B, hinged together, standards C, rods E, and ropes F, for raising the sections B to open the bridge, substantially as specified.

3. The combination of the sections A B, hinged together, standards C, rods E, and ropes G, for lowering the sections B to close the bridge, substantially as specified.

4. The combination of the sections A B, hinged together, standards C, rods E, ropes F G, and winding shaft or drum H, for raising and lowering the sections B to open and close the bridge, substantially as specified.

5. In a draw-bridge, the hinged floor-sections A B, supported and arranged to fold together when lifting-power is applied to the abutment-section, substantially as described.

WILLIAM HARMAN.

Witnesses:

ALBERT H. ADAMS,
HARRY T. JONES.