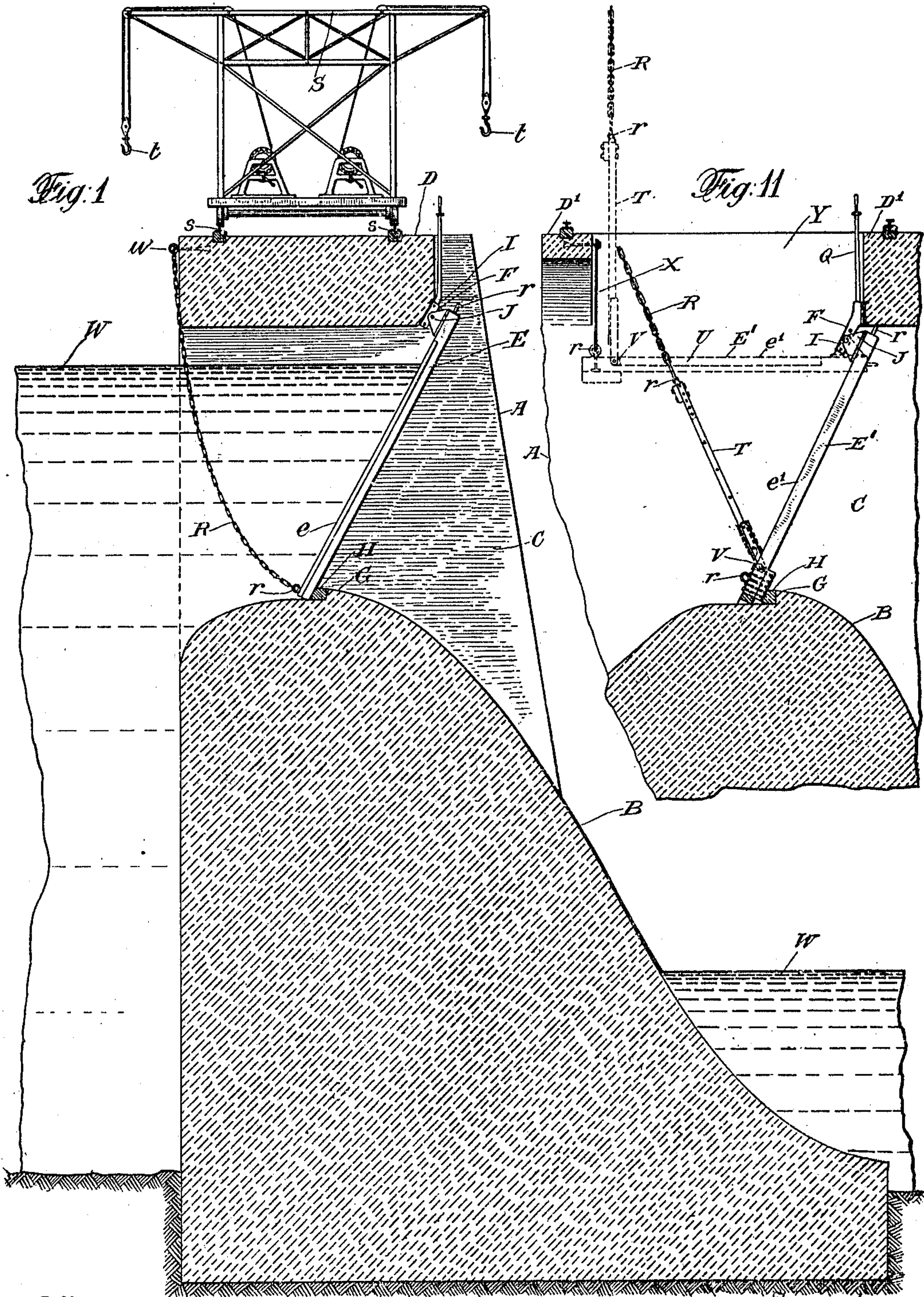


H. L. COOPER.
DAM AND APPARATUS FOR CONSTRUCTING THE SAME.
APPLICATION FILED MAR. 18, 1909.

955,851.

Patented Apr. 26, 1910.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

Fig. 2

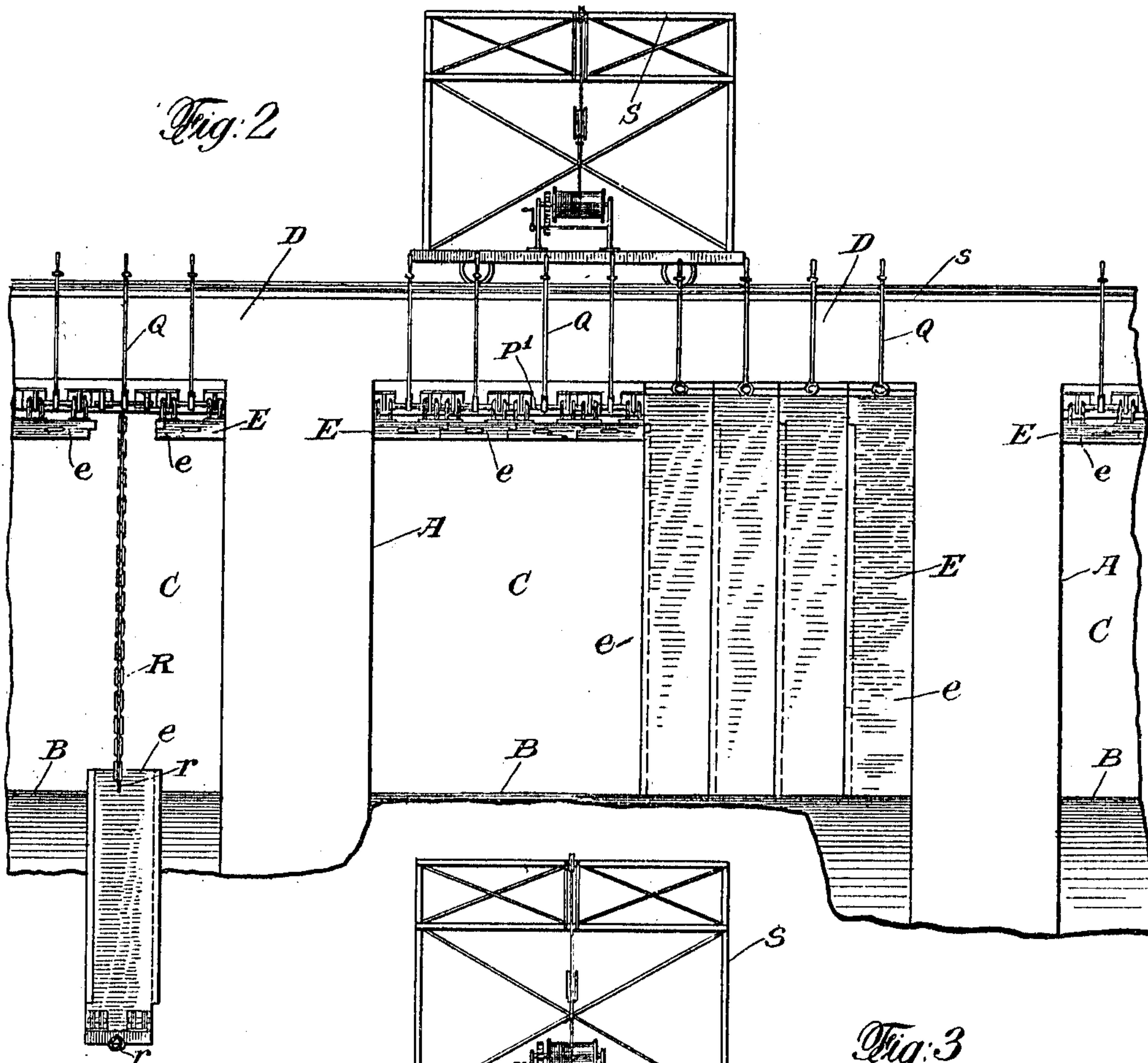
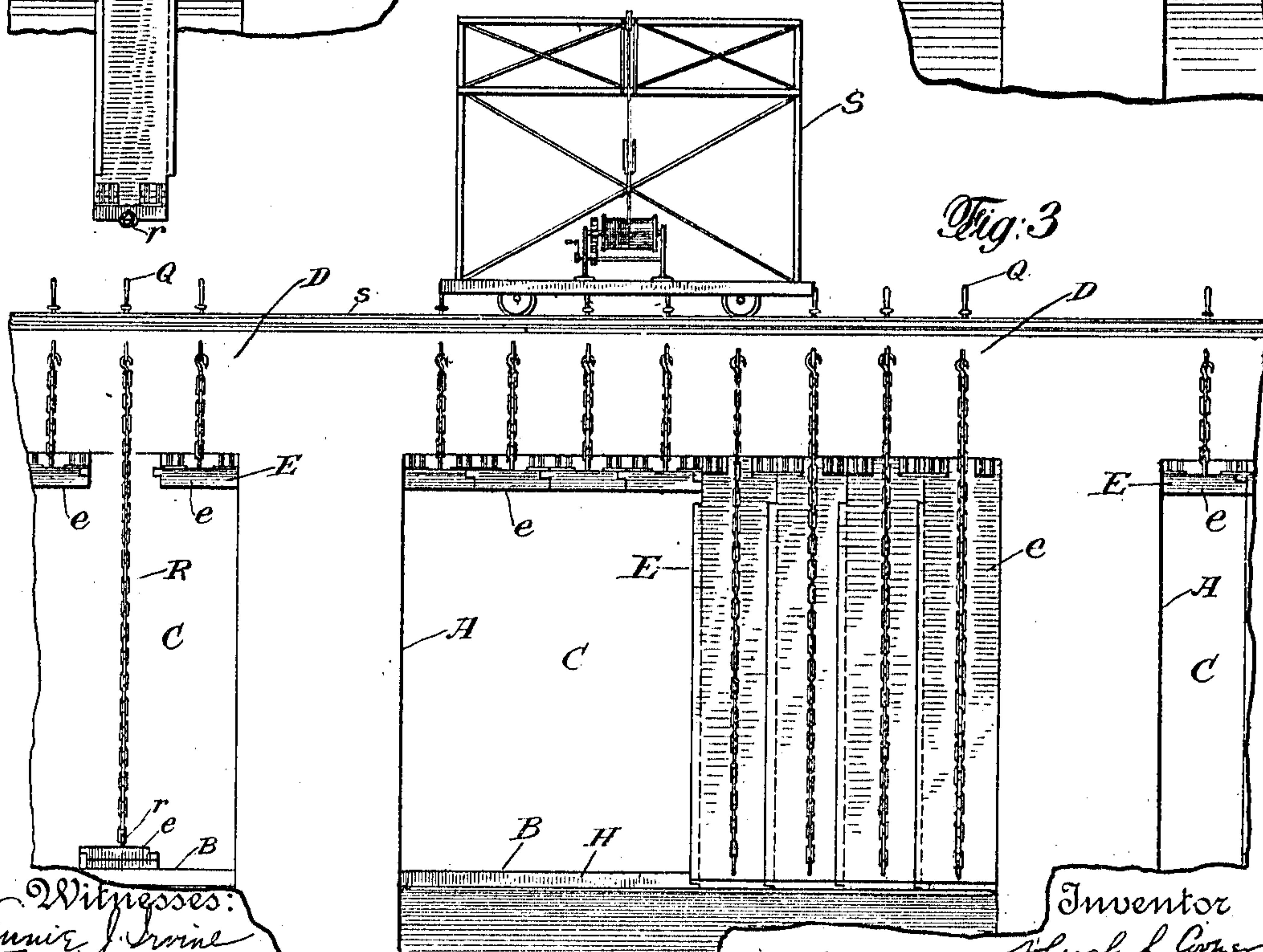


Fig. 3



Witnesses:
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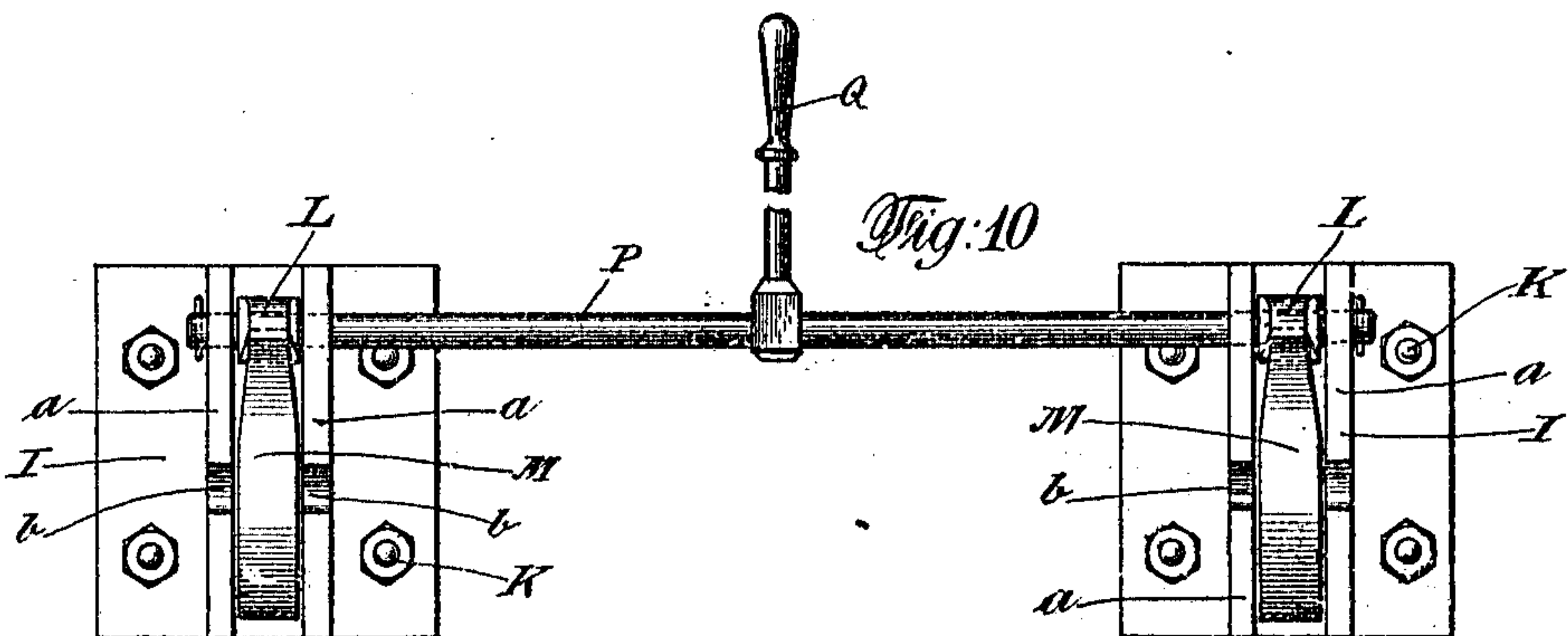
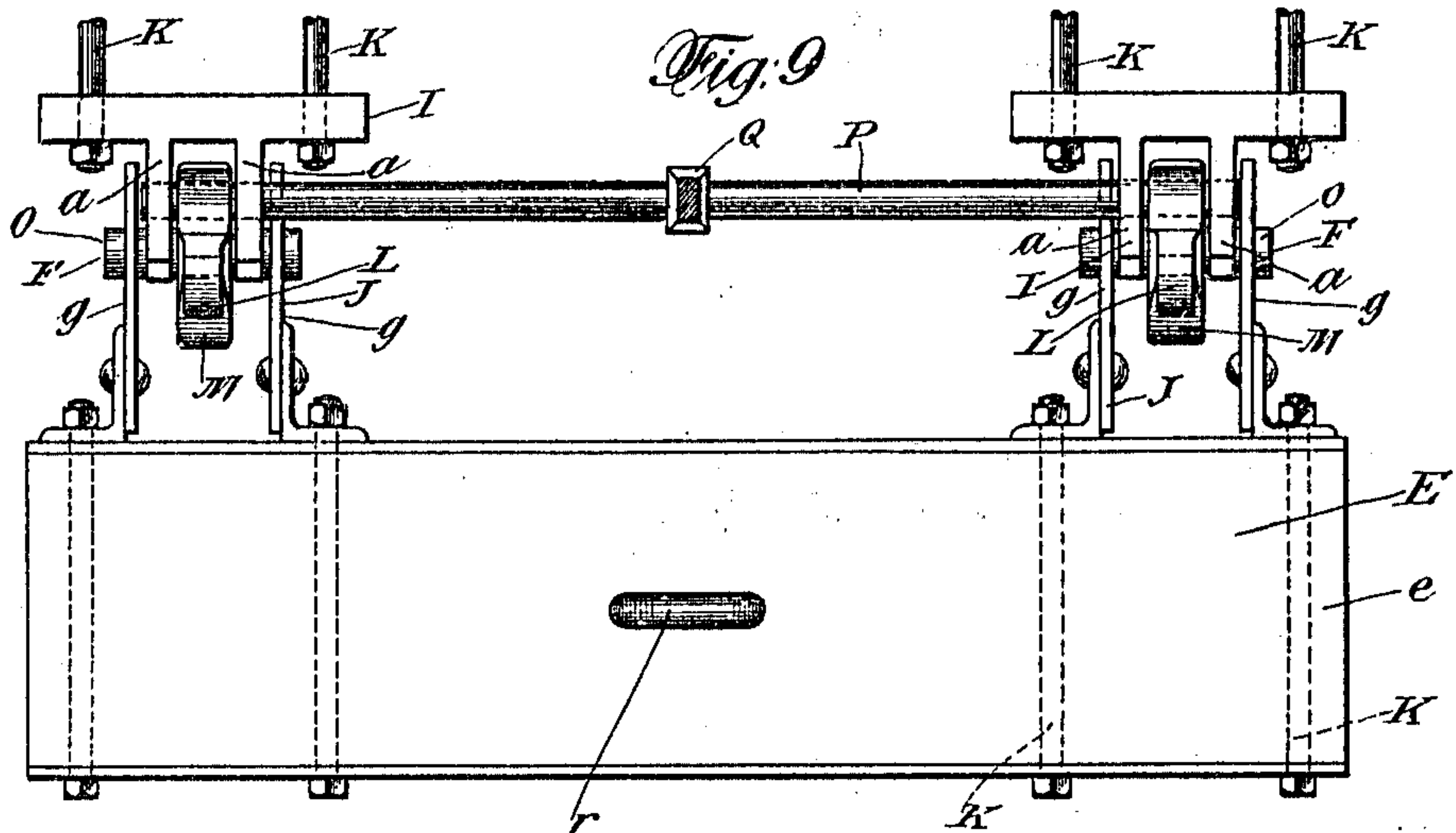
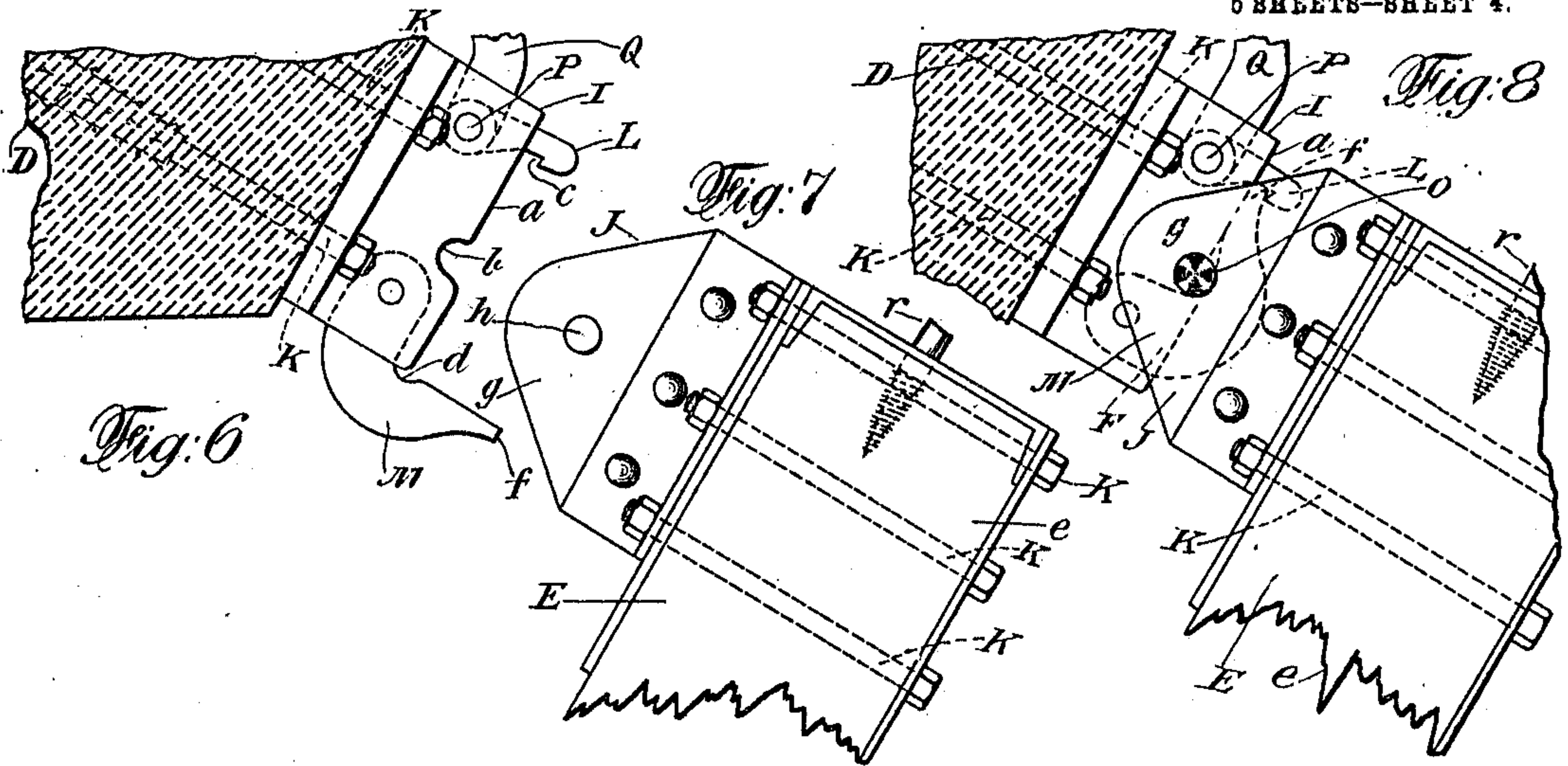
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5 SHEETS—SHEET 4.



Witnesses:
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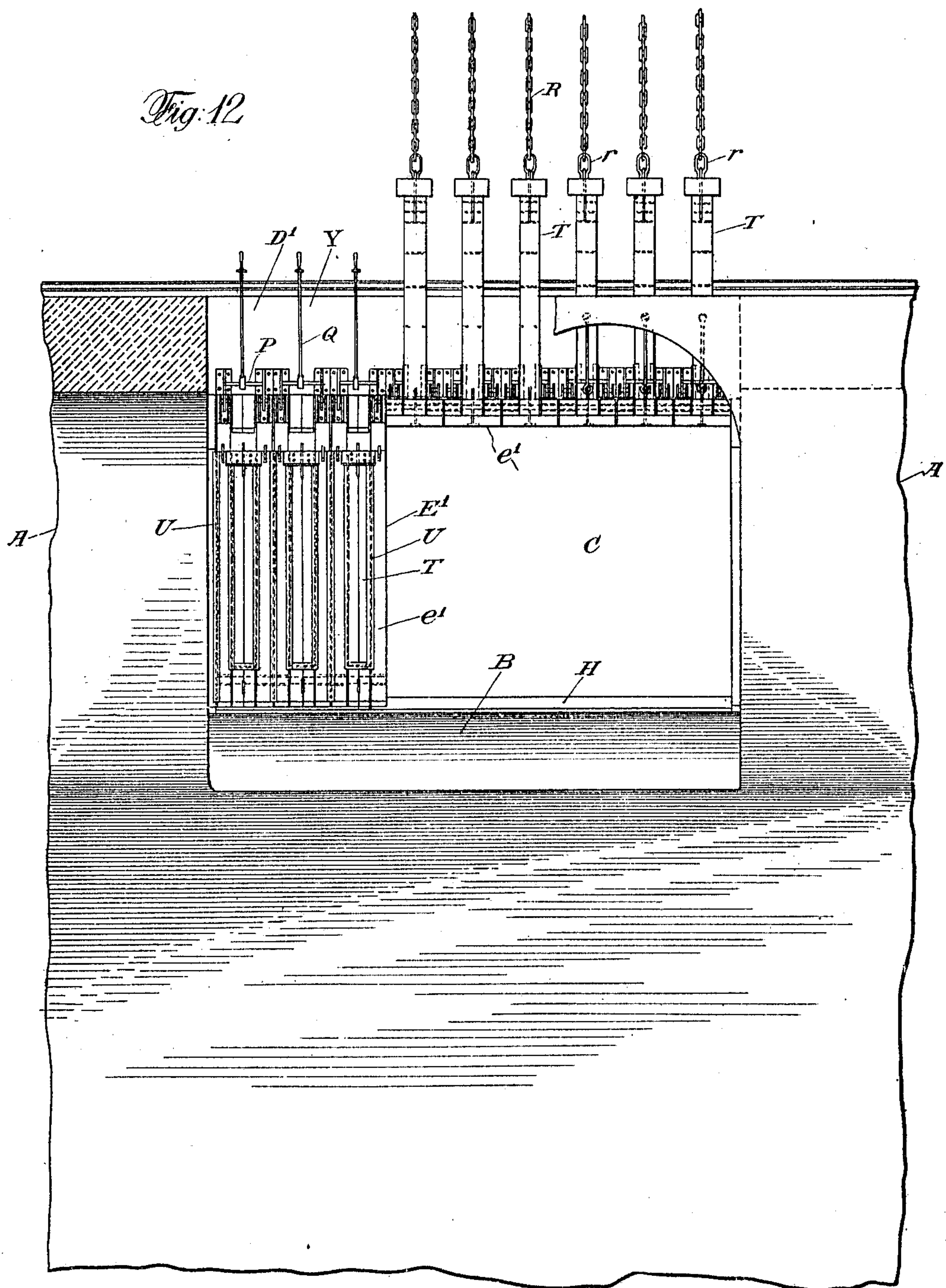
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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

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DAM AND APPARATUS FOR CONSTRUCTING THE SAME.

955,851.

Specification of Letters Patent.

Patented Apr. 26, 1910.

Application filed March 18, 1909. Serial No. 484,128.

To all whom it may concern:

Be it known that I, HUGH LINCOLN COOPER, a citizen of the United States, residing in the city of Stamford, county of Fairfield, and State of Connecticut, have invented new and useful Improvements in Dams and Apparatus for Constructing the Same, of which the following is a specification.

This invention relates to dams and to apparatus for constructing the same, and has for its object the construction of dams, preferably in sections, in such manner that some parts or sections of the dam extend above other parts or sections thereof, thereby forming open spaces for the flow of the water between each two successive parts or sections extending above a part or section intervening between them, and the provision, in one or more of said open spaces for the flow of the water, of means hereinafter more particularly described for regulating the flow of the water, together with the other advantages and features hereinafter described and claimed.

In the accompanying drawings forming part of this specification, Figure 1 is an elevation, partly in vertical section, of a dam constructed in accordance with this invention, the section being made across the dam parallel to the direction of the flow of the water; Fig. 2 is an elevation of an upper part of the dam shown in Fig. 1, the view being from the down-stream side of the dam; Fig. 3 is an elevation of the part of the dam shown in Fig. 2, the view being from the up-stream side of the dam; Figs. 4 and 5 are elevations, partly in vertical section, made as in Fig. 1, of the upper part of the dam shown in Fig. 1, Fig. 4 showing the flash-board or leaf of the flash-board shown in Fig. 1 raised and Fig. 5 showing the same flash-board or leaf thereof released from its support; Figs. 6 and 7 are elevations, Fig. 6 being partly in vertical section, showing in detail means for holding the upper end of the flash-board or leaf of the flash-board shown in Fig. 1; Fig. 8 is an elevation showing the parts shown in Figs. 6 and 7 joined together; Fig. 9 is a plan view from above showing a flash-board or leaf of a flash-board joined to its support; and Fig. 10 is an elevation showing the support shown in Fig. 9 for the flash-board or leaf of the flash-board shown in Fig. 9. Figs. 11 and 12 show details of a modification of the up-

per part of a dam made in accordance with this invention, Fig. 11 being an elevation, mostly in vertical section made as in Fig. 1, and Fig. 12 being an elevation, partly in vertical section and partly broken away, as viewed from the up-stream side of the dam. In the drawings like letters indicate like parts.

AA are parts or sections of the dam extending above other parts or sections BB thereof.

CC are open spaces for the flow of the water over the parts BB and between each two successive parts AA.

D is a bridge extending across the dam at the top thereof from shore to shore, passing over the open spaces CC and resting on the parts or sections AA.

EE are flash-boards, sluice-gates or stop-gates which may be made of a single leaf, but which are preferably made, as shown in the drawings, of several leaves *ee*. When a flash-board E is made of two or more leaves *ee*, the leaves *ee* should, preferably, overlap each other along their adjoining edges.

The flash-boards EE, or the several leaves *ee* thereof, extend across the open spaces CC and are so supported that they may be moved so as to close or open, partially or entirely, the open spaces CC, whereby the flow of the water through one or more of the open spaces CC may be checked entirely, as shown in Fig. 1, or partially, as would be the case when the leaves of the flash-board are arranged as shown in the central openings C of Figs. 2 and 3, or not at all, as shown in Figs. 4 and 5.

In a dam constructed in accordance with this invention, the flash-boards EE or the several leaves *ee* thereof should, preferably, be supported normally at their upper ends by means of hinges FF, as shown in Figs. 1 and 4. The lower ends of the flash-boards EE or of the several leaves *ee* thereof should, preferably, when fully lowered, rest against projecting edges GG of the parts or sections BB provided, preferably, with facings HHH of suitable material, such as felt soaked with tar, tar melted and applied with brushes, asphalt, elastic material and the like.

The hinge F may be constructed as clearly shown in Figs. 6, 7, 8, 9 and 10 or in any other suitable manner, but preferably in such manner, as shown in Figs. 6, 7, 8, 9

and 10, as to permit the easy and quick separation of the parts thereof to release the upper ends of the flash-boards EE or of the several leaves *ee* from their supports. The hinge F may consist of two parts, I and J. The part I may be joined by bolts KK to the bridge D and may be provided with two, parallel, outwardly extending, flat pieces of metal *aa*, having recesses *bb*. The piece I may be also provided with two pivoted arms L and M, the arm L having a notch *c* and the arm M having a recess *d* and having its free end *f* so shaped as to fit and catch in the notch *c* of the arm L.

The part J of the hinge F may be joined by bolts KK to the flash-board E or to a leaf thereof *e* and may be provided with two, outwardly extending, flat pieces of metal *gg*, each provided with a hole *h*.

As shown in Figs. 8 and 9, the parts I and J of the hinge F may be joined together by passing a bolt O through the two holes *hh* of the part J, bringing the bolt O to rest in the recesses *bb* of the part I and securing the bolt in position by turning the arms M and L upon their pivots until the end *f* of the arm M is caught and held in the notch *c* of the arm L, when the recess *d* of the arm M will rest about one side of the bolt O.

The arm L of the hinge F may be connected with a revoluble rod P operated by a lever Q, so that when pressure is exerted upon the lever Q the rod P is thereby caused to revolve in the proper direction and the arm L of the part I of the hinge F will be lifted up or away from the end *f* of the arm M, whereupon the arm M will fall by reason of its own weight and of the weight of the flash-board E or leaf *e* thereof, and of the parts connected therewith, and as the arm M falls, the flash-board E or the leaf *e* thereof will also fall and no longer obstruct the flow of the water through the open space C in which it may be, as shown in Fig. 5.

Each flash-board E or leaf *e* thereof should, preferably, be provided at each end with means, such as a ring *r*, suitable for attachment to a chain, cable or like device R. A crane S, traveling on tracks *ss* upon the bridge D and provided with cables, pulleys and hooks *tt*, may be employed as suitable means for hoisting any of the flash-boards EE or leaves *ee* thereof.

The lower end of each chain R is attached to a ring *r* at the lower end of each flash-board E or leaf *e* thereof, and when not in use the upper end of each chain may be secured to a ring or like device *u* upon one side of the bridge D. When it is desired to raise the lower end of any flash-board E or leaf *e* thereof, the upper end of the chain connected therewith is disconnected from the ring *u* and attached to a hook *t* of the crane S, whereupon, by operation of the crane, the flash-board E or leaf *e* thereof

may be raised, as desired, either partially so as to permit a partial flow of the water or entirely, as in Fig. 4, so as to permit an unobstructed flow of the water.

When the upper end of a flash-board E or leaf *e* thereof is disconnected from its support and falls as in Fig. 5, the chain R holds it and prevents it from being carried away by and with the flowing water. The ring *r* at the upper end of the flash-board E or leaf *e* thereof may serve as a means of securing that end to a hook *t* of the crane S when the flash-board or leaf thereof has been recovered by means of the chain R and it is desired again to connect the upper end thereof to its support.

W represents the water in Figs. 1, 4 and 5.

As indicated above, each flash-board E, extending across an open space C of the dam, may consist of one leaf or of several leaves and may be made of steel, timber or other suitable material. Where the open space C is of considerable width or where the water flows through the open space C at a considerable depth above the part or section B the flash-board E should, preferably, consist of several leaves as shown in Figs. 2 and 3.

The parts or sections AA and BB of the dam may consist of any suitable material, such as masonry, steel, timber and like material, preferably masonry. Those portions of the parts or sections AA which extend above the parts or sections BB may be either of the same material as the lower portions thereof or of different material, but I prefer to make the parts or sections AA entirely of masonry, as shown in the drawings.

The bridge D may be of any suitable construction or width, depending upon the purpose for which it is designed, such as the transit of foot passengers, vehicles or other purpose.

From the foregoing description of a dam constructed and provided with flash-boards in accordance with this invention, it will be clear to those skilled in the art to which this invention appertains, that the utility and advantages thereof are several and important. Where the water of a stream, river, lake or other body of water is held back or stored up by means of a dam, it is, in most cases, especially in those cases where the flow or discharge of the water varies greatly, necessary to provide means for adjusting and keeping approximately constant the level of the water held back or stored up by the dam. This necessity results from several causes. At times of what may be called the flood discharge of the water, the level of the water held back or stored up will rise or tend to rise and may overflow the shores of the body of water unless means are provided for permitting greater quantities of water to flow, in any given time, over

or through the dam. Too great a rise in the level of the water held back or stored up by the dam will, moreover, threaten the integrity of the dam or destroy it, by reason, for instance, of the increase in the pressure of the water upon the dam, because, as a matter of reasonable economy in the construction of dams, a dam is generally constructed to sustain with safety the pressure exerted by the water held back or stored up at an approximately fixed level. On the other hand, at times of the low or minimum discharge of the water, the level of the water held back or stored up by the dam falls, or tends to fall, below the level necessary to secure the proper operating head of the water, which is determined by the difference in elevation between the level of the head water, or water held back or stored up by the dam, and the level of the tail water, or water on the down-stream side of the dam, as shown in Fig. 1, unless means are provided in such case for checking the flow of the water over or through the dam in order to keep the water held back or stored up by the dam approximately at the proper level.

For the reasons stated, and for other like reasons, what may be called the crest proper of the dam, that is the top of the parts or sections BB or bottom of the open spaces CC, must be far enough below the limit of the proper level of the water held back or stored up by the dam to permit, by proper manipulation of the flash-boards, sluice-gates or stop-gates of the dam, an increased discharge of the water over or through the dam, especially during times of flood discharge. As will be well understood, moreover, at times of the low discharge of the water the depth of the water flowing over and above the crest of the dam diminishes and there is at such times a corresponding falling in the level of the water held back or stored up by the dam from the level at a greater or flood discharge of the water.

Because of the foregoing considerations, it is, in the proper construction of a dam designed to store up water or to store it up and make it available for any use, such as use in operating power plants or like use, necessary to provide means for raising at low discharge and for lowering at flood discharge, or, in other words, adjusting and keeping approximately constant the level of the water held back or stored up by the dam. These objects are accomplished by means of flash-boards, sluice-gates or stop-gates arranged above the crest proper of the dam. The construction and manipulation of such flash-boards, sluice-gates or stop-gates are, however, attended with much difficulty and in times of flood discharge, when violent fluctuations are apt to occur in the flow of the water, the dam itself may be destroyed or the rising water may overflow the adjoining

shores unless the flash-boards can easily and quickly be removed so as to permit the unimpeded flow of the water through the dam or over the crest proper thereof. Such easy and quick removal of the flash-boards is accomplished in the manner above described and shown in the drawings in a dam constructed in accordance with this invention.

In adjusting and keeping approximately constant the level of the water held back or stored up by the dam, such number of flash-boards or leaves thereof are raised or lowered, partially or entirely, as occasion may require. When the flash-boards or leaves thereof are lowered, they may, by the aid of the crane, or other suitable device, be lowered gradually, the chain or cable holding back the lower ends thereof as the flowing water tends to carry them downwardly as they turn upon their hinges.

It will be apparent that in case of violent or sudden fluctuation in the discharge of the water over or through the dam, effective means are provided in a dam constructed in accordance with this invention to insure the easy and quick removal of the flash-boards. Should the means provided for raising the flash-boards become inoperative for any cause, or should it not be possible to raise the flash-boards because of ice or other material pressing against them or because of any other cause, the releasing from their supports of the upper ends of the flash-boards or of the leaves thereof in the manner described, will at once remove them and permit the unobstructed flow of the water as shown in Fig. 5.

As will be understood, the revoluble rod P, operated by the lever Q, may be connected with one or with several of the arms L of the supports for the upper ends of the flash-boards or leaves thereof, so that when pressure is exerted upon a single lever Q and the rod P is caused to revolve in the proper direction, one or more flash-boards or leaves thereof will be released.

In Fig. 2 the rod P' is shown as extending across the central open space C and connected with all the arms L of all the supports for the upper ends of the leaves *ee* of the flash-board E, so that pressure in the proper direction upon any one lever Q connected with said rod P' will at once release all of said leaves *ee* forming the flash-board E of said central space C, while in the spaces CC to the right and left of said central space C of Fig. 2 each support for each leaf of the flash-boards is provided with a separate rod P operated only by the lever Q connected with it.

Even where the flash-boards E are, as shown in Figs. 2 and 3, made of several leaves *ee*, difficulty may be experienced in raising or lowering the flash-boards or the several leaves thereof through the water or

against the pressure of the water. This difficulty may be overcome in a dam constructed in accordance with this invention by providing the flash-boards or several leaves thereof with one or more pad-gates. Such pad-gates are shown in Figs. 11 and 12 of the drawings which illustrate the details of a modification of the upper part of a dam made in accordance with this invention. In Figs. 11 and 12, E' is the flash-board and e'e' are leaves thereof which may be pivoted and detachably suspended as by hinges FF in the manner above described. As shown in Figs. 11 and 12, the several leaves e'e' of the flash-board E' may be provided with pad-gates TT covering openings UU in the leaves e'e'. The pad-gates TT are, preferably, secured at their lower ends to pivots VV secured in the leaves e'e' and provided with rings rr at their upper ends to which chains RR may be attached. As shown in Fig. 11, a pull upon the chain R will cause the pad-gate T to turn upon its pivot V and thus uncover the opening U, which openings U are shown in dotted lines in Fig. 12. The uncovering of the opening U will permit the water to pass through the opening and will at the same time relieve the pressure of the water upon the leaf e' and make it less difficult to raise or lower the leaf e' in and through the water. By continuing the pull upon the chain R, the pad-gate T and the flash-board E' or the leaf e' thereof will be raised out of the water and will assume the positions shown by the dotted lines in Fig. 11, whereupon the parts in question may be secured in such positions by the aid of the hook X. In Fig. 12 several leaves e'e' provided with pad-gates TT are shown in position partially closing the space C and several are shown raised so as to partially open the space C. To facilitate the raising of the flash-boards E'E' or leaves e'e' thereof, when provided with pad-gates, the bridge D' may be provided with openings YY.

In lowering the flash-boards or leaves thereof, provided with pad-gates as described, the pad-gates will not close the openings U until the flash-boards or leaves are in position and consequently the force necessary to hold the flash-boards or leaves back against the pressure of the water, while lowering the same, is not so great as would be required if the flash-boards or leaves were not provided with openings and pad-gates. The pad-gates, moreover, may be used to regulate the level of the water stored up by the dam.

What I claim is;—

1. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board suspended within said space and above the crest of the dam, substantially as described.

2. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board suspended by a hinge within said space and above the crest of the dam, substantially as described.

3. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board comprising a leaf suspended within said space and above the crest of the dam, substantially as described.

4. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board comprising a leaf suspended by a hinge within said space and above the crest of the dam, substantially as described.

5. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a pivoted flash-board suspended within said space and above the crest of the dam, substantially as described.

6. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board comprising a pivoted leaf suspended within said space and above the crest of the dam, substantially as described.

7. A stable dam provided with a crest and an open space for the flow of water over the crest and means for regulating such flow of water comprising a flash-board comprising pivoted leaves suspended within said space and above the crest of the dam, substantially as described.

8. A dam provided with an open space for the flow of water and a flash-board suspended by a detachable support within said space, substantially as described.

9. A dam provided with an open space for the flow of water and a flash-board suspended by a separable hinge within said space, substantially as described.

10. A dam provided with an open space for the flow of water and a pivoted flash-board suspended by a detachable support within said space, substantially as described.

11. A dam provided with an open space for the flow of water and a flash-board comprising a pivoted leaf suspended by a detachable support within said space, substantially as described.

12. In a dam provided with an open space for the flow of water, the combination of a flash-board, means for suspending the flash-board within said space, and means for detaching the flash-board from said means for suspending it, substantially as described.

13. In a dam provided with an open space for the flow of water, the combination of a

flash-board comprising a leaf, means for suspending the leaf within said space, and means for detaching the leaf from said means for suspending it, substantially as described.

14. In a dam, the combination of a flash-board, a support for the suspension thereof, means for connecting the flash-board to the support, and a rod connected with said means to disconnect the flash-board from its support upon the movement of the rod, substantially as described.

15. In a dam, the combination of a flash-board comprising a leaf, a support for the suspension of the leaf, means for connecting the leaf to the support, and a rod connected with said means to disconnect the leaf from its support upon the movement of the rod, substantially as described.

16. In a dam, a flash-board, pivoted and suspended at its upper part substantially as described.

17. In a dam, a flash-board comprising a leaf pivoted and suspended at its upper part, substantially as described.

18. In a dam, the combination of a flash-board pivoted and suspended at its upper part and means for elevating the lower end of the flash-board, substantially as described.

19. In a dam, the combination of a flash-board comprising a leaf pivoted and suspended at its upper part and means for elevating the lower end of the leaf, substantially as described.

20. In a dam, the combination of a support, a flash-board detachably suspended from the support and means for retaining the flash-board when detached from its support, substantially as described.

21. In a dam, the combination of a support, a flash-board comprising a leaf detachably suspended from the support and means for retaining the leaf when detached from the support, substantially as described.

22. A dam provided with a crest and two parts extending above an intervening part of the crest, thereby forming an open space for the flow of water, a bridge extending above and across the open space and a flash-board suspended within said space and above the crest of the dam, substantially as described.

23. A dam provided with a crest and two parts extending above an intervening part of the crest, thereby forming an open space for the flow of water, a bridge extending above and across the open space and a flash-board comprising a leaf suspended within said space and above the crest of the dam, substantially as described.

24. In a stable dam, the combination of parts of the dam forming an open space between for the flow of water, and a pivoted sluice-gate suspended in said space, substantially as described.

25. In a stable dam, the combination of

parts of the dam, said parts being built of masonry, forming an open space between for the flow of water, and a pivoted sluice-gate suspended in said space, substantially as described.

26. A stable dam comprising consecutive parts, some parts extending above another part and forming an open space for the flow of water, and a pivoted sluice-gate suspended in said space, substantially as described.

27. A dam comprising consecutive parts, some parts extending above another part and forming an open space for the flow of water, and a pivoted sluice-gate detachably suspended in said space, substantially as described.

28. A stable dam comprising consecutive parts, some parts extending above another part and forming an open space for the flow of water, and a sluice-gate suspended in said space, substantially as described.

29. A dam comprising consecutive parts, some parts extending above another part and forming an open space for the flow of water, and a sluice-gate detachably suspended in said space, substantially as described.

30. In a dam, a flash-board located above the crest of the dam and provided with a pad-gate, substantially as described.

31. In a dam, a pivoted flash-board located above the crest of the dam and provided with a pad-gate, substantially as described.

32. In a dam, a flash-board located above the crest of the dam and provided with a pivoted pad-gate, substantially as described.

33. In a dam, a pivoted flash-board located above the crest of the dam and provided with a pivoted pad-gate, substantially as described.

34. In a dam, a flash-board located above the crest of the dam and comprising a leaf having a pad-gate, substantially as described.

35. In a dam, a flash-board comprising a pivoted leaf having a pad-gate, substantially as described.

36. In a dam, a flash-board located above the crest of the dam and comprising a leaf having a pivoted pad-gate, substantially as described.

37. In a dam, a flash-board located above the crest of the dam and comprising a pivoted leaf having a pivoted pad-gate, substantially as described.

38. In a dam, the combination of a pivoted flash-board provided with a pivoted pad-gate and means attached to the pivoted pad-gate for elevating the lower end of the flash-board, substantially as described.

39. In a dam, the combination of a flash-board comprising a pivoted leaf having a pivoted pad-gate and means attached to the pivoted pad-gate for elevating the lower end of the leaf, substantially as described.

40. A dam provided with a crest and an open space for the flow of water over the

crest and a pivoted flash-board having a pivoted pad-gate suspended within said space and above the crest of the dam, substantially as described.

5 41. A dam provided with a crest and an open space for the flow of water over the crest and a flash-board suspended within said space and above the crest of the dam

comprising a pivoted leaf and a pad-gate covering an opening in said leaf, substantially as described. 10

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