No. 844,498. PATENTED FEB. 19, 1907.

H. L. COOPER.

DAM AND APPARATUS FOR AND METHOD OF CONSTRUCTING THE SAME.

APPLICATION FILED MAY 5, 1906.

3 SHEETS—SHEET 1.

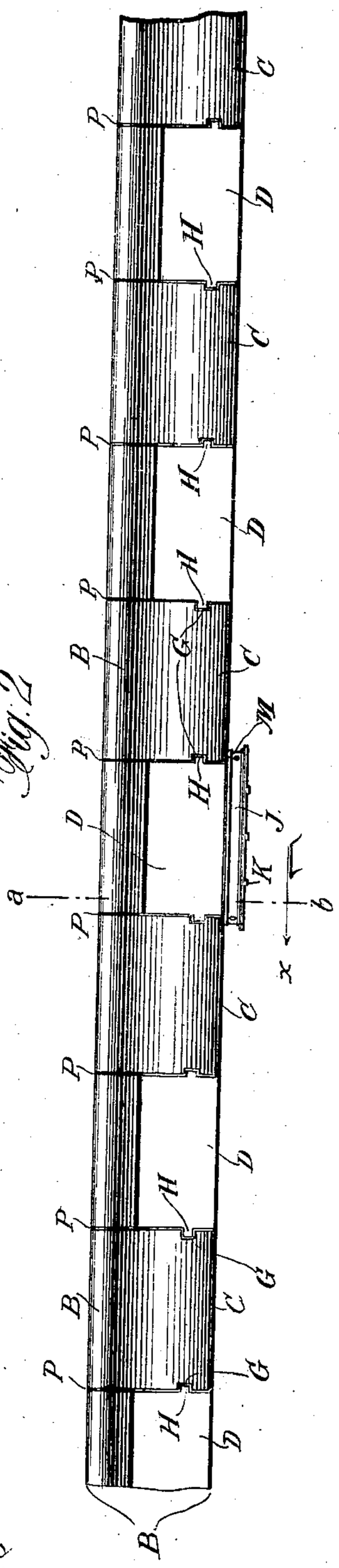

Fig. 2.

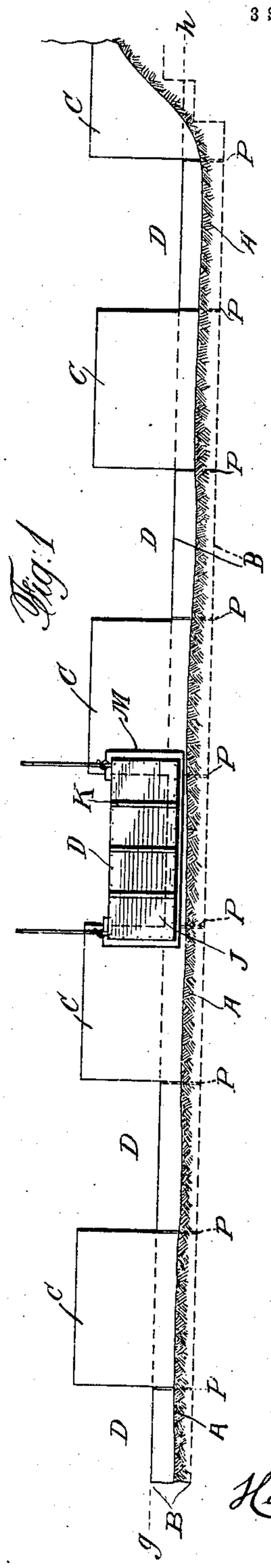

Fig. 1.

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By his Attorney Louis Hicks

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APPLICATION FILED MAY 6, 1906.

3 SHEETS—SHEET 2.

Fig. 5

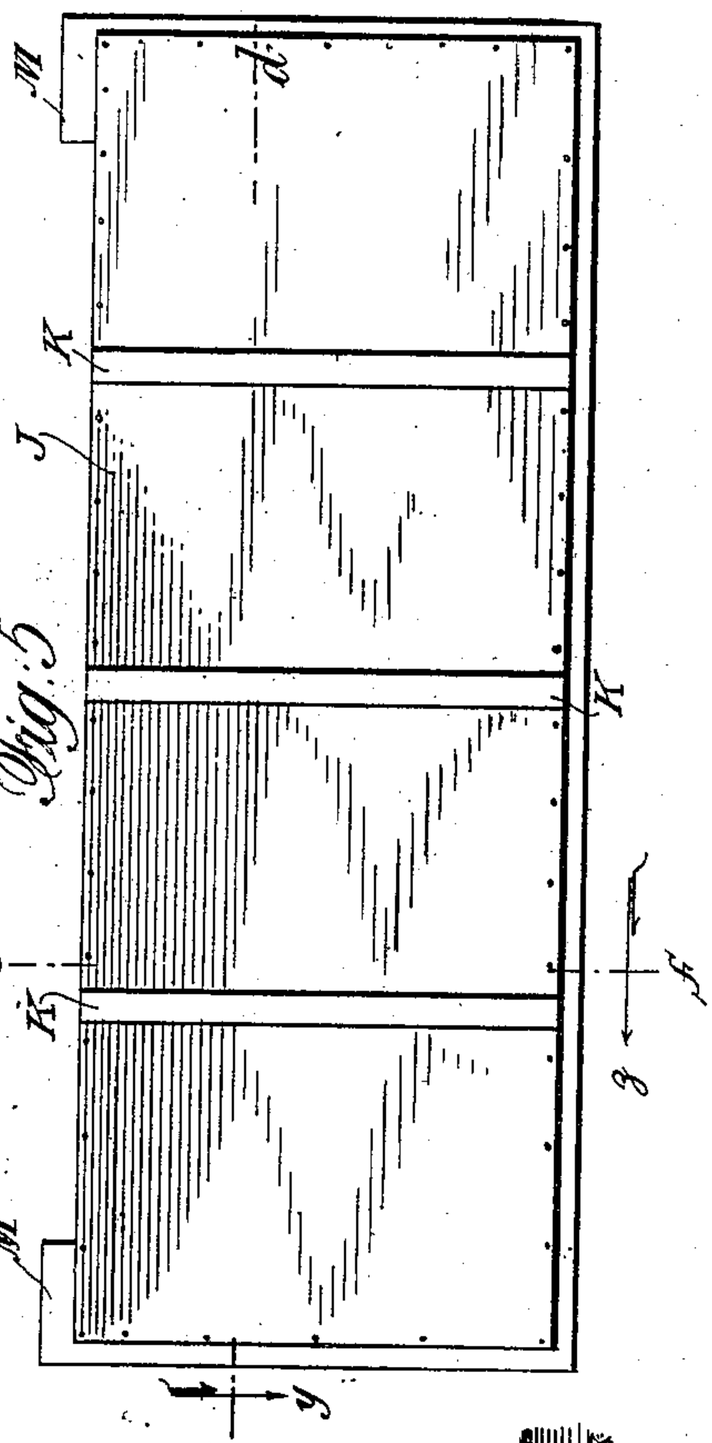


Fig. 6

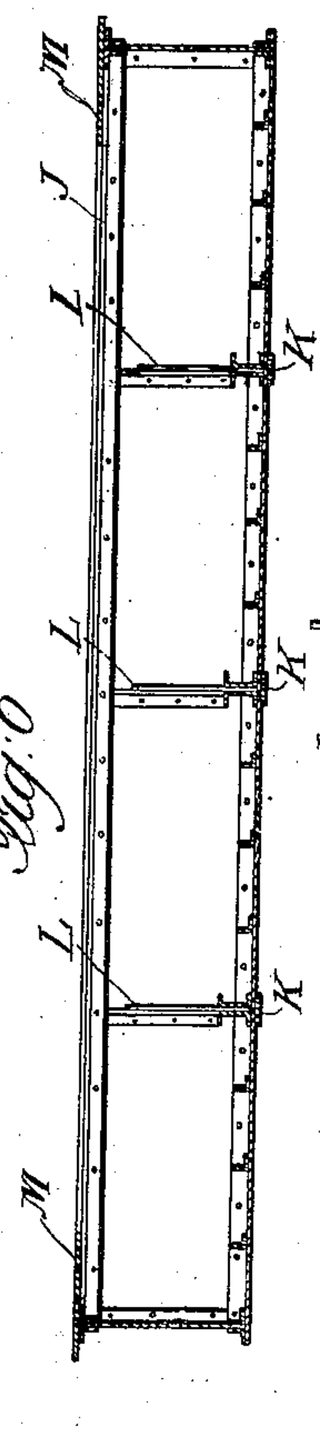


Fig. 7

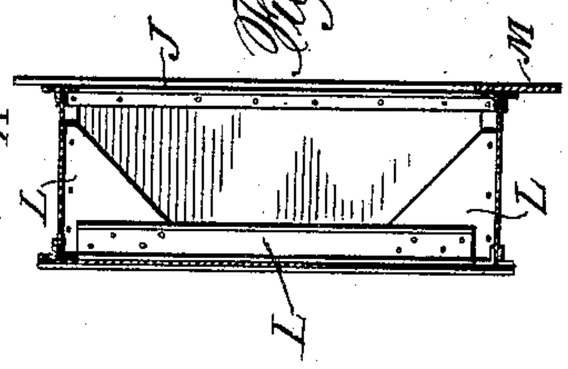


Fig. 3

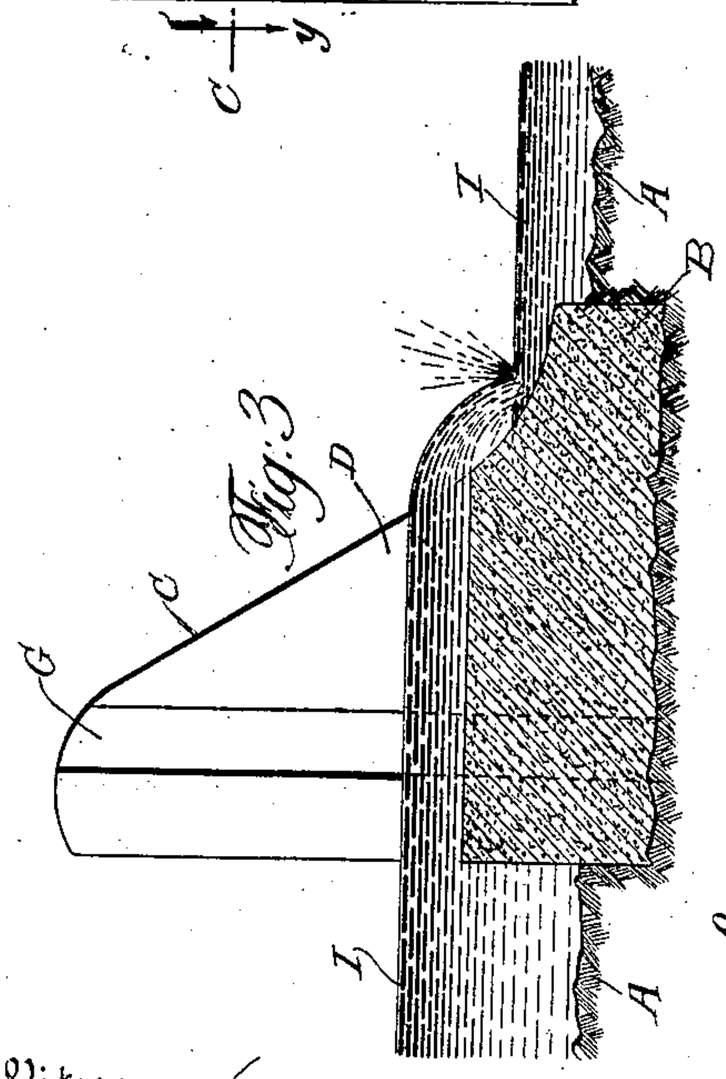
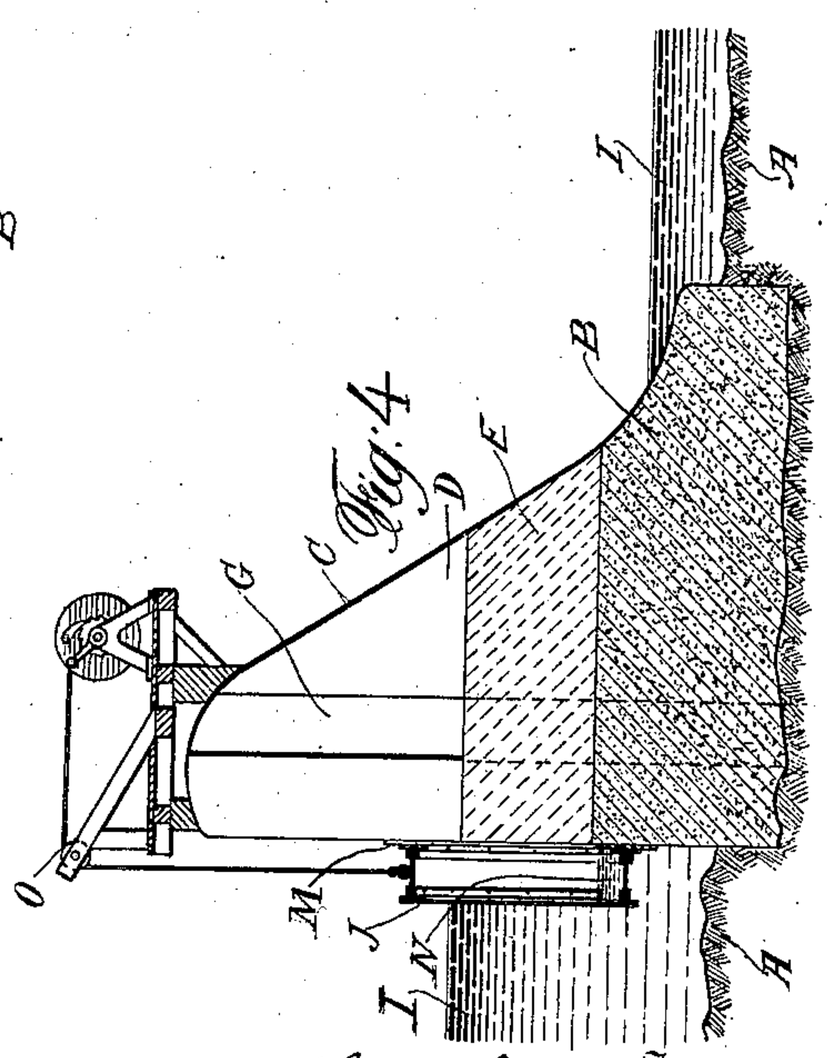


Fig. 4



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APPLICATION FILED MAY 5, 1906.

3 SHEETS—SHEET 3.

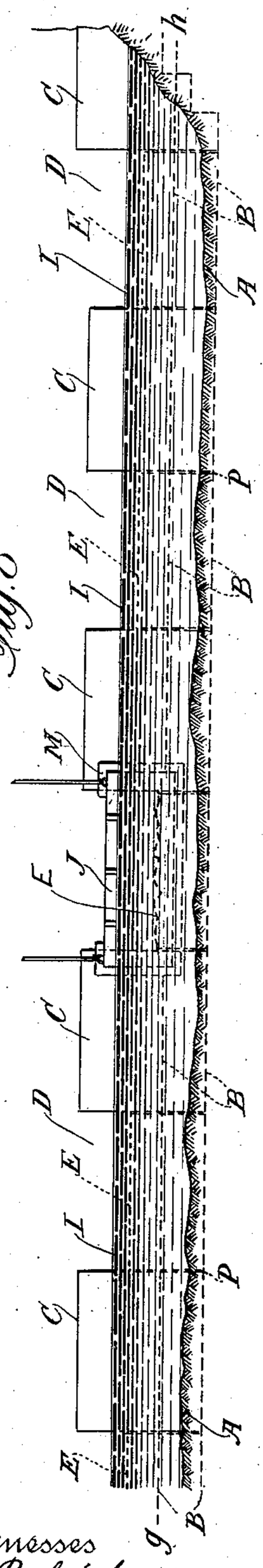

Fig. 8

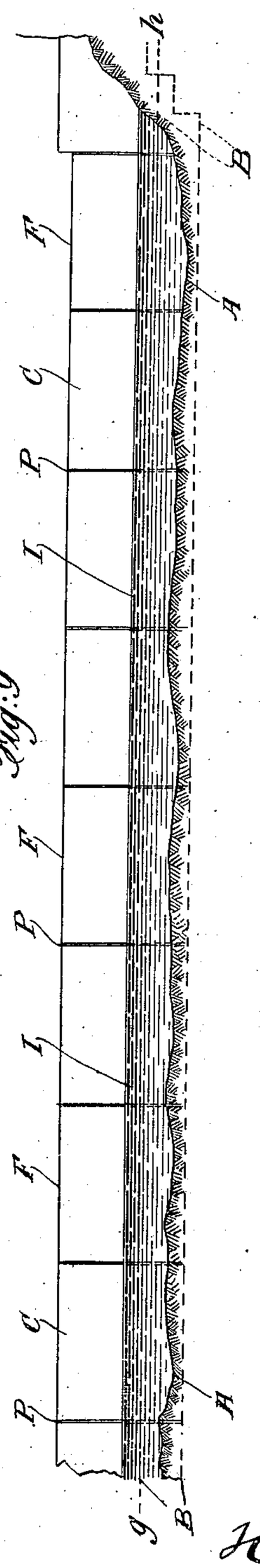

Fig. 9

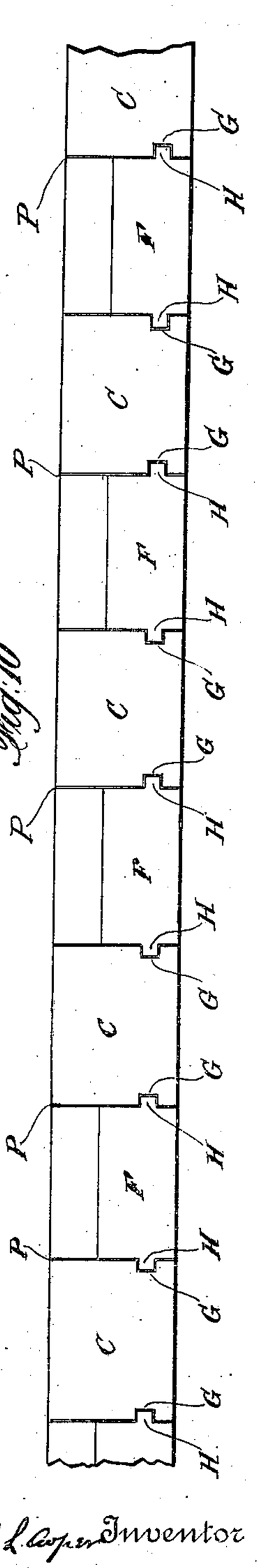

Fig. 10

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UNITED STATES PATENT OFFICE.

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DAM AND APPARATUS FOR AND METHOD OF CONSTRUCTING THE SAME.

No. 844,498. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed May 5, 1906. Serial No. 315,427.

To all whom it may concern:

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

This invention relates to dams and to apparatus for and method of constructing the same, and has for its object the economical and perfect construction of dams in sections and by the aid of stop logs or gates and of material or means suitable for joining the sections and in the manner and by the means hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a view in elevation showing completed alternate sections of a dam and a stop-log in position for work to be done upon a section intervening between the two adjacent completed sections. Fig. 2 is a plan view from above of the parts of the dam and of the stop-log shown in Fig. 1. Fig. 3 is a view in elevation, partly in section, looking in the direction of the arrow *x* at a section of the dam indicated by the line *a b* in Fig. 2, with the stop-log, however, removed and the water flowing through the open section and over the footing-course of the dam. Fig. 4 is a view similar to that of Fig. 3, the section being made, however, with the stop-log in place and masonry or stone work of the section inserted and carried to a considerable height. Fig. 4 also shows methods of placing, adjusting, and holding the stop-log in position. Fig. 5 is a rear elevation of the stop-log shown in Figs. 1 and 2, the view being similar to that of the stop-log shown in Fig. 1, but on a larger scale. Fig. 6 is a view looking in the direction of the arrow *y* at a horizontal section indicated by the line *c d* of the stop-log shown in Fig. 5. Fig. 7 is a view looking in the direction of the arrow *z* of a vertical section indicated by the line *e f* of the stop-log shown in Fig. 5. Fig. 8 is a view similar to that of Fig. 1 except that the masonry in all but one of the openings or sections between the completed alternate sections has been carried to a height nearly uniform throughout the dam. In Fig. 8 at the opening or section where the stop-log is in position the masonry or stone work of the section is being inserted and carried approximately to the height already reached in the other uncompleted sections of the dam, and, as shown in Fig. 8, while such work is being done by aid of the stop-log the water is flowing through the spaces of the other uncompleted sections of the dam where the work is not going on. Fig. 9 shows an elevation of a completed dam embodying the features of this invention and constructed according to the method and by means of the apparatus of this invention, the completed dam being in sections, which sections are joined by some suitable material, as hereinafter described. Fig. 10 is a plan view from above of part of the completed dam, showing a joining together of completed sections of the dam.

Referring generally to the figures of the drawings, A A A is the bottom of the river or other body of water across which the dam is to be constructed. B B B are the footing-courses built to a suitable height, (indicated by the line *g h*.) C C C are completed alternate sections of the dam built upon and carried up from the footing-courses. The sections C C C are preferably made integral with the footing-courses. D D D are openings of the dam above the footing-courses and between adjacent completed sections. E E E are partially-completed sections of the dam built upon and above the footing-courses and between adjacent sections C C C, and F F F are sections E E E when the latter have been completed or built to the height and conditions required. The sections E E E and F F F are preferably made integral with the footing-courses. G G G are recesses in sections of the footing-courses and in sections C C C for the reception of ribs H H H, which project from sections E E E and F F F and in like manner from sections of the footing-courses.

I is the water of the river or other body of water.

J is a stop-log. The stop-log is preferably constructed as shown in the drawings, wherein the stop-log is shown as a hollow box open on one side. When such a stop-log is adjusted in position, as in Figs. 1, 2, and 4, the stop-log is open on the downstream side. The stop-log may be constructed of steel or other suitable metal or material and it need not be a hollow box, but may be of any suitable or convenient form. A flat stop-log consisting of or like the rear or upstream side of the stop-log shown in Fig. 5 would be a suitable

stop-log. To insure sufficient strength to the stop-log, bars K K K, of steel or other suitable material, may be secured to the rear or upstream side of the stop-log. To give additional strength to a stop-log consisting of a hollow box, suitable supports L L L may also be applied.

M is a rim or flap, of rubber or other suitable material, affixed to and projecting from the edges of the sides of the stop-log which press toward or against the masonry or stone work of the dam, the purpose of the rim or flap being to lessen or prevent the leakage of water between the stop-log and the masonry of the dam.

In Fig. 4, N is water that has leaked into the stop-log J, and O are means which may be used for placing, adjusting, and holding the stop-log in position; but the pressure of the water against the stop-log is mainly or entirely relied upon to secure or hold the stop-log in position and to press its surrounding rim, flap, or gasket M against the masonry to reduce or prevent leakage.

P is suitable material by which the sections of the dam are joined.

Of the many considerations involved in building dams, especially large masonry dams, two important ones are, first, the exclusion of the water of the river or other body of water from the masonry or other material of the dam while it is being placed in position, and, second, the effect of expansion and contraction in the finished masonry or material of the dam throughout its length from end to end, due especially to changes in temperature. With reference to the first consideration various methods have been adopted for keeping the work dry during construction, their nature depending largely upon local conditions; but coffer-dams or other temporary diverting works have been required in most cases. Such coffer-dams or other temporary diverting works are often of great magnitude, and in general the methods heretofore resorted to for excluding water from the work during construction have formed a very important item in the cost of dams. With reference to the second consideration, masonry dams have heretofore been designed and built as monoliths without any provision being made to guard against the effects of expansion and contraction of the mass longitudinally. In many such cases large and small cracks have developed in the masonry, and such cracks always cause more or less leakage and may impair the strength and integrity of the dam.

In the construction of a dam according to this invention the foregoing considerations are fully provided for and the dam may be constructed in sections, as follows:

The footing-courses B B B are built to a suitable height in any ordinary manner, as by the aid of coffer-dams or other temporary diverting-works, as will be well understood by those skilled in the art to which this invention appertains. The footing-courses B B B should, however, preferably be built in sections, which may correspond to the sections C C C and F F F of the rest of the dam built upon them, in order that provision may be made, as hereinafter explained, to guard longitudinally against the effects of expansion and contraction of the mass of the footing-courses. When a part of the footing-courses B B B or some only of the sections of the footing-courses have been completed, alternate sections C C C of the dam are then built complete, preferably to the top upon the completed part or sections of the footing-courses. Then the remaining part or parts or remaining sections of the footing-courses are built and the remaining alternate sections C C C of the dam are then built complete, preferably to the top upon the said remaining part or parts or sections of the footing-courses thus completed, the water in the meantime flowing through the openings D D D between the sections C C C previously constructed. The constructed sections C C C will now alternate with the open spaces D D D throughout the length of the dam, and at this stage of the work the waters flow through all the openings D D D between the constructed sections C C C. The work of filling up the openings D D D and of constructing the remaining sections F F F of the dam is then begun and is carried on in such a way, as hereinafter explained, that the height of the masonry E E E in the openings D D D is made and kept preferably nearly uniform throughout the progress of the work and until the sections F F F have been constructed. Sections F F F are constructed in the openings D D D by the aid of stop-logs J and in the following manner: The stop-logs J are of length sufficient to extend across the openings D D D left in the dam after the construction of the sections C C C and to overlap and to rest against the masonry on each side of the openings D D D. The stop-logs J are placed in vertical positions against the back or upstream side of the dam. If the stop-log is a hollow box, its open side is placed against the back or up stream side of the dam. The depth of each stop-log J is such that its top edge projects above the water and its lower edge overlaps and rests against the masonry. This position of the stop-log is maintained as the stop-log is carried up along the opening D as the work progresses. The stop-log in this position forms a gate excluding water from the opening D between two sections C C of the dam, and as the stop-log is raised and vertically adjusted to the work as the work progresses the water is excluded from the work in the opening D from bottom to top and until the section F has been constructed. Any water N that may

collect through leakage or otherwise in a pocket formed by the stop-log when placed in position against the back or upstream side of the dam may be removed by pumping or in any other convenient or suitable manner.

The construction of the dam in sections, as herein described, avoids the necessity of carrying the original coffer-dams or other temporary diverting-work above the height necessary for the construction of the footing-courses, since the openings D D D between the sections C C C provide for the flow of the water during the progress of the work. The water flows during the progress of the work only through those openings D D D to which stop-logs are not applied and in which the sections E E E or F F F of the dam are not being built. According to this invention provision is therefore made in the progress of the work itself for the discharge of the water of the river, stream, or other body of water during the construction of the masonry or body of the dam above the footing-courses. For the construction of the alternate sections C C C in the manner herein described it is not necessary, as will be well understood by those skilled in the art to which this invention appertains and as clearly appears from the foregoing description, to carry the coffer-dams or other temporary diverting-works upward above the height necessary to construct the footing-courses; and because the dam is constructed in sections, by reason of which the openings D D D provide means for the discharge of the water during the progress of the work, as above explained, the remaining parts of the dam or sections E E E or F F F may be constructed by the use of stop-logs, as herein explained.

The construction of the dam in sections according to this invention also permits the effects of expansion and contraction of the mass to be guarded against longitudinally. If the sections of the footing-courses or the sections C C C and F F F built upon the footing-courses were joined together without provision made against the bonding of the several adjoining sections, so that the footing-courses form a monolith, and the sections C C C and F F F form a monolith, or so that all the sections taken together form a monolith, large and small cracks would ordinarily develop in the dam, cause more or less leakage, and threathen or impair the strength and integrity of the dam. By building the dam in sections, as herein described, and by joining the sections and interposing some suitable material P between the adjacent sections the effects of expansion and contraction referred to are avoided. By such a construction of the dam in sections and by such a joining of the adjacent sections bonding of the adjacent sections will not occur, and neither the footing-courses will form a monolith, nor will the parts above the footing-courses form a monolith, nor will the footing-courses and the parts of the dam above the footing-courses together form a monolith. As a consequence efficient provision is made against the development of cracks in the dam and against leakage caused by such cracks and against the threatening and impairing of the strength, efficiency, and integrity of the dam. The material P used for joining the adjacent sections may be any suitable material which will prevent the sections from bonding, such as felt soaked in tar, tar melted and applied with brushes, suitable oil, such as linseed-oil, asphalt, elastic material, and the like. The material P, interposed between the adjacent sections, is intended primarily to prevent the sections from bonding. If the material employed is such as to make a water-tight joint, such effect is secondary. Deposits from the water will in time make a joint water-tight, as is well understood. The several sections of a dam so constructed will when finished be independent blocks. A section of the footing-courses and a section C or a section F of the dam built upon it should preferably constitute an independent block, it not being necessary or advisable to insert the material P between the footing-courses and the sections C C C and F F F built upon the footing-courses or otherwise to prevent the bonding between the sections of the footing-courses and the other sections of the dam built upon and above the footing-courses. In the completed dam the sections of the footing-courses should preferably be integral with the sections C C C and F F F built upon them. The sections C C C and F F F may advantageously be dovetailed together, as by recesses G G G and ribs H H H projecting into them, the material P also being used, as above described, and so may the several sections of the footing-courses.

The stop-logs J may be handled, placed, and adjusted in position by any suitable means—for example, by suitable tackle and apparatus operating from a barge or from the dam.

It will be clear to those skilled in the art to which my invention appertains that dams may be constructed according to the main features of my invention without following all the details above given.

What I claim is—

1. The method of constructing a dam, consisting in constructing sections of the dam with open spaces between for the flow of the water, then progressively excluding the water from the open spaces, and filling the open spaces, after and while the water is excluded therefrom, substantially as described.

2. The method of constructing a dam, con-

sisting in constructing sections of the dam with open spaces between for the flow of water, then progressively excluding the water from the open spaces, and filling the open spaces to successive and approximately uniform heights, substantially as described.

3. The method of constructing a dam, consisting in constructing sections of the dam with open spaces between for the flow of the water, then progressively placing stop-logs in position across the open spaces and excluding thereby the water from the open spaces and filling the open spaces, after and while the water is excluded therefrom, substantially as described.

4. The method of constructing a dam, consisting in constructing sections of the dam with open spaces between for the flow of the water, and then, by the aid of a stop-log, progressively excluding the water from the open spaces and filling the open spaces to successive and approximately uniform heights, substantially as described.

5. The method of constructing a dam, consisting in constructing the footing-courses and upon the footing-courses sections of the dam with open spaces between for the flow of the water, then progressively closing the open spaces above the footing-courses and excluding thereby the water from the open spaces, and filling the open spaces, substantially as described.

6. The method of constructing a dam, consisting in constructing the footing-courses and upon the footing-courses sections of the dam with open spaces between for the flow of the water, then progressively excluding the water from the open spaces, and filling the open spaces to successive and approximately uniform heights, substantially as described.

7. The method of constructing a dam, consisting in constructing the footing-courses and upon the footing-courses sections of the dam with open spaces between for the flow of the water, then progressively placing stop-logs in position across the open spaces above the footing-courses and excluding thereby the water from the open spaces and filling the open spaces, substantially as described.

8. The method of constructing a dam, consisting in constructing the footing-courses and upon the footing-courses sections of the dam with open spaces between for the flow of the water, and then, by the aid of a stop-log, progressively excluding the water from the open spaces and filling the open spaces to successive and approximately uniform heights, substantially as described.

9. The method of constructing a dam, consisting in constructing the footing-courses in sections, and upon the footing-courses sections of the dam with open spaces between for the flow of the water, and then filling the open spaces, substantially as described.

10. The method of constructing a dam, consisting in constructing part of the footing-courses and, upon the part constructed of the footing-courses, sections of the dam with open spaces between for the flow of the water, then constructing the remaining footing-courses and, upon the remaining footing-courses, sections of the dam with open spaces between for the flow of the water, and then filling the open spaces, substantially as described.

11. The method of constructing a dam, consisting in constructing the dam in sections of masonry and in joining adjacent sections by means of material interposed between the sections and suitable to prevent the sections from bonding, substantially as described.

12. The method of constructing a dam, consisting in constructing the dam in sections of masonry above the footing-courses and in joining adjacent sections by means of material interposed between the sections and suitable to prevent the sections from bonding, substantially as described.

13. The method of constructing a dam, consisting in constructing the footing-courses in sections, building sections of masonry upon the footing-courses and joining the adjacent sections by means of material interposed between the sections of the footing-courses and between the sections built upon the footing-courses and suitable to prevent the sections of masonry from bonding, substantially as described.

14. In a dam, the combination of sections of the dam forming open spaces between for the flow of the water, and a stop-log in position across such an open space from which the water is excluded, substantially as described.

15. In a dam, the combination of sections of the dam forming open spaces between for the flow of the water, and a stop-log provided with a gasket in position across such an open space from which the water is excluded, substantially as described.

16. In a dam, the combination of sections of the dam forming spaces between for the flow of the water partially filled with sections of masonry to approximately uniform heights, substantially as described.

17. In a dam, the combination of sections of the dam forming spaces between for the flow of the water partially filled with sections of masonry to approximately uniform heights, and a stop-log in position across such a space from which the water is excluded, substantially as described.

18. In a dam, the combination of sections of the dam forming open spaces between for the flow of the water partially filled to approximately uniform heights, and a stop-log provided with a gasket in position across such an open space from which the water is excluded, substantially as described.

19. In a dam, the combination of footing-

courses, sections built upon the footing-courses and material interposed between the sections and suitable to prevent the sections from bonding, substantially as described.

20. In a dam, the combination of footing-courses in sections, sections built upon the footing-courses and material interposed between the sections of the footing-courses and between the sections built upon the footing-courses and suitable to prevent the sections from bonding, substantially as described.

21. In a dam, the combination of footing-courses and sections built upon the footing-courses with open spaces between the sections and above and across the footing-courses for the flow of the water over the footing-courses, substantially as described.

22. In a dam, the combination of footing-courses and sections built upon the footing-courses with open spaces between the sections, partially filled to approximately uniform heights, above and across the footing-courses, for the flow of the water over the partially-filled spaces, substantially as described.

23. In a dam, the combination of footing-courses in sections and sections built upon the footing-courses with open spaces between for the flow of the water, substantially as described.

24. In a dam, the combination of footing-courses in sections and sections built upon the footing-courses with open spaces between for the flow of the water, partially filled to approximately uniform heights, substantially as described.

25. In a dam, the combination of footing-courses and sections built upon the footing-courses with open spaces between for the flow of the water, and a stop-log in position across such an open space, from which the water is excluded, substantially as described.

26. In a dam, the combination of footing-courses and sections built upon the footing-courses with spaces between for the flow of the water, partially filled to approximately uniform heights, and a stop-log in position across such a space from which the water is excluded, substantially as described.

27. In a dam, the combination of footing-courses in sections, and sections built upon the footing-courses with open spaces between for the flow of the water, and a stop-log in position across an open space, substantially as described.

28. In a dam, the combination of footing-courses in sections, and sections built upon the footing-courses with spaces between for the flow of the water, partially filled to approximately uniform heights, and a stop-log in position across one of the spaces, substantially as described.

29. A dam, consisting of footing-courses and sections built upon the footing-courses with spaces between for the flow of the water, partially filled to approximately uniform heights, and material interposed between the sections and suitable to prevent the sections from bonding, substantially as described.

30. A dam, consisting of footing-courses in sections, and sections built upon the footing-courses with spaces between for the flow of the water, partially filled to approximately uniform heights, and material interposed between the sections of the footing-courses and between the sections built upon the footing-courses and suitable to prevent the sections from bonding, substantially as described.

31. A dam, consisting of footing-courses and consecutive, independent sections of masonry built upon and across and along the footing-courses, substantially as described.

32. A dam, consisting of footing-courses in sections and consecutive, independent sections of masonry built upon and across and along the footing-courses, substantially as described.

33. A dam, consisting of independent blocks of masonry and material interposed between adjacent blocks and suitable to prevent the blocks from bonding, substantially as described.

34. A dam, consisting of consecutive sections of masonry provided with recesses and ribs projecting into the recesses, substantially as described.

35. A dam, consisting of footing-courses and consecutive sections of masonry built upon the footing-courses and provided with recesses and ribs projecting into the recesses, substantially as described.

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