No. 677,656. Patented July 2, 1901.

N. GHERASSIMOFF.

DAM.

(No Model.) (Application filed May 28, 1900.) 5 Sheets—Sheet 1.

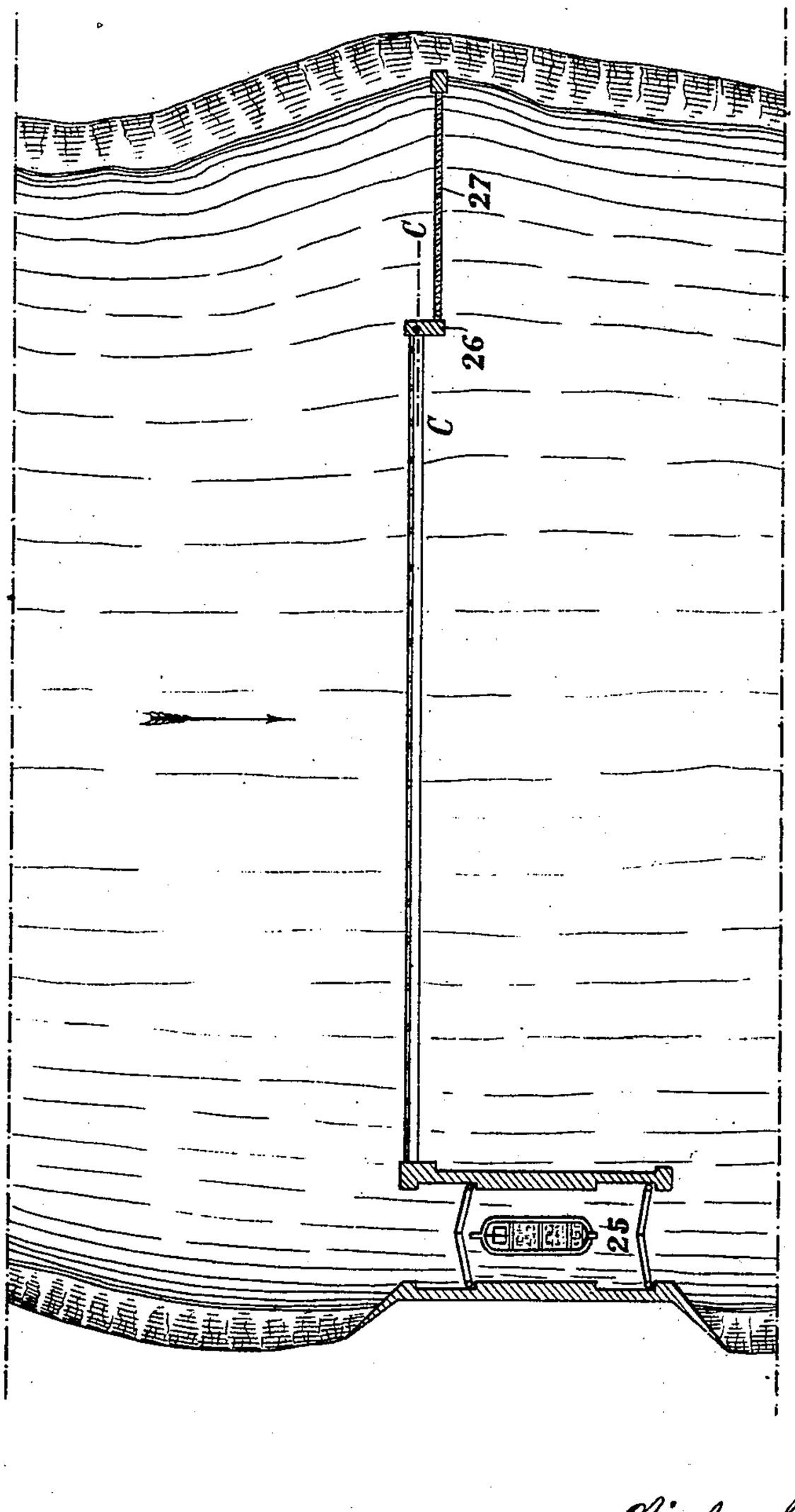

Fig. 1.

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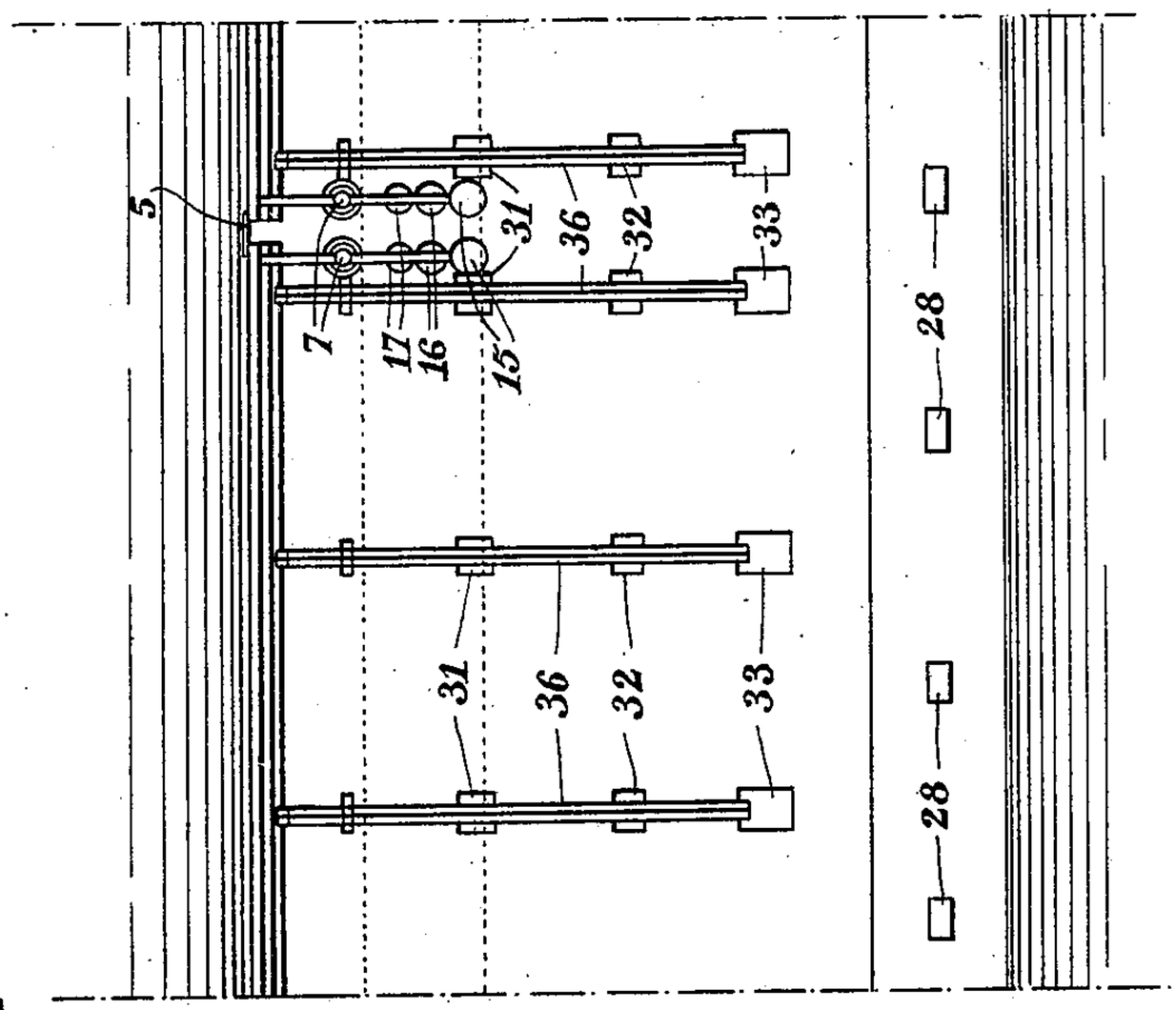

Fig. 2

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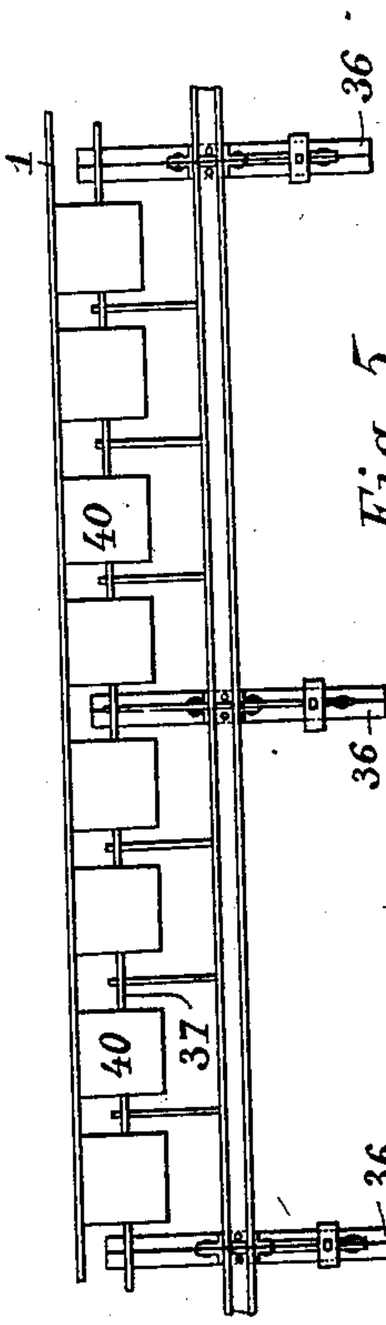

Fig. 5

Fig. 3

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No. 677,656.

Patented July 2, 1901.

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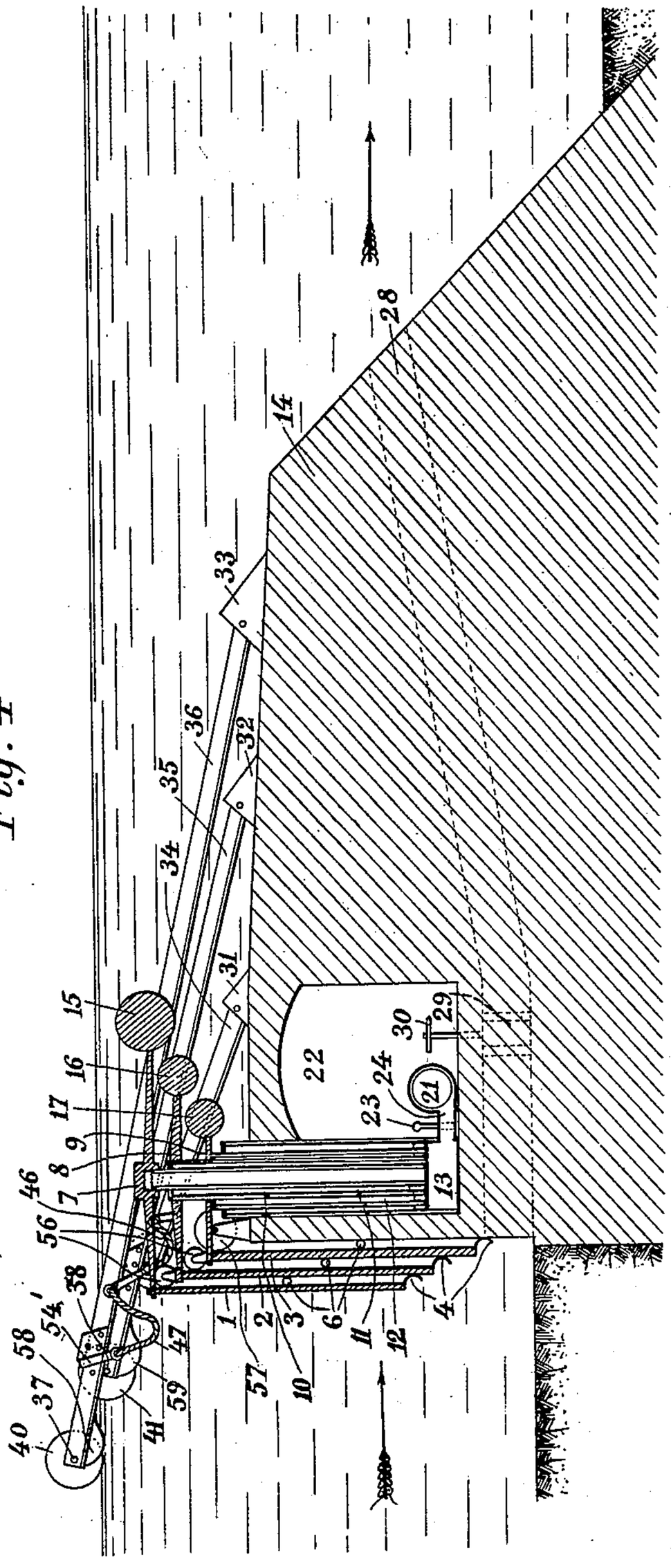
(Application filed May 28, 1900.)

(No Model.)

5 Sheets—Sheet 4.

Fig. 4



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(Application filed May 28, 1900.)

5 Sheets—Sheet 5.

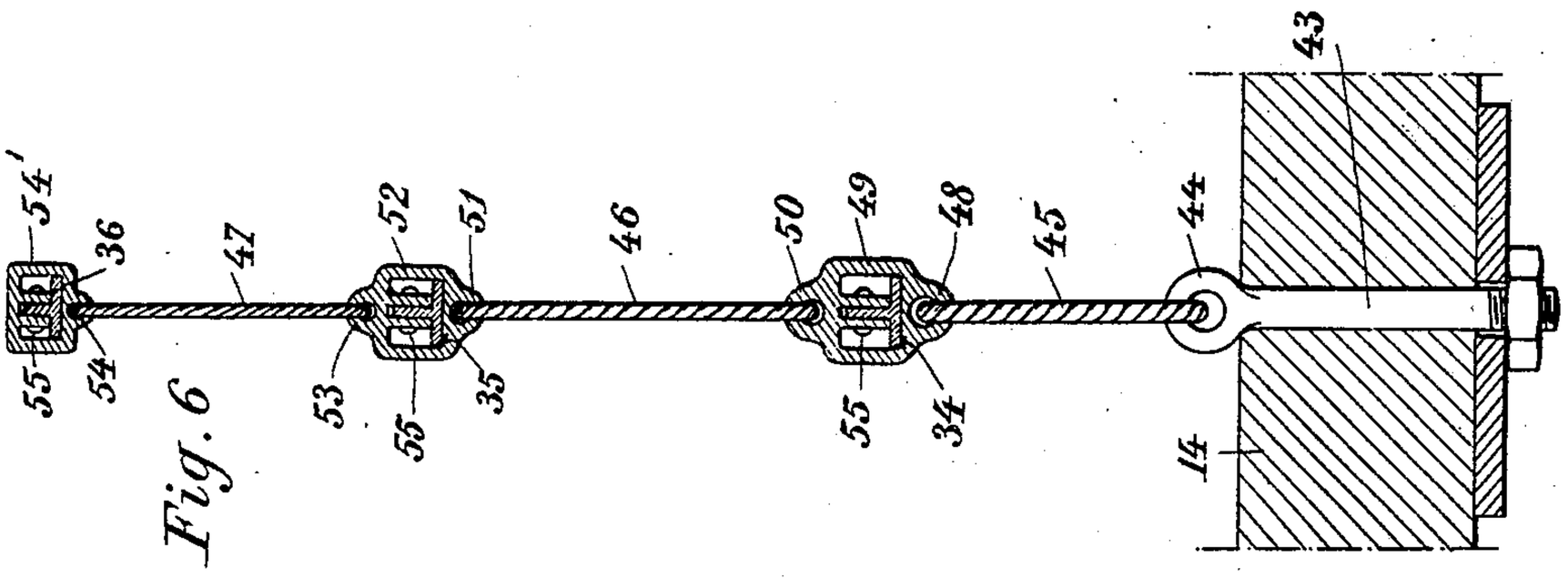

Fig. 6

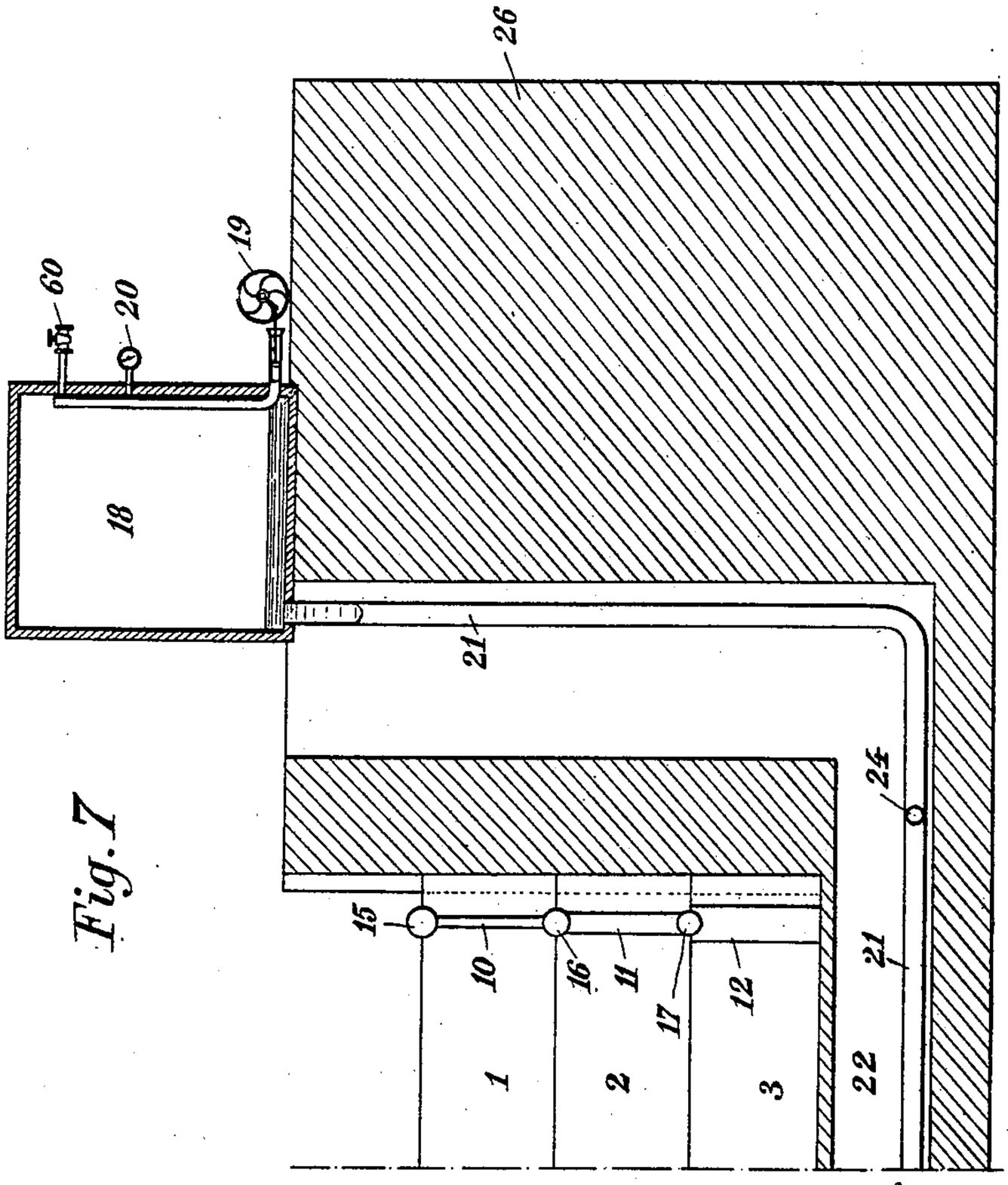

Fig. 7

Witnesses.
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UNITED STATES PATENT OFFICE.

NICOLAS GHERASSIMOFF, OF ST. PETERSBURG, RUSSIA.

DAM.

SPECIFICATION forming part of Letters Patent No. 677,656, dated July 2, 1901.

Application filed May 28, 1900. Serial No. 18,285. (No model.)

To all whom it may concern:

Be it known that I, NICOLAS GHERASSIMOFF, military engineer, a subject of the Czar of Russia, residing at 45 Rue de Kasan, log. 45, St. Petersburg, Russia, have invented a certain new and useful Improvement in Dams, (for which I have applied for Letters Patent in Russia under date of November 4, 1899, new style;) and I do hereby declare that the following is a full, clear, and exact specification of the same.

This invention consists of a dam, the characteristic feature of which resides in that it is capable of being folded in order that when unfolded or developed it shall obstruct the flow of water, while when folded up or collapsed it shall allow the stream or river across which it is erected to run freely.

The object in view is to derive motive power from streams or rivers, while at the same time affording the possibility of partly or wholly damming up a stream irrespective of its width and of the depth of the backwater and without the use of intermediate piers.

Broadly speaking, the invention consists in a vertical gate composed of one or more sections placed across the stream and capable of being slid with reference to each other so as to fold up or unfold and either permit or obstruct the flow of water, the said gate while in operation being supported against the backwater by a series of braces resting upon the sill of the structure. The sections constituting the sliding gate are operated by a series of vertical pistons arranged concentrically parallel to the sections and telescoping into or out of each other as the sections are being unfolded or folded up. Hydraulic or other suitable pressure is applied to the moving of the pistons for the purpose of operating the sections.

In the accompanying drawings I have illustrated a folding dam designed according to my improvement.

Figure 1 is a plan showing the general arrangement of the dam. Fig. 2, on a larger scale, is a plan showing a portion of the dam. Fig. 3, on a smaller scale, is a vertical section on the line A A of Fig. 2, showing the dam unfolded in operation. Fig. 4, on the same scale, is a vertical section corresponding to Fig. 3, the dam being folded up or collapsed. Fig. 5, on the same scale, is a detail showing in plan the arrangement of one of the set of thrust-rollers pressing against one of the sliding sections composing the gate. Fig. 6, on a larger scale, is an elevation in section on the line B B of Fig. 3, showing in detail the means for connecting the braces together; and Fig. 7, on a larger scale, shows a vertical cross-section of the pier 26 on the line C C of Fig. 1.

Referring to Figs. 2 to 6, the dam is shown as comprising a gate composed of three sections 1 2 3; but this number may vary, as well also as the height of each section. Each section may be composed of one single plate or of a series of plates, according to the width of the stream to which the dam is to be applied, and the sections may be made of wood strengthened by means of angle-iron or be otherwise formed. The horizontal space formed between adjacent edges of the sections 1 2 3 through which the water might flow can be closed by means of flexible jointing-strips 4 4 4, Figs. 3 and 4, made of thin metal or other suitable material. The vertical space formed between the various series of horizontal plates in each section, assuming the dam to be formed of sections each comprising a series of plates, as illustrated in Fig. 2, can be closed by overlapping strips 5 5 of like flexible material. The various sections 1 2 3 are separated from each other by one or more rollers 6 6 6, the purpose of which is to facilitate the sliding movements of the sections with reference to each other. The said rollers may either be loose or fitted to the respective sections. The top of each section 1 2 3 is connected to the cross-pieces or heads 7 8 9 of concentric pistons 10 11 12, arranged parallel to the sections and so as to telescope into and out of each other, the lower piston working in a stationary cylinder 13 sunk in a shaft built in the sill 14, Fig. 4. The heads 7 8 9 of the pistons 10 11 12 are preferably balanced by means of counterweights 15 16 17. The pistons 10 11 12 are operated by hydraulic pressure from a tank 18, Fig. 7, containing a certain amount of water and provided with an air-pump 19 for forcing air into the reservoir, the pressure being indicated by a gage 20 and conveyed to the pistons by a pipe 21, laid in a subway 22 of the required

size for enabling an attendant to conveniently operate the valve 23, Fig. 3, fitted on a branch pipe 24 and controlling the inlet of pressure to the hydraulic pistons.

The sill 14 is preferably built of concrete or masonry, and it extends (see Fig. 1) from an ordinary sluice 25 (enabling vessels to pass from one level to the other) to the pier 26 of the dike 27, at which point the turbines (not shown) are erected.

In the sill 14 is formed one or more channels 28, each controlled by a sluice-valve 29, which is operated by a screw-threaded rod or its equivalent 30 for the purpose of driving off periodically, by means of the water-pressure itself, the sediment which accumulates in front of the sill at the bottom of the river.

On the sill 14 are secured three series of bearings 31 32 33, to which are pivoted the lower ends of three series of braces 34 35 36, respectively, made of T or other shaped girders. (See section Fig. 6.) Through the upper end of all the braces of each series is passed a stout metallic rod 37 38 39, upon which may revolve a number of rollers 40 41 42, one set alone of which is shown in plan in Fig. 5. These rollers are in contact with the respective gate-sections 1 2 3 when the dam is unfolded, as in Fig. 3, and they receive collectively the full pressure of the backwater exerted against the said sections. The braces 34 35 36 are capable of pivoting around the pivots in their bearings 31 32 33, and the extent of such motion is limited in both directions. In the one direction—that is to say, in the upward motion—movement is limited by a cable which is anchored to the sill 14, as hereinafter explained, and in the other direction—that is to say, in the downward motion—movement is limited by their coming to rest upon the collapsed mechanism, as shown in Fig. 4. In the sill 14 is embedded an anchor 43, Figs. 3 and 6, terminating at the top in an eye or hook 44, connected to a cable formed of three parts 45 46 47, the first one of which, 45, is connected to an eye 48, dependent from a socket 49, through which passes the brace 34, while the second one, 46, is connected at the bottom to an eye 50 of the socket 49 and at the top to an eye 51 of a similar socket 52, through which passes the brace 35, and the third one, 47, is connected at the bottom to an eye 53 on the socket 52 and at the top to an eye 54 of a socket 54′, through which passes the upper brace 36. In the position they occupy in Fig. 3 the braces 34 35 36 have a tendency to be thrown back by the gate-sections 1 2 3, with the result that, being held by their pivots in the bearings 31 32 33, the said braces are caused to be swung upwardly until motion is limited by the cables 45 46 47. The sockets 49, 52, and 54′ are secured to the respective braces 34 35 36 by rivets 55 or otherwise. (See Fig. 6.)

At the top of the middle gate-section 2 and of the lower gate-section 3 is provided one or more rollers 56, the purpose of which is to receive the thrust of the preceding gate-sections 1 2 the moment such gate-sections when moving downward cease to be propped up by the series of rollers 40 and 41, respectively appertaining to the braces 35 and 36. A like roller or set of rollers 57 are fitted upon the sill 14 to serve a like purpose with reference to the lower gate-section 3. These sets of rollers 56 and 57 only requiring to act when the dam is being folded up from the position shown in Fig. 3, they are preferably a slight distance away from the surface of the gate-sections when the latter assume the developed position shown in the said figure.

The under faces of the upper and middle braces 36 and 35 may be provided near their outer ends with one or more pads or curved pieces of iron, wood, or other material 58 59 for the purpose of easing the contact which takes place between the braces 35 and 36 and the rest of the mechanism as the dam is being folded up from the position shown in Fig. 3 to that shown in Fig. 4.

It is to be observed that the counterweights 15, 16, and 17 and the diameter of the pistons 10 11 12 should best be so calculated that the pistons shall only move one after the other. For instance, the upper piston 10 should remain upright as long as the pressure in the hydraulic main 21 is equal to, say, at least seven atmospheres, the middle piston 11 should remain upright as long as such pressure is equal to, say, at least five atmospheres, and the lower piston 12 should remain upright as long as such pressure is equal to, say, at least three atmospheres. This varying pressure in the hydraulic main 21 can be obtained by the air-compressor 19, as previously described.

If it be desired to reduce the height of the backwater, and assuming the dam to be fully unfolded, as in Fig. 3, the pressure in the hydraulic main is decreased until it is below, say, seven atmospheres and above, say, five atmospheres. Such decrease is obtained by letting out some compressed air from the tank 18 by opening a blow-off valve or cock 60, Fig. 7. The upper piston 10 will then move down into the middle piston 11, carrying with it the upper gate-section 1 and simultaneously reducing the height of the backwater. If it be desired to still further reduce the said height, the pressure is decreased in like manner until it is less than, say, five atmospheres and more than, say, three atmospheres, whereupon the middle piston 11 will move down into the lowermost piston 12, carrying with it both the upper gate-section 1 and the middle gate-section 2 and correspondingly reducing the height of the backwater. If the pressure be reduced further still, then the whole system will collapse into the folded position shown in Fig. 4. By proceeding inversely the system can be made to again assume the unfolded or developed position shown in Fig. 3.

It may be found desirable to so construct the mechanism that instead of causing the gate-

sections 1 2 3 to operate successively in the above-described order each gate-section may be placed under the immediate control of a distinct hydraulic hoisting apparatus. In that case the three pistons 10 11 12 would be disassociated from each other and be independently operated.

I claim—

1. A vertically-extensible dam comprising independently-supported and vertically-movable damming elements, for the purpose set forth.

2. A vertically-extensible dam comprising independently-supported damming elements movable relatively to each other and non-interdependent means limiting such movement, for the purpose set forth.

3. A vertically-extensible dam comprising a plurality of abutting dam-sections each comprising damming elements movable vertically relatively to each other, for the purpose set forth.

4. A vertically-extensible dam comprising a plurality of abutting dam-sections each comprising damming elements movable vertically relatively to each other and mechanism organized to move the elements of each section independently of those of the other section or sections, for the purpose set forth.

5. A vertically-extensible dam comprising damming elements movable vertically relatively to each other, a fluid-operated piston connected with each of said elements, a source of fluid-supply under pressure common to all the pistons and means for varying the pressure of the fluid on the pistons actuating the damming elements, for the purpose set forth.

6. A vertically-extensible dam comprising damming elements movable vertically relatively to each other, telescopic fluid-operated pistons, one for each of said elements, a source of supply of fluid under pressure common to all the pistons and means for varying the pressure of the fluid acting on the several pistons, for the purpose set forth.

7. A vertically-extensible dam comprising vertically-extensible sections, power-pistons for operating the same, and cross-heads for connecting said sections to the pistons, for the purpose set forth.

8. A vertically-extensible dam comprising vertically-extensible sections, power-pistons for operating the same, cross-heads for connecting the sections to the pistons and counterweights on the cross-heads for balancing the sections, for the purpose set forth.

9. A vertically-extensible dam comprising vertically-extensible sections, power-pistons for operating the same, and means operated by said pistons for receiving the thrust exerted by the backwater against the sections, for the purpose set forth.

10. A vertically-extensible dam comprising vertically-extensible dam-sections, power-pistons for operating the same, counterweighted cross-heads carried by the pistons and supporting the dam-sections, means for raising and lowering the pistons independently of each other, and means operated by the dam-sections for receiving the thrust exerted by the backwater against said sections, substantially as and for the purpose set forth.

11. A dam comprising one or more gate-sections, power-pistons for operating the same, cross-heads carried by said pistons and supporting the gate-sections, braces pivoted behind the gate-sections and adapted to be raised thereby, means for limiting the movement of said braces and means for operating the power-pistons, substantially as and for the purpose set forth.

12. A dam comprising a plurality of gate-sections, a plurality of power-pistons for operating the same, cross-heads mounted on the pistons and supporting said gate-sections, a sill, a brace for each of said gate-sections pivoted in said sill, cables connecting said braces, means for anchoring said cables, roller-bearings mounted in the ends of the braces and adapted to bear against the gate-sections, and means for raising and lowering the power-pistons, substantially as set forth.

13. A dam comprising a plurality of vertically-movable gate-sections mounted one in front of the other, a sill, power-pistons mounted therein, a cross-head mounted on each piston and connected to a gate-section, a counterweight on each cross-head, braces pivoted in bearings mounted on the sill, roller-bearings carried by said braces adapted to bear against the gate-sections, a cable anchored in the sill connecting the braces, rollers on the tops of the gate-sections and between the same and means for operating the pistons, substantially as set forth.

14. A vertically-extensible dam comprising vertically-extensible damming elements and non-interdependent means for extending the same, for the purpose set forth.

15. A vertically-extensible dam comprising vertically-extensible damming elements and power-pistons for operating the elements, for the purpose set forth.

In witness whereof I have hereunto set my hand, this 15th day of May, (new style,) 1900, in presence of two subscribing witnesses.

NICOLAS GHERASSIMOFF.

Witnesses:
H. LOVIAGUINE,
W. KLEIBER.