No. 862,066. PATENTED JULY 30, 1907.

H. FITCH.

CANAL LOCK CONSTRUCTION.

APPLICATION FILED APR. 5, 1907.

6 SHEETS—SHEET 1.

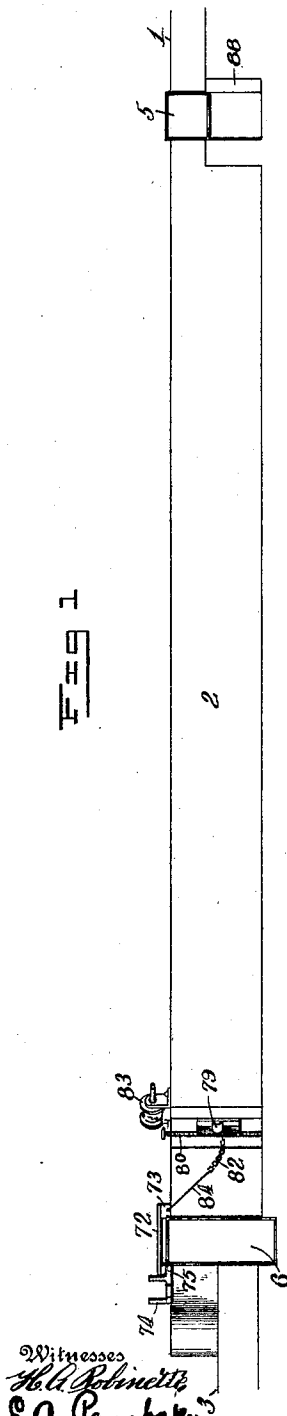


Fig 1

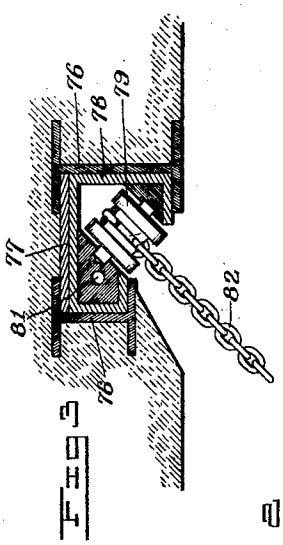


Fig 3

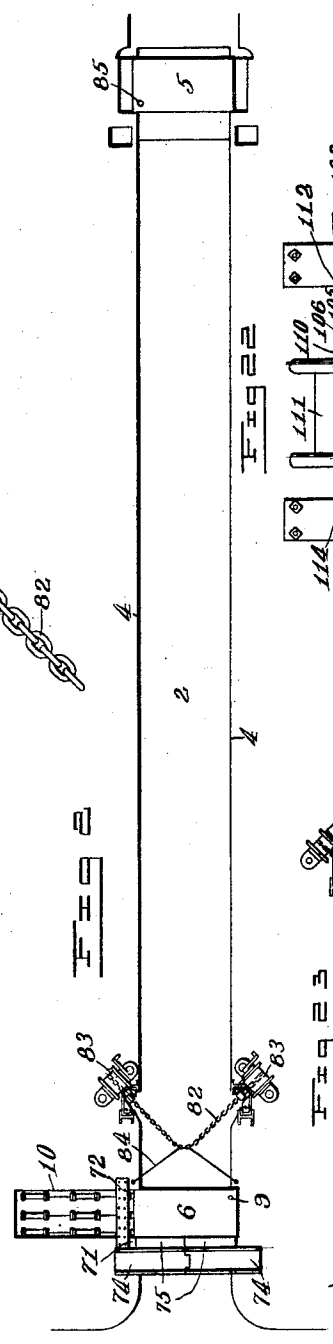


Fig 2

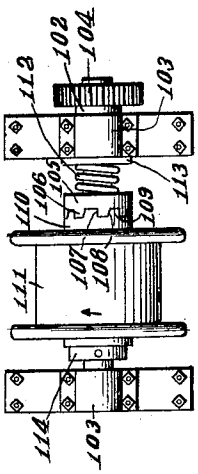


Fig 2a

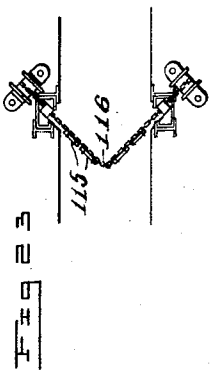


Fig 2b

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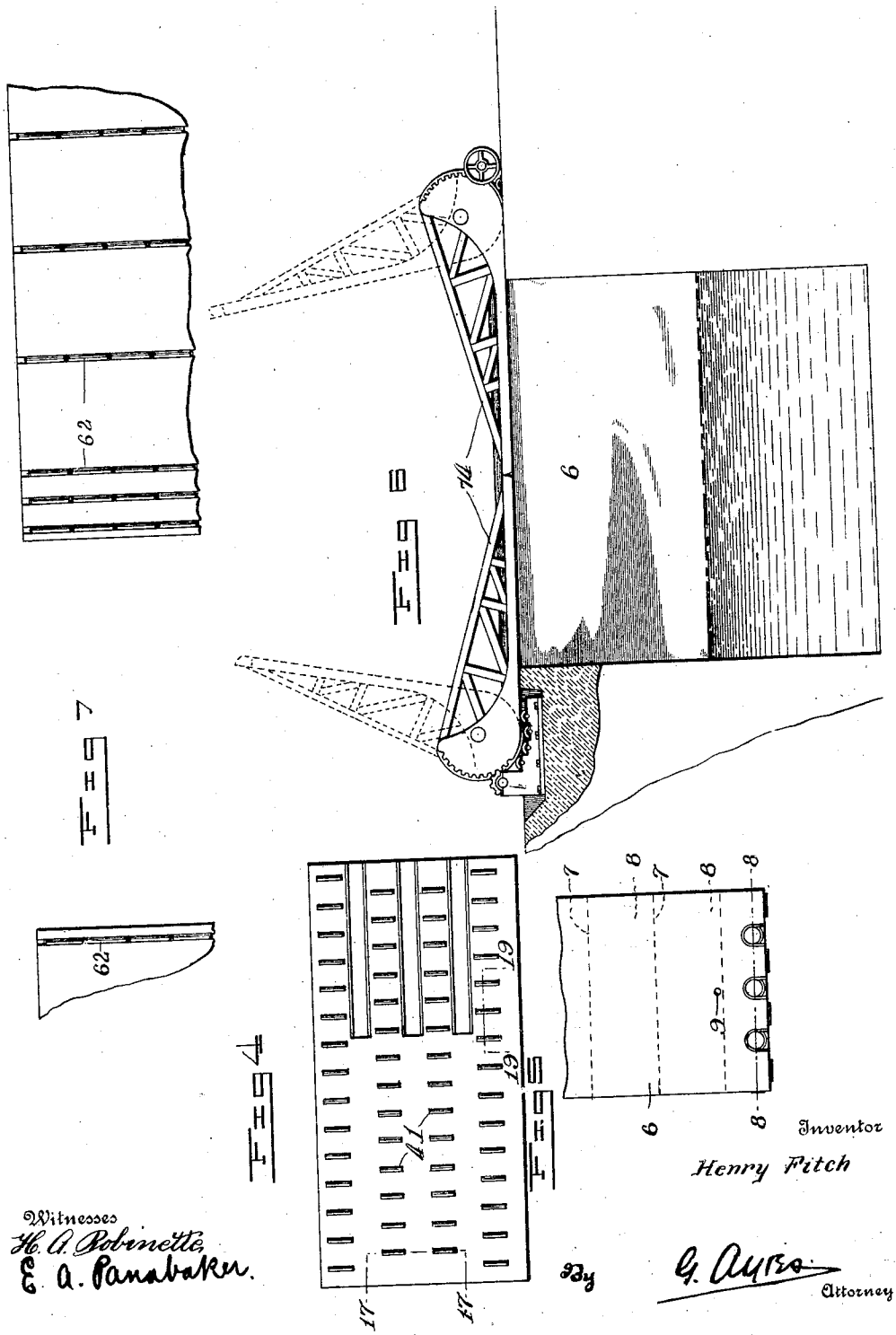
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6 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

Fig 8

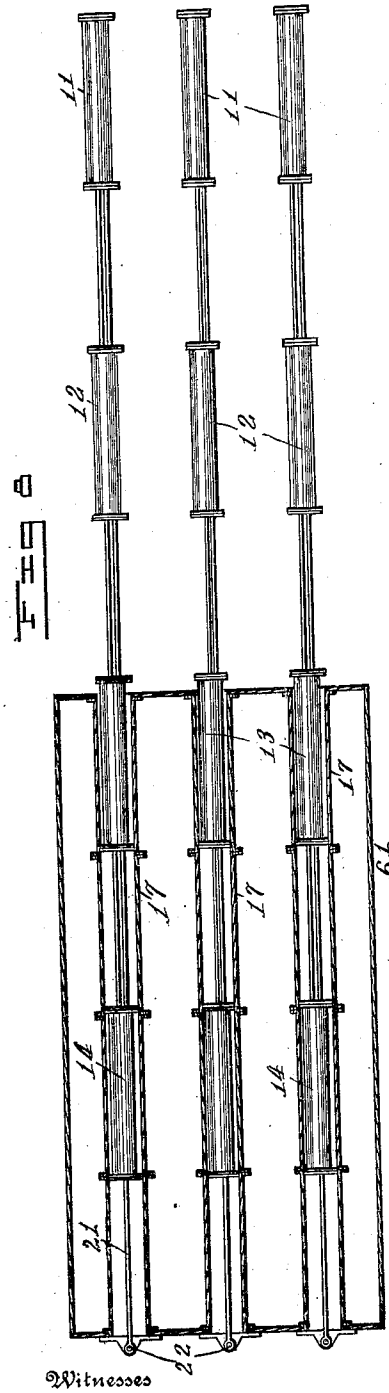


Fig 9

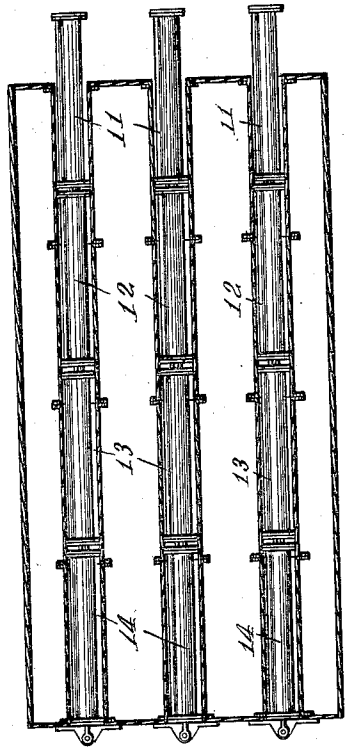


Fig 10

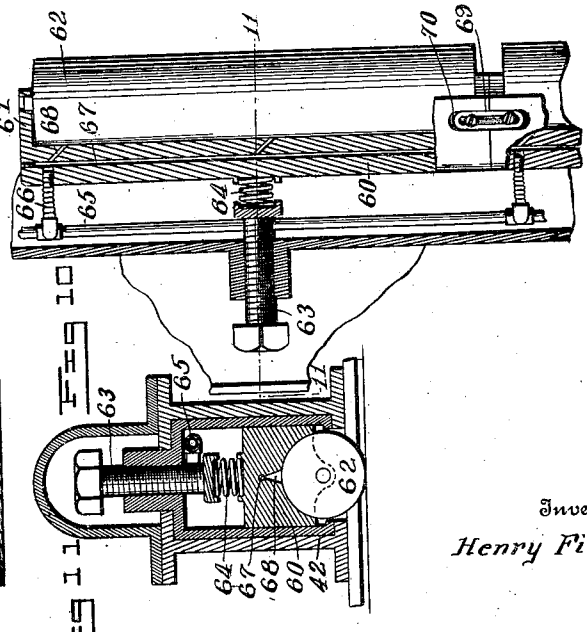


Fig 11

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6 SHEETS—SHEET 4.

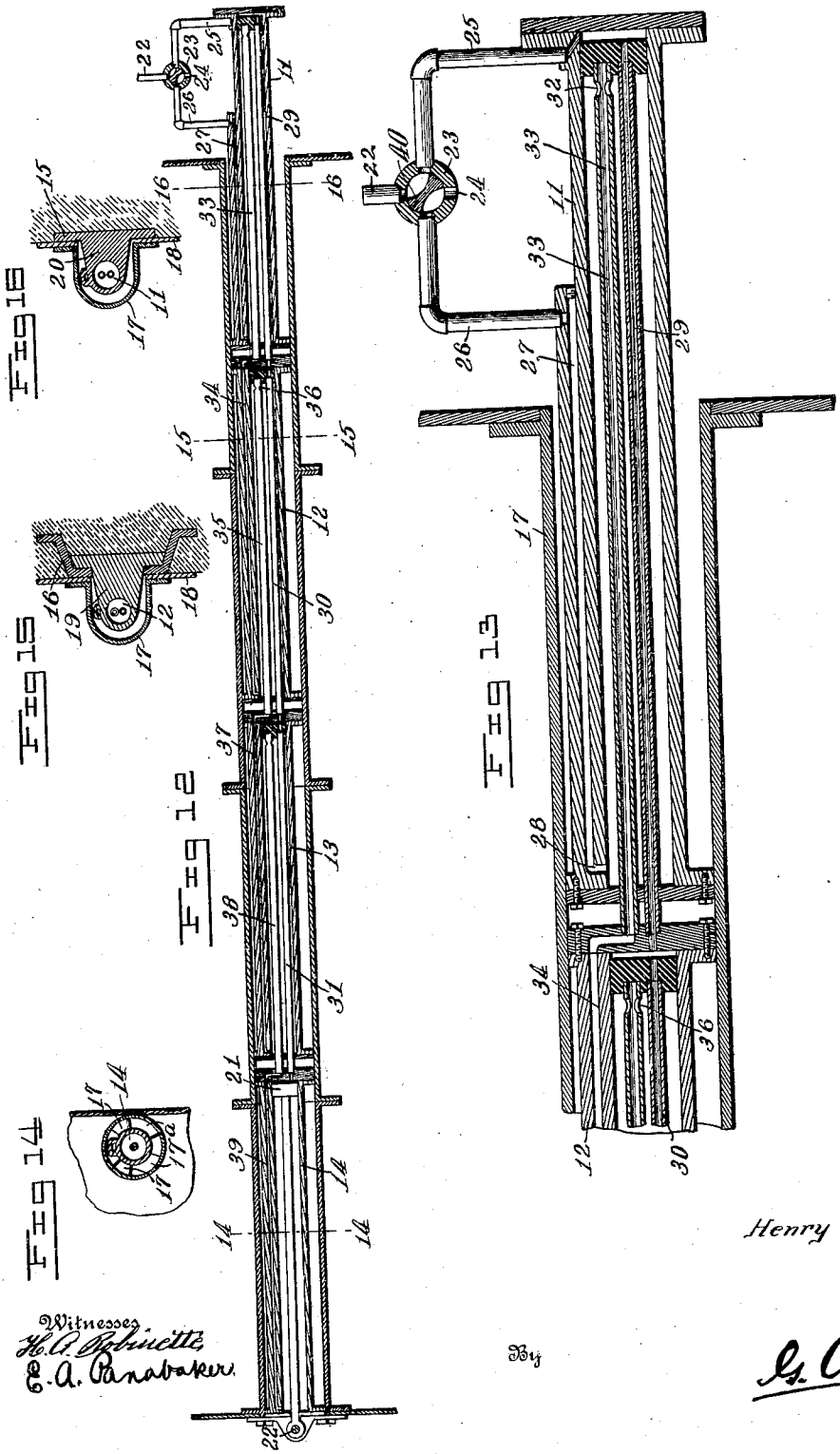


Fig 15

Fig 15

Fig 12

Fig 13

Fig 14

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6 SHEETS—SHEET 5.

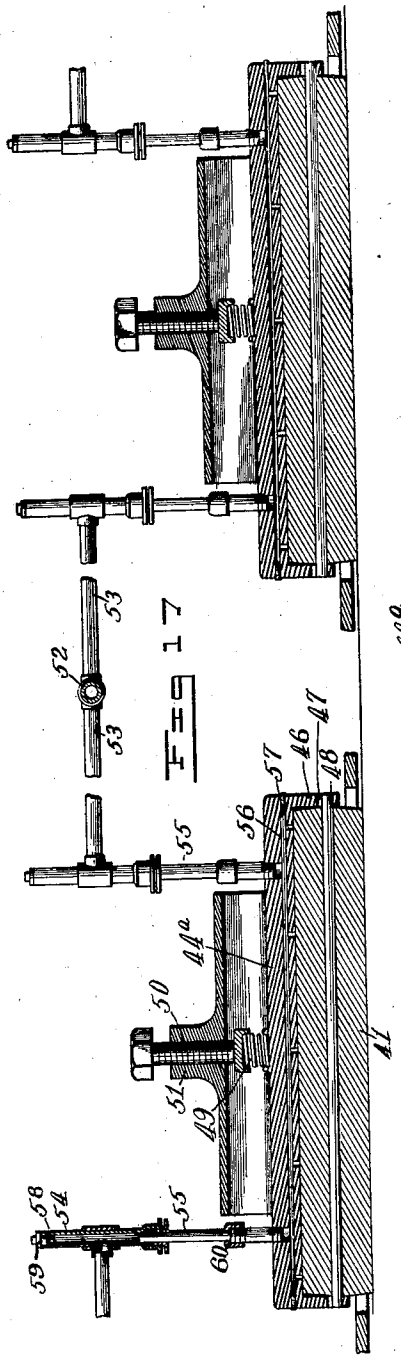


Fig 17

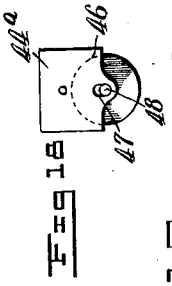


Fig 18

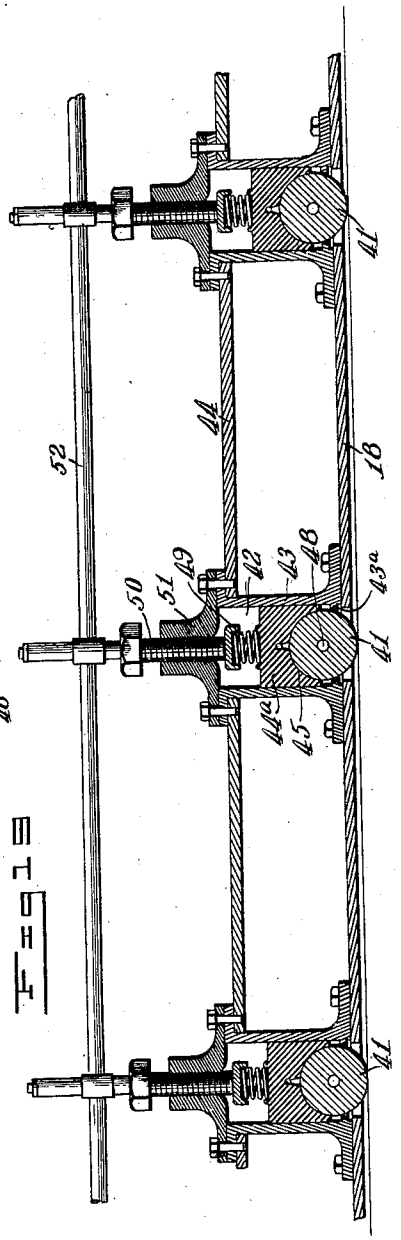


Fig 15

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6 SHEETS—SHEET 6.

Fig 20

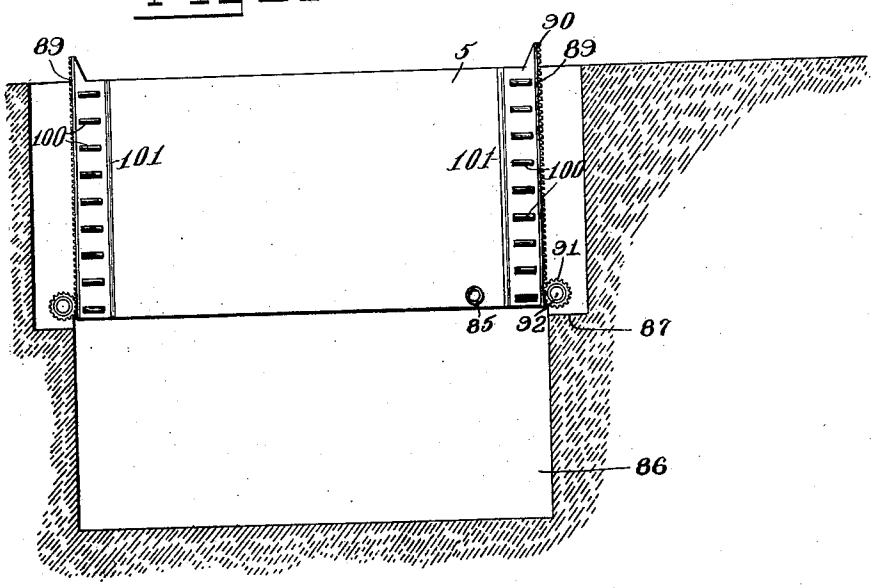
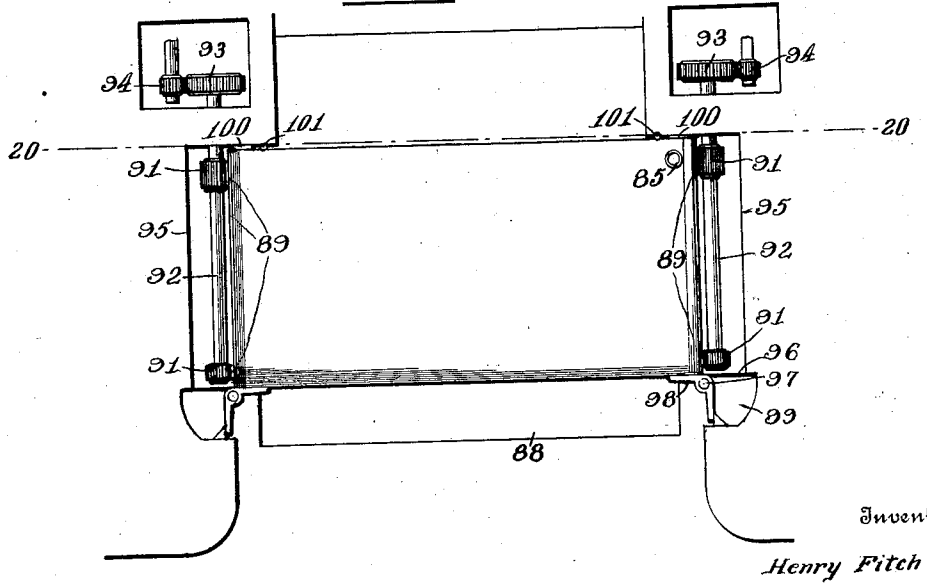


Fig 21



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UNITED STATES PATENT OFFICE.

HENRY FITCH, OF LAWRENCEBURG, INDIANA, ASSIGNOR TO FRANK B. FITCH, OF LOS ANGELES, CALIFORNIA.

CANAL-LOCK CONSTRUCTION.

No. 862,066. Specification of Letters Patent. Patented July 30, 1907.

Application filed April 5, 1907. Serial No. 366,564.

To all whom it may concern:

Be it known that I, HENRY FITCH, a citizen of the United States, residing at Lawrenceburg, in the county of Dearborn and State of Indiana, have invented certain new and useful Improvements in Canal-Lock Constructions, of which the following is a specification.

My invention relates to improvements in water-ways, and it consists in the constructions, combinations and arrangements herein described and claimed.

An object of my invention is to provide an improved system and construction of locks, which will insure certainty of operation under all conditions occurring in practice.

A further object of my invention is to provide an improved lock, constructed to minimize the danger of accidents, and in which accidents to any portion of the lock will be localized thereon without injury to other portions of the lock system.

A further object of my invention is to provide an improved lock construction, in which the lock gates and their operating means are so constructed and arranged as to require a minimum increase in the length of the lock walls, and which can be advantageously adapted for constructions larger than those practical with the existing types.

A further object of my invention is to provide an improved construction of pontoon lock gates, provided with water tight compartments in which the amount of water ballast can be readily varied to meet all practical conditions, and in which all parts of the gate are conveniently accessible from the interior thereof.

A further object of my invention is to provide an improved construction of pontoon gate formed of independent sections, in which the buoyancy of the sections can be varied at will and the several sections independently removed from and assembled to position.

In the accompanying drawings, forming a part of this application, and in which similar reference symbols indicate corresponding parts in the several views:—Figure 1 is a longitudinal sectional view through a lock, illustrating one embodiment of my invention; Fig. 2 is a plan view of the construction shown in Fig. 1; Fig 3 is a detail sectional view, on a larger scale, of one of the buffer heads shown in Figs. 1 and 2; Fig. 4 is a bottom plan view of the tail gate, showing a preferred arrangement of bearing rollers thereon; Fig. 5 is a side elevation of the tail gate; Fig. 6 is an elevation looking from the lower hydraulic level toward the tail gate; Fig. 7 is a fragmentary elevation showing a preferred arrangement of bearing rollers in the rear vertical wall of the tail gate pit; Fig. 8 is an enlarged horizontal sectional view on the line 8—8 of Fig. 5; and showing the hydraulic operating means in its extended position for closing the gate; Fig. 9 is a view similar to Fig. 8, the hydraulic operating means being shown in their contracted position for opening the gate; Fig. 10 is an enlarged vertical sectional view of one of the bearing rollers shown in Fig. 7; Fig. 11 is a sectional view on the line 11—11 of Fig. 10; Fig. 12 is a central horizontal sectional view through one of the series of connecting cylinders and pistons, shown in Figs. 2, 8 and 9, for operating the tail gate; Fig. 13 is an enlarged view of the part shown in the right-hand portion of Fig. 12; Fig. 14 is a sectional view on the line 14—14 of Fig. 12; Fig. 15 is a sectional view on the line 15—15 of Fig. 12; Fig. 16 is a sectional view on the line 16—16 of Fig. 12; Fig. 17 is an enlarged vertical sectional view on the line 17—17 of Fig. 4, showing the construction of two of the bearing rollers in the bottom of the tail gate; Fig. 18 is an end elevation of one of the bearing rollers and blocks shown in Fig. 17; Fig. 19 is a vertical sectional view on the line 19—19 of Fig. 4; Fig. 20 is a vertical sectional view on the line 20—20 of Fig. 21; Fig. 21 is a plan view of the head gate shown in Figs. 1, 2 and 20. Fig. 22 is a plan view, illustrating a drum having a flexible connection for permitting gradual unwinding of the buffer chain under abnormal stresses on the latter; and Fig. 23 is a detail plan view of the buffer chain shown in Fig. 2, illustrating a modification in which floats are secured to the buffer chain in lieu of the guy chain.

Referring to the drawings, 1 indicates an upper water level connected by a lock 2 with the lower water level 3; the lock being provided with the usual side walls 4 of reinforced concrete construction, a head gate 5 and a tail gate 6.

I have shown a pontoon type of tail gate, which is preferably constructed of iron plates suitably braced by interior truss work. The tail gate is divided by a series of partitions 7 into a plurality of independent water tight compartments 8; any usual suitable means, such as man-holes, being provided for access between the several compartments and for independently sealing said compartments. Valved inlets 9 are provided at any convenient point in the tail gate for pumping the water from its compartments, or for forcing said water out under pneumatic pressure, to adjust the amount of water ballast carried by said gate. In practice, a sufficient amount of water ballast is employed to give the gate the necessary stability, without placing an excessive weight on the roller bearings supporting the base of said gate.

A pit 10 is provided in one of the side walls 4 for receiving the horizontally slidable tail gate and containing the operating means for said gate. The operating means comprises a plurality of systems of fluid-actuated

cylinders and pistons 11, 12, 13 and 14; the piston of each cylinder being rigidly connected to the next adjacent cylinder of the system.

The initial cylinder 11 of each system is stationarily supported, or anchored, to the bottom surface of the tail gate pit, as shown at 15 in Fig. 16. The second cylinder 12 of each system is slidably supported in guides 16 embedded in the bottom surface of the tail gate pit, as shown in Fig. 15. The third cylinder 13 and final cylinder 14 of each system are slidably supported in all of their positions in guide ways 17 in the tail gate; said guide ways being preferably formed of metal plates.

The cylinders are provided with end flanges and heads which extend into sliding engagement with the guide ways 17; said flanges and heads on the cylinders 13 and 14 being provided with openings 17ª for preventing the entrapping of water between the several cylinders during their travel in said ways.

The portions of the guide ways which receive the cylinders 13 and 14 when the system of cylinders has been contracted for opening the tail gate, as shown in Fig. 9, are formed with a complete circular cross-section, as shown especially in Fig. 14. The portions of the guide ways which receive the cylinders 11 and 12 in such contracted position of the systems, are formed with a substantially U-shaped cross-section extending through the bottom plate 18 of the tail gate, for receiving the slide extensions 19 of the cylinders 12 and the stationary supports 20 of the cylinders 11.

The systems extend entirely through the gate, and the pistons 21 of the final cylinders 14 are trunnioned at 22 on the exterior surface of said gate in position for convenient access.

A supply pipe 22 for water, or other fluid, under pressure, communicates with a valve casing 23, which also is provided with an exhaust outlet 24. A pipe 25 provides free communication between said valve casing and the rear end of the stationary cylinder 11, and a pipe 26 provides communication between said casing and a conduit 27 opening at 28 into the front end of the cylinder 11.

The pistons of the cylinders 11, 12, and 13, carry double hollow piston rods to provide passages for the actuating fluid between said several cylinders. The rear end of the cylinder 11 is thus maintained in communication with the rear end of the cylinder 12 by the hollow piston rod 29; the rear end of the cylinder 12 being similarly maintained in communication with the rear end of the cylinder 13 by the hollow piston rod 30, and the rear end of said cylinder 13 maintained in communication with the rear end of the final cylinder 14 by the hollow piston rod 31.

The forward end of the initial cylinder 11 is maintained in communication with the forward end of the adjacent cylinder 12 by means of the apertures 32 in the hollow piston rod 33 and the conduit 34 which provides communication between said hollow rod 33 and the forward end of the cylinder 12. Similarly, the forward end of the cylinder 12 is maintained in communication with the forward end of the cylinder 13 by the hollow piston rod 35 provided with openings 36, and a conduit 37 which provides communication between said hollow rod 35 and the forward end of the cylinder 13; the forward end of the cylinder 13 being maintained in free communication with the forward end of the final cylinder 14 by the hollow piston rod 38 and a conduit 39 which provides communication between said hollow rod 38 and the forward end of the final cylinder.

As shown in Fig. 13, the common controlling valve 40 is positioned to admit water under pressure from the supply pipe 22 to the branch pipe 25, and simultaneously to place the branch pipe 26 in communication with the exhaust 24. In this position of the valve, water under pressure will be admitted to the rear end of the initial cylinder 11, from which it will be conducted by the hollow piston rods 29, 30 and 31, to the rear ends of the several cylinders 12, 13 and 14; thereby forcing said cylinders through their outer, or forward, stroke for shifting the system of cylinders and pistons to its extended position for closing the tail gate, as shown in Fig. 8. Simultaneously with such admission of the actuating water under pressure through the branch pipe 25 to the rear ends of the several cylinders, the forward ends of said cylinders will be maintained in free communication with the exhaust 24 through the sucessively connected conduits and hollow pistons 39, 38, 37, 35, 34, 33 and 27.

It will be obvious that the common controlling valve 40 can be shifted to place the branch pipe 26 in communication with the supply of water under pressure and simultaneously place the branch pipe 25 in communication with the exhaust 24. This position of the valve acts to admit water under pressure to the forward ends of the cylinders for forcing the pistons through their inner, or rearward, stroke for shifting the system of cylinders and pistons to its contracted position for opening the tail gate. Further, the valve 24 can be adjusted to its central position for simultaneously closing both of the branch pipes 25 and 26, when it is desired to maintain the tail gate at rest in any position.

The above described construction provides a very efficient and advantageous operating means for a lock gate, and one which eliminates the tendency of the gate to lateral shifting or opening under the action of the operating force applied thereto. By extending the several hydraulic systems slidingly through the gate in the line of the latter's travel, and securing the free ends of the systems to the side of the gate opposite to the anchored ends of said systems, a rigid and firmly supported construction is provided, which will occupy a minimum of space and accommodate a maximum of gate travel.

The connections for maintaining communication between the corresponding ends of the several cylinders insures a more or less elastic system, in which the hydraulic pressure is equalized in the several cylinders of the system. A very satisfactory arrangement for equalizing hydraulic pressure in the several independent systems is to employ a common valve casing 23 and valve 40 for the branch pipes 25 and 26 of the several systems.

Referring especially to Figs. 4, 5, 17, 18 and 19, a plurality of series of bearing rollers 41 are adjustably mounted in channels 42 in the bottom of the tail gate. Said channels can be satisfactorily formed by castings, or angle irons, 43 bolted, or riveted, to the bottom plate 18 of the gate, and secured at their upper ends to braces 44 extending therebetween.

A bearing block 44ª is slidably mounted in each channel 42 and provided with a curved bearing face 45 for

engaging the periphery of the roller 41. Said block is provided with end flanges 46 having elongated slots 47 for receiving pins, or spindles, 48, extending through the rollers. This construction enables the roller to be withdrawn with the block when the latter is lifted from its channel 42, while permitting all weight on the roller to be transmitted to the full bearing surface 45 in the block when said parts are operatingly positioned in their channels 42.

One or more springs 49, confined between the top surface of each bearing block and screws 50 threaded in the cap 51 of the channel 42, constitute means for providing a yielding resistance to the upper thrust of the bearing rollers 41 under load; the screws 50 providing convenient means for independently adjusting the resistance of the several rollers.

A common supply pipe 52 conducts water, or other suitable lubricant, under pressure to a series of branch pipes 53 provided with tubular members 54 in which are telescopingly mounted pipes 55 secured to the upper surfaces of the bearing blocks. The pipes 55 communicate with suitable discharge channels 56 and 57 for distributing the lubricant to the bearing surfaces 45 of the blocks; the pipes 55 sliding in the members 54 to compensate for vertical adjustment or shifting of the blocks under the action of the load of the bearing rollers 41.

Under certain practical conditions, it will be found advantageous to discharge the lubricating water through the distributing channels 56 and 57 under sufficient pressure to maintain a thin film of water between the rollers 41 and their bearing surfaces 45.

The pipes 55 are provided with a swiveled joint at 60, and are formed at their upper ends with internal screw threads for engaging threaded bosses 58 extending axially within the tubes 54 from cap closures 59 at the upper end thereof. By this construction, the pipes 55 can be extended upwardly in the tubes 54 and secured in their upper position by the threaded bosses 58, for permitting removal of the blocks and bearing rollers 41 from their channels 42. The pipes 55, when thus secured in their upper position, extend past the ends of the branch pipes 53 and act as valves to cut off the flow of lubricant therethrough.

The entrance of water through the openings in the bottom plate of the gate when the rollers have been removed for repairing the structure can be conveniently prevented by sliding wrought metal plates between the bottom plate 18 and clamping rails 43^a extending from the side walls of the channels 42; such plates then acting as shields for closing the openings provided in the bottom plate for extension of the bearing rollers therethrough.

Figs. 7 and 10 illustrate a preferred form of bearings carried in the rear vertical wall of the tail-gate pit, for supporting said gate during its travel. As shown especially in Fig. 10, these bearings are provided with bearing blocks 60 having slotted end flanges 61 and carrying bearing rollers 62; said elements, together with the adjustable screws 63 and springs 64, being similar to the construction described in reference to Figs. 17 and 18.

A suitable lubricant, such as water, is supplied under pressure through a main pipe 65, from which it is conducted through preferably flexible branch pipes 66 to distributing channels 67 and 68 in the bearing blocks.

In arranging these bearings in their vertical channels, the bottom flange 61 of each block will be supported on the upper flange of the block beneath; any suitable connection, such as links 69 sunk in recesses 70 in the adjacent edges of the blocks, being provided to constitute detachable and somewhat flexible connections between the several blocks; whereby the entire series can be conveniently withdrawn from position. When the series of bearings are withdrawn from their vertical channel, the main lubricant pipe 65 is simultaneously elevated; said pipe being removed in sections as the several bearing blocks are successively detached from the series upon being raised from the vertical channel.

Referring especially to Figs. 1, 2 and 6, the outer corner 71 of the rear wall of the tail-gate pit 10 is rigidly supported and anchored by tie-beams 72 extending across said pit and secured to iron reinforcing members 73 embedded in the concrete walls of the lock.

Swinging trusses 74, mounted on the opposite walls of the lock, are operated in a manner similar to the well known Bascule bridges to constitute a solid abutment bearing against the upper portion of the tail gate when the latter is in its closed position. Said trusses carry bearings 75 in position for engaging the rear surface of said tail gate to strongly brace the latter in its closed position, and to constitute supporting bearings for said gate during its travel.

At a point adjacent the tail gate, vertical guide channels are formed in the side walls of the lock by suitable angle beams 76 and plates 77. A carriage 78 is slidably mounted in each channel, and carries a chain pulley 79 arranged axially to the wall of the lock. Suitable means, are provided for adjusting the carriages along their channels and for locking them in their several adjusted positions; I have shown for this purpose screw rods 80 swiveled to stationary supports and engaging threaded openings 81 in the carriages. A heavy buffer chain 82 extends between the two chain pulleys 79, from which it is carried to winding drums 83. The drums 83 provide convenient means for regulating the length of chain between the pulleys 79 and said drums are preferably provided with any well known yielding or flexible connection to permit gradual unwinding of the chain therefrom under the action of abnormal stresses on the latter.

Fig. 22 illustrates a satisfactory form of drum provided with a flexible connection, in which the drum shaft 102 is journaled in suitable bearings 103; a gear wheel 104 being secured to said shaft for rotating it. A clutch member 105 is provided with teeth 106, having axially extending forward faces 107 and rearwardly inclined rear faces 108; said teeth engaging corresponding teeth 109 on a coöperating clutch member 110 secured to the drum 111. The clutch member 105 is splined on the shaft 102 for axial movement thereon, and is yieldingly maintained in engagement with the clutch member 110 of the drum by a spring 112 confined between said member 105 and a collar 113 rigidly secured to the shaft 102. The drum is loosely mounted on the shaft 102; a collar 114 being secured to said shaft for preventing axial movement of the drum under the action of the spring 112. The spring 112 is formed of sufficient strength to maintain the clutch members 105 and 110 in engagement under all normal conditions. It will be obvious that under abnormal stress on the

buffer chain tending to rotate the drum forwardly in the direction of the arrow, the inclined forward faces of the drum clutch member 110 will shift the clutch member 105 axially against the spring 112 sufficiently to disengage said clutch members and permit unwinding of the buffer chain during continuance of the abnormal stress thereon.

Adjustable guy chains or cables 84 engage the buffer chain 82 for elevating the latter sufficiently to properly engage any vessel in the lock 2 which might approach in dangerous proximity to the tail gate 6. The buffer chain 82 provides a very efficient and readily adjusted means for preventing danger of injury to the tail gate by the accidental contact therewith of ships during lockage. The adjustable carriages 78, drums 83 and guy chains 84 enable the buffer chain to be readily adjusted for efficient operation with all characters of vessels and under all practical conditions; said buffer chain being lowered to the bottom of the lock when a vessel is to pass therefrom. This construction could be modified by discarding the guy chains 84, and securing floats to the buffer chain to cause the desired upward inclination of the portion of said chain between pulley 79. Such float construction is illustrated in Fig. 23, where a series of floats 115 are shown secured along the buffer chain 116.

Referring to Figs. 1, 2, 20 and 21, 5 indicates a vertical traveling head gate, which is preferably constructed with water tight compartments, and provided with valved openings 85 through which the water can be admitted or discharged for regulating the amount of water ballast carried within said compartments.

A pit 86 extends downwardly from the bed 87 of the upper water level for receiving said gate when lowered to its open position with its top surface level with, or slightly beneath, said bed 87. A sluice-way 88 is provided in the front wall of the pit to permit free flow of the water to and from said pit during the travel of the head gate therein.

I have shown the head gate provided with a plurality of racks 89 extending vertically along its sides, and projecting somewhat above the top of said gate, as shown at 90. If desired, any usual construction of adjustable flash board can be mounted on the top of the gate to extend between such upward projections 90 at the sides of the latter. Pinions 91 are carried by shafts 92 in mesh with the several racks 89; said shafts being driven in any convenient manner, as by gears 93 and pinions 94.

The drive shafts 92 and their connections are mounted in lateral pits 95 extending downwardly in the side walls of the lock substantially to the bed 87 of the upper water level; thereby permitting the convenient transmission of power to said shafts and ready access to the several parts for inspection and repairs.

The forward, or head, ends of the lateral pits 95 are closed by partitions 96, which are preferably constructed of metal. Vertical rods 97 are suitably secured along the outer edges of the partitions 96, and rotatably support adjustable wings 98. These wings are locked in the position shown in Fig. 21 to constitute guides for the gate during travel of the latter; said wings being swung into recesses 99 in the side walls of the lock to prevent injury thereto by vessels passing when the gate 5 is in its lower open position.

The rear wall of the gate is shown provided with vertical series of bearing rollers 100 for guidingly and supportingly engaging the adjacent walls of the lock during travel of said gate. An expansible or flexible tube or hose 101 is carried in a suitable seat in the gate extending along each of the series of bearing rollers 100. When the gate has been raised to its closed position, the tube 101 is expanded to force it into tight sealing engagement with the adjacent lock wall, for preventing leakage of water past the closed gate.

I have illustrated and described preferred and satisfactory constructions, but, obviously, changes could be made within the spirit and scope of my invention.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is:

1. In a lock for water-ways, the combination of a slidably supported lock gate, guide ways extending through said gate, and fluid-actuated means secured to said gate and extending slidably through the guide ways therein, substantially as described.

2. In a lock for water-ways, the combination of a slidably supported lock gate, guide ways extending through said gate, and systems of connected hydraulic cylinders and pistons anchored at one end and extending through said guide ways, the free ends of said systems being connected to said gate, substantially as described.

3. In a lock for water-ways, the combination of a slidably supported lock gate, a system of cylinders and pistons connected in series and stationarily supported at one end, the free end of said system being secured to said gate, and means for controlling the supply of actuating fluid to said cylinders, substantially as described.

4. In a lock for water-ways, the combination of a slidably supported lock gate, guide-ways within said gate, a system of cylinders and pistons connected in series and stationarily supported at one end, said system extending slidably within said guide-ways and being connected at its free end to the gate, and means for controlling the supply of actuating fluid to said cylinders, substantially as described.

5. In a lock for water-ways, the combination of a slidably supported lock gate, a series of cylinders and pistons, each piston being rigidly secured to the next adjacent cylinder of the series, means for stationarily supporting the initial cylinder of said series, means for connecting the final piston of said series to said gate, and means for controlling the supply of actuating fluid to said cylinders, substantially as described.

6. In a lock for water-ways, the combination of a slidably supported lock gate, a series of cylinders and pistons, each piston being rigidly secured to the next adjacent cylinder of the series, means for stationarily supporting the initial cylinder of said series, means for connecting the final piston of said series to said gate, and a common means for controlling the admission and exhaust of an actuating fluid to said several cylinders, substantially as described.

7. In a lock for water-ways, the combination of a slidably supported lock gate, a series of cylinders and pistons, a piston rod carried by each piston and rigidly secured to the next adjacent cylinder of the series, means for stationarily supporting the initial cylinder of said series, means for connecting the final piston of said series to said gate, means for controlling the admission and exhaust of an actuating fluid to said stationary cylinder, and means extending through said piston rods for placing the several cylinders in communication with the admission and exhaust of said stationary cylinder, substantially as described.

8. In a lock for water-ways, the combination of a slidably supported lock gate, a series of double-acting cylinders and pistons, each piston being rigidly secured to the next adjacent cylinder of the series, means for stationarily supporting the initial cylinder of said series, means for slidably supporting the remaining cylinders of said series, means for connecting the final piston of said series to said

gate, and means for controlling the admission and exhaust of an actuating fluid to said several cylinders, substantially as described.

9. In a lock for water-ways, the combination of a slidably supported lock gate, bearing rollers carried by said gate, bearing blocks engaging the peripheries of said rollers, means for maintaining a yielding pressure on said bearing blocks, and a common means for supplying a lubricant under pressure between the engaging surfaces of said several blocks and rollers, substantially as described.

10. In a lock for water-ways, the combination of a vertically sliding gate for closing said lock, a pit for receiving said gate when lowered to open the lock, means for actuating said gate, and shiftable guides for engaging said gate during its travel, substantially as described.

11. In a lock for water-ways, the combination of a vertically sliding gate for closing said lock, a pit for receiving said gate when lowered to open the lock, means for actuating said gate, shiftable guides for engaging the front face of said gate during its travel, and sealing devices carried by the rear face of said gate in position to engage the lock wall, substantially as described.

12. In a lock for water-ways, the combination of a lock gate, a buffer mounted in said lock adjacent to said gate, and means for adjusting said buffer to meet the varying conditions occurring in practice, substantially as described.

13. In a lock for water-ways, the combination of a lock gate, a buffer chain extending across the lock for shielding said gate from accidental impact of ships within the lock, and adjustable means for varying the height and inclination of said buffer chain, substantially as described.

14. In a lock for water-ways, the combination of a lock gate, guiding means adjustably carried in the walls of said lock, a buffer chain engaging said guiding means and extending across the lock in proximity to said gate, and means for shifting said adjustable guiding means, substantially as described.

15. In a lock for water-ways, the combination of a lock gate, guiding means adjustably carried in the walls of said lock, a buffer chain engaging said guiding means and extending across the lock in proximity to said gate, means for shifting said adjustable guiding means, and means for adjusting the length of said buffer chain extending between said guiding means, substantially as described.

16. In a lock for water ways, the combination of a lock gate, guiding means adjustably carried in the walls of said lock, a buffer chain engaging said guiding means, and means for yieldingly anchoring the ends of said buffer chain, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY FITCH.

Witnesses:
G. AYRES,
H. A. ROBINETTE.