C. E. MERCER.

ELECTROMAGNETICALLY CONTROLLED IRRIGATING HEAD GATE.

APPLICATION FILED JULY 29, 1913.

**1,176,390.**

Patented Mar. 21, 1916.

2 SHEETS—SHEET 1.

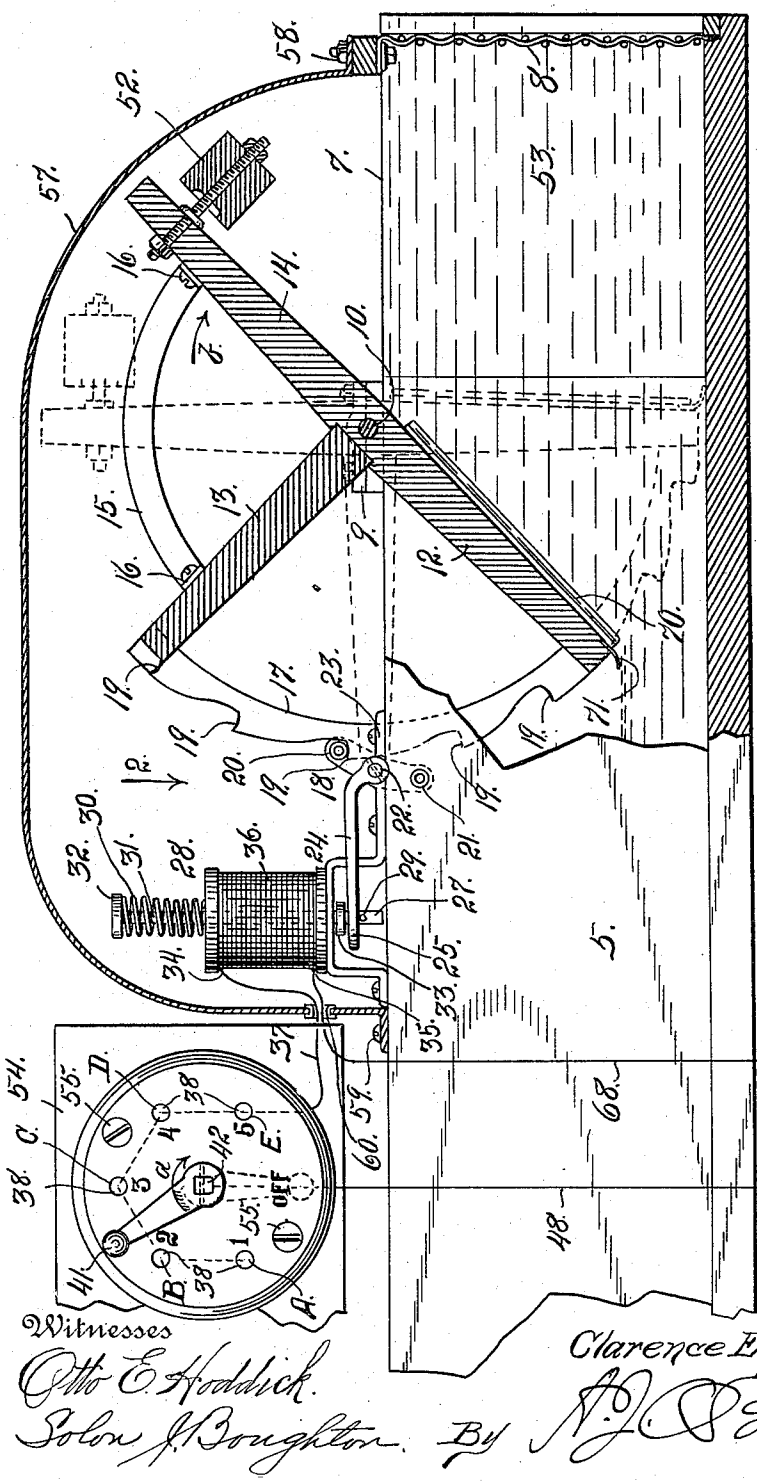



Fig. 1.

Witnesses

Otto E. Hoddick.

Solon J. Broughton.

Inventor

Clarence E. Mercer.

By N. J. O'Brien

Attorney

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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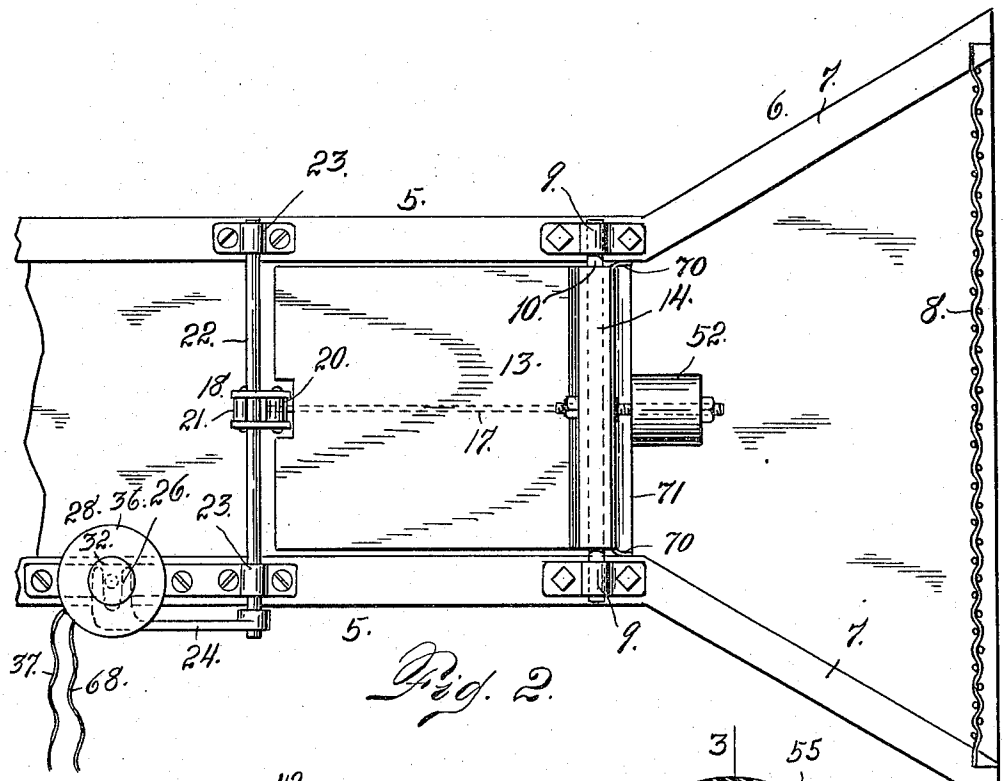



Fig. 2.

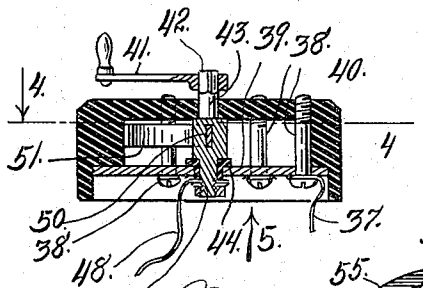



Fig. 3.

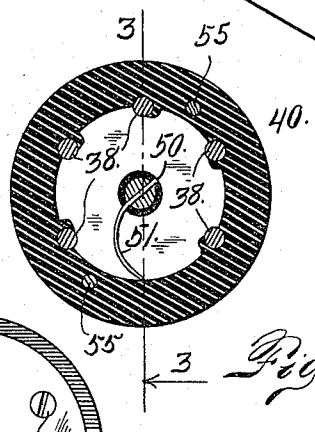



Fig. 4.

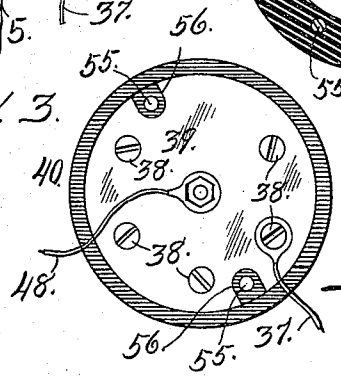



Fig. 5.

Witnesses

Otto E. Hoddick.

Solon J. Broughton

Inventor

Clarence E. Mercer.

By A. J. Boone

Attorney

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D

# UNITED STATES PATENT OFFICE.

CLARENCE E. MERCER, OF DENVER, COLORADO.

## ELECTROMAGNETICALLY-CONTROLLED IRRIGATING HEAD-GATE.

1,176,390. Specification of Letters Patent. Patented Mar. 21, 1916.

Application filed July 29, 1913. Serial No. 781,744.

*To all whom it may concern:*

Be it known that I, CLARENCE E. MERCER, a citizen of the United States, residing in the city and county of Denver, and State of Colorado, have invented certain new and useful Improvements in Electromagnetically-Controlled Irrigating Head-Gates; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in irrigating head gates adapted to be controlled by the making-and-breaking of an electrical circuit, the switch for controlling the circuit being located at any desired distance from the gate.

My object is to make it practicable to control a gate of this character at a distance therefrom so that the person in charge of the work of irrigation may, if he desires, have a switch located in his house, which switch may be capable of manipulation to open the head gate to permit the desired quantity of water to pass through and also to close the gate. By virtue of this construction, it becomes practicable for one person in a given location to accurately control a considerable number of gates without leaving the vicinity of the switches or a switchboard constructed for the purpose.

The construction, generally speaking, consists of a rotary device preferably having three members radially disposed from its axis, two of the members being connected by a segmental ratchet engaged by an escapement device, the latter being electro-magnetically controlled preferably by the employment of a solenoid. The escapement is fast on a rock spindle with which is rigidly connected a crank arm arranged to be depressed by the core of the solenoid when the coils of the latter are energized. The escapement and ratchet arm are so arranged that when the magnet is energized, the core of the latter acts to disengage the upper arm of the escapement from the ratchet, while the lower arm is thrown into position to engage the next tooth. The switch arm, however, is preferably adjusted so that the closing of the circuit shall be but momentary, the switch arm being moved past the circuit closing contact so that the circuit through the coils of the magnet is practically immediately broken after closing. In this event, a spring acting on the core of the solenoid, the said core being suitably connected with the crank arm for the purpose, will actuate the crank arm to return the escapement to its normal position, and during this movement the lower arm of the escapement will be disengaged from the tooth of the ratchet and the upper arm of the escapement will be thrown into position to engage such tooth. Thus, during each circuit closing act, the gate will move rotatively a distance corresponding with the distance between the teeth of the segmental ratchet arm, with which the escapement coöperates. The operation of the escapement serves to release the gate and the weight connected with the blade thereof, which is normally uppermost, will serve to move the gate when it is desired to close the same, and to such position that the weighted arm will be engaged by the current of the water, which acts thereon to return the gate to the closed position. The construction will be such that the operator will understand the effect upon the gate by each movement of the switch arm for circuit closing purposes.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a side elevation partly in section, of my improved electrically controlled irrigating head gate. Fig. 2 is a top plan view of the same with parts removed. Fig. 3 is a sectional view in detail of the switch for making-and-breaking the circuit through the magnet. Fig. 4 is a section taken on the line 4—4, Fig. 3, viewed in the direction of the arrow. Fig. 5 is a view illustrating the manner of securing the switch to a stationary support.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the opposite parallel side walls of the head gate structure, with the inlet end of which is connected a mouth member 6 whose walls diverge from each other as they extend away from the body of the structure, thus making a mouth which is largest at its receiving extremity. Stretched across this mouth, between the two diverging walls 7 thereof, is a screen 8

which is of pure mesh to prevent the entrance of material which would have a tendency to clog or interfere with the proper operation of the gate.

Journaled in boxes 9 mounted on the upper edges of the side walls 5 is a shaft or axle 10 on which the head gate proper is mounted and made fast. As illustrated in the drawing, this gate consists of three radially disposed blades or members 12, 13 and 14. The two blades 13 and 14 are connected by a curved strengthening brace 15 which is interposed therebetween, its extremities being secured by suitable fastening devices as screws 16. The two blades 12 and 13 are connected by an interposed ratchet arm 17 which coöperates with an escapement 18 for regulating and controlling the operation of the gate as will be hereinafter more fully described. The ratchet is notched to form a number of offsets 19 adapted to be engaged by rollers 20 and 21 respectively, carried by the opposite extremities of the escapement which is fast on a spindle 22 journaled in bearings 23 applied to the upper edges of the side walls 5 forward of the axle of the gate, the distance between the spindle 22 and the axle 10 being sufficient to allow the blades of the gate to pass without interfering with the escapement when the latter is released or disengaged from the ratchet.

The escapement is mounted on the spindle 22 midway between the walls 5 of the structure. Also made fast to one extremity of the spindle 22 outside of the adjacent wall 5 is a crank arm 24 whose free extremity 25 is bifurcated as shown at 26 to straddle the core 27 of the electro-magnet 28 of the solenoid class, the core being movable vertically in an opening surrounded by the magnet coils. This core extends below the extremity 25 of the crank arm and is equipped with a pin 29 of sufficient length to form a stop to the passage of the core through the slot of the bifurcated ends of the crank arm. A spiral spring 30 extends above the coils of the magnet and surrounds the core 31 where it projects above the coils, the said spring being interposed between a stop 32 at the upper end of the core, and the upper end of the spool carrying the magnet coils. This spring normally, or when the magnet is deenergized acts upon the core and the latter in turn upon the crank arm 25, to hold the escapement in interlocking engagement with the ratchet 17. However, as soon as the magnet is energized by the closing of the circuit hereinafter described, the core is moved inwardly causing a second stop 33 located above the bifurcated end of the arm, to act upon the latter to impart a partial rotary movement to the spindle 22, whereby the escapement is moved to disengage the roller 20 from an offset 19 and throw the roller 21 at the opposite end of the escapement into the path of the offset 19 of the ratchet next below, the last named roller acting as a check to prevent the sudden movement of the gate to a greater degree than desired. As heretofore explained, the closing of the circuit is only momentary and as soon as it is broken, the spring 33 acting on the core of the magnet will lift the latter and impart a corresponding movement to the crank arm 24 which will return the roller 20 to its normal position in the path of the offset 19 which the roller 21 has just left. In this way, each circuit closing act is attended by a movement of the head gate on its axle to a predetermined degree.

As illustrated in the drawing, the terminals 34 and 35 of the coils 36 of the magnet are respectively connected with conductors 37 and 68. The conductor 37 is connected by means of a screw 38 with a disk 39 of the switch 40, the said switch being equipped with a number of these screws all of which are designated by the same reference character as they simply serve as a means for closing the circuit through the movement of a switch arm 41 which has a socket polygonal in cross section to fit an extremity 42 of counterpart shape formed on a spindle 43 journaled in the casing of the switch and insulated from the disk 39 as shown at 44. The conductor 68 leads to a pole 45 of an electrical source 46 of any suitable character preferably consisting of a suitable number of battery cells. From the opposite pole 47 of this source a conductor 48 leads to one extremity of the spindle 43, the connection being made at a point 49. This connection is made in such a manner that the spindle 43 may turn in the switch casing while the terminal of the wire 48 remains stationary, the electrical connection, however, being constantly established.

The head of the spindle 43 is equipped as shown at 50 with a contact spring 51 which has the spindle turned in the direction indicated by the arrow in Fig. 1, and which will be successively brought into engagement with the contact screws 38 of the disk 39.

It must be assumed that the switch 40 is located at any desired distance from the head gate proper. The conductors 37 and 68 are broken between the switch and the magnet to indicate this condition.

If it be assumed that the head gate be closed or in the position shown by full lines in Fig. 2 and by dotted lines in Fig. 1, and if it be also assumed that the switch arm 41 is in the dotted line position in Fig. 1, the circuit being broken, if it is desired to move the head gate from the dotted line position in Fig. 1 to the full line position in the same figure, the switch arm will be moved from the dotted line position of Fig. 1 first to bring the contact spring 51 into engagement with the screw 38 in position A. During

this engagement, the magnet circuit will be closed and the crank arm 24 actuated to disengage the roller 20 of the escapement from the uppermost offset 19 of the ratchet and to throw the roller 21 into the path of the offset 19 next below. However, as the movement of the switch arm is continued in the direction of the arrow "*a*" whereby the contact spring 51 is disengaged from the screw, whereby the circuit is again broken, the spring 30 will act through the open medium of the core 27 and the pin 29 and the crank arm 24, to return the escapement to its normal position whereby the roller 21 will be released from the second offset 19 causing the gate to move in the direction indicated by arrow "*b*" to cause the second offset to engage with the roller 20. If it is desired to leave the gate in the position resulting from its movement a distance corresponding with the distance between two offsets 19 of the ratchet, the switch arm will preferably be left midway between the screws 38 occupying positions "A" and "B." If, however, it is desired to further open the gate or cause it to assume the position indicated by full lines in Fig. 1, the switch arm 41 will be moved first to cause the contact spring 51 to engage the screw 38 in position "B" when the escapement will be actuated to disengage the roller 20 from the second offset 19 of the ratchet while the roller 21 will act as a stop to the movement of the gate as soon as the movement has been sufficient to bring the third offset 19 into engagement with the roller 21. Then as the switch arm 41 is moved to disengage the contact spring 51 from the screw 38 occupying position "B," and to bring the contact spring into a position intermediate the screw 38 in position "B" and the screw 38 in position "C," the circuit will be broken and the escapement will be returned to its normal position when the third offset 19 will engage the roller 20 and the gate will be locked in the position as shown in full lines Fig. 1 until it is desired to further actuate the same. Should it be desired to open the gate to its full capacity, and lock it in such open position, the switch arm will be moved to bring the contact spring successively into engagement with the screws 38 occupying the positions "C" and "D" and then moved beyond the screw 38 in position "D" and in the direction of the arrow "A" to break the circuit. In this event, the roller 20 of the escapement will bring the lowermost offset 19 of the ratchet and the arms 12 and 14 will occupy horizontal positions approximately on a level with the upper edges of the side walls 5 of the structure. Then should it be desired to close the gate, the switch arm will be further moved in the direction of arrow "A" to bring the contact spring 51 into engagement with the screw 38 in position "E". This will result in the escapement to disengage the roller 20 from the lowermost offset 19 and the member 14 of the gate will move downwardly under the influence of the weight 52, until the member 14 is brought into the path of the current of water 53 when the action of the water upon the member 14 will move the gate to bring the arm 13 into the path of the water which will act thereon to bring the last named arm into position to be engaged by the roller 20 of the escapement in which event the gate will be again in the position indicated by dotted lines in Fig. 1.

The weight 52 is of sufficient mass to impart a positive movement to the gate when in the position shown by dotted lines in Fig. 1, independently of the action of the current upon the member 12 of the gate. In any event, it coöperates with the action of the water to impart the initial movement to the gate as soon as the escapement is actuated through the instrumentality of the electro-magnet.

In order to protect the mechanism above the top of the casing, trough or flume, through which the water to be controlled flows, a housing 57 is employed, the same being connected with the walls 5 of the casing as shown at 58 and 59. This housing is of sufficient size to inclose the necessary space required by the blades 12, 13 and 14 when traveling above the walls of the flume. The electro-magnet and its connections for operating the escapement, are also inclosed by the said housing.

Fig. 5 is for the purpose of illustrating the manner of securing the switch 40 to a suitable stationary support 54 by means of two screws 55 which are passed through the frame of the switch and slots 56 formed in the metal disk 39 so that there will be no interference with the circuit during the operation of the contact spring 51, as the screws 55 will be insulated from the disk.

In order to tightly close the channel of the casing upon which the gate is mounted when the blade 12 is in the position shown by dotted lines in Fig. 1, the opposite side edges of the blade are equipped with a suitable packing material 70 which by virtue of its engagement with the side walls 5 of the casing forms a liquid tight joint. The lower extremity of this blade 12 is also provided with a packing strip 71 for the same purpose. Attention is called to the fact that the screen 8 applied to the front extremity of the casing is an important feature as it prevents fish from entering the casing from the main ditch or canal. Fish which enter and pass through a channel which the gate controls eventually die as the water leaves the lateral during the work of irrigation. The screen 8 is therefore important because it prevents the escape of fish

from the main canal and therefore has a tendency to prevent their destruction.

Having thus described my invention, what I claim is:

1. The combination of a casing, a gate rotatably mounted thereon and composed of a plurality of blades, a ratchet carried by the gate, an escapement adapted to engage the ratchet, means for normally holding the escapment in engagement with the ratchet to lock the gate against movement, and electro-magnetic means adapted when energized to act in opposition to the holding means to release the escapement.

2. The combination of a casing forming a channel through which the water to be controlled passes, a gate journaled on that casing and having a plurality of blades adapted to enter said channel in succession as the gate is rotated, two of the blades being radially disposed and oppositely arranged, one blade being weighted and the other adapted to close the channel and shut off the water, means for locking the gate against the tendency to rotate, resulting from the pressure of the water on the blades in the channel, and electro-magnetic means for releasing the locking means.

3. The combination of a casing forming a water channel, a gate rotatably mounted on the casing and equipped with a plurality of blades adapted to enter the water channel in succession as the gate is rotated, one of said blades being constructed to close the channel by forming a water tight joint with the side walls thereof, a ratchet carried by the gate, an escapement engaging the ratchet, a lock spindle to which the escapement is made fast, a crank arm made fast to the spindle, an electro-magnetic coil, a circuit in which the coil is located, a core passing through the coil and connected with the crank arm, a spring acting on the core to cause it to maintain the crank arm in position to lock the gate against movement by virtue of the engagement of the escapement with the ratchet when the magnet coils are deënergized, and a switch located in the circuit for making and breaking the latter for the purpose set forth.

In testimony whereof I affix my signature in presence of a witness.

CLARENCE E. MERCER.

Witness:
A. J. O'BRIEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."