

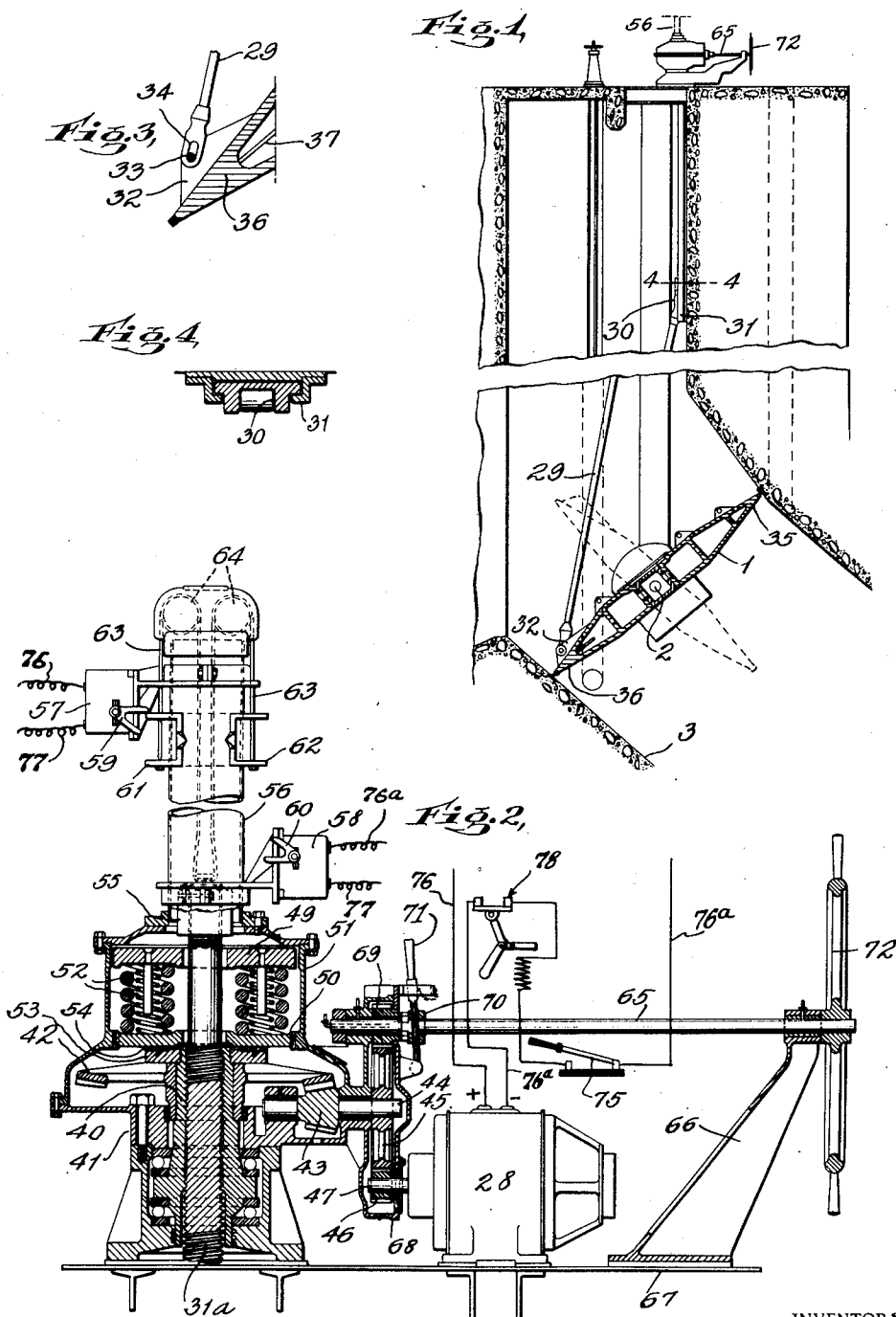
Aug. 21, 1928.

1,681,487

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APPARATUS FOR CONTROLLING HYDRAULIC GATES

Filed April 25, 1927



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Patented Aug. 21, 1928.

1,681,487

UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONTROLLING HYDRAULIC GATES.

Original application filed October 4, 1924, Serial No. 741,575. Divided and this application filed April 25, 1927. Serial No. 186,544.

This invention is an improvement in apparatus for controlling hydraulic gates, and more particularly in apparatus for operating the gates controlling the flow through relatively large passage ways, such as pen stocks and turbine flumes in hydro-electric power development.

Gates of the character in question, are large and heavy, and as a consequence difficult to move. They are usually operated to open and close by a rigid connecting member, moved longitudinally in either direction by a suitable motor.

Since the gates are usually at a distance from the motor, and the operator thereof is not in a position to know when they are fully closed or open, an indicator is relied upon, and if there is delay in the checking of the motor at the proper time, overtravel of the rigid connecting member results, with consequent liability to damage.

One of the primary objects of the present invention is the provision of an improved mechanism for operating the gate, and a remote control for the mechanism.

Another object is the provision of means for enabling a limited overtravel of the motor which opens and closes the gate, without damage to the parts.

Another object is the provision of means in connection with the operating mechanism for increasing the load near the end of the movement of the gate toward closed position, thereby to brake the operation of the said mechanism.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, the invention consists in the elements and their relation one to the other, as hereinafter defined in the appended claims, reference being had to the accompanying drawings forming a part hereof, which show a preferred embodiment of apparatus for carrying out the method, and in which:

Fig. 1 is a partial vertical section of the pen stock and gate, with the operating apparatus therefor.

Fig. 2 is a sectional view of the operating apparatus.

Fig. 3 is a detail in section of that edge of the gate which is lowest when closed.

Fig. 4 is a section on the line 4-4 of Fig. 1.

In the embodiment of the invention shown

in the present application, which is a division of Serial No. 741,575, filed October 4, 1924, the gate indicated generally at 1, and journaled at 2 on an axis transverse to the passage way 3, is arranged to stand in a position substantially perpendicular to the direction of flow through the passage way. In the present instance this position places the gate at an angle of about 45° to the vertical.

The mechanism for moving the gate to open and closed position includes a suitable motor indicated at 28 of any preferred construction, and a rigid connecting member 29 for transmitting the movement of the motor to the gate. The connecting member 29 is pivoted at one end to the gate, and at the other end to a cross head 30 which moves in guides 31 on the pen stock wall.

The cross head is connected to means moved directly by the motor, in the present instance a screw 31^a, and it will be obvious that when the screw is moved in either direction by the motor, the movement thereof will be transmitted to the gate. At its lower end the connecting member is received between a pair of lugs 32 on the gate, and near that edge of the gate which will be the lowest when the gate is closed.

A lost motion connection is provided between the cross head and the gate. In the present instance this connection is provided for by pivotally and slidably connecting the member 29 with the lugs, by means of a cross pin 33 connecting the lugs, and passing through a slot 34 in the connecting member. The lost motion connection thus provides a means for compensating for overtravel of the motor.

In order to insure closing of the gate in all positions, should the connecting member 29 become broken for instance, or fail to function for any reason, the gate is suitably counterweighted. This counterweighting is provided for by solid portions indicated at 35 and 36, the portion 36 being of greater extent than the portion 35, thus providing additional weight at that part of the gate which will be lowest when the gate is closed. Rods 37 are cast integral with the counterweight 36, so that additional weight may be connected thereto, as for instance more metal or concrete.

In Fig. 2, mechanism is shown for moving

the screw, which opens and closes the gate, means being provided in connection therewith, operated by the screw, to control the usual overload release forming part of the motor control thereby to stop the motor when the gate is fully closed.

As shown, the screw 31^a is threaded through a nut 40 arranged within a gear housing 41 supported at the top of the pen stock.

The nut 40 has rigid therewith a miter gear wheel 42, which meshes with a similar gear 43 on a horizontal stub-shaft 44 journaled in bearings, supported by the gear housing. A gear 45 is secured to the shaft outside of the gear housing, and the wheel meshes with a pinion 46 on the shaft 47 of a suitable electric motor 28. By means of the motor, the nut 40 may be rotated, thereby to lift and lower the screw, to open and close the gate.

Just above the miter gear 42 a pair of disks 49 and 50 is mounted, loosely on the screw, and the disks, which are within an extension 51 of the gear housing, are normally pressed away from each other by coil springs 52, the said springs being arranged between the disks. The lower disk 50 which is keyed to the extension to prevent rotation thereof with the screw rests upon a collar 53 which is rigid with the miter gear and nut, and which has a friction ring 54 secured to the edge thereof, for engagement by the disk. A head 55 is threaded onto the upper end of the screw, the head extending through the upper end of the extension 51, into a substantially cylindrical casing 56, which is supported by the head of the extension 51, being secured thereto.

The operation of the parts just described, is as follows. When the motor is running, the screw 31^a will be moved longitudinally, the direction depending upon the direction of movement of the motor. When the screw is moved downward, and the gate is fully closed, should for any reason there be a failure to stop the motor, the head 55 will engage the disk 49 and will press the disk downward toward the disk 50. The springs 52 are compressed, and the disk 50 is pressed closely against the friction ring 54 of the miter gear 42. As the friction increases, the load upon the motor increases, and when the increase has reached a selected degree, the overload release of the motor control will be operated to stop the motor, thereby to prevent buckling of the screw 31^a, and of the connecting member 29.

Limit switches 57 and 58 are interposed in the motor circuit, for opening the circuit at selected periods in the travel of the screw. Each of these switches is operated by a rocker 59 for the switch 57, and 60 for the switch 58. The rockers are engaged by indicators 61 and 62, respectively operated by the screw, in a manner to be presently described.

These indicators indicate the extent of travel of the screw, and at the end of its movement in each direction, one of the indicators will engage a rocker to open the motor circuit. On the upstroke of the indicators the rocker 59 is operated by the indicator 61, and on the downstroke the rocker 60 is operated by the indicator 62. The indicators are connected to the head 55 by flexible members 63 which pass upwardly from the head over suitable pulleys 64 and downwardly to the respective indicators.

Manually controlled mechanism is provided for turning the shaft 44. The said mechanism comprises a shaft 65 journaled in a bearing arm 66 on the platform 67 which supports the motor and the gear housing, and in a casing 68 which houses the gears 45 and 46. The said shaft has loosely journaled thereon a pinion 69 meshing with the gear wheel 45, and the pinion may be coupled to the shaft 65 by a clutch 70. The clutch is operated by a lever 71, and a hand wheel 72 is secured to the shaft 65 for turning the same. With this arrangement, when it is desired to operate the screw by hand, the clutch 70 is operated to connect the shaft 65 with the pinion 69. When now the shaft is rotated, the drive shaft 44 of the screw will also be operated.

It will be evident from the description that mechanism is provided, in the form of limit switches for opening the circuit of the motor at the limit of the travel of the screw in each direction. Other mechanism is provided, positively controlled by the movement of the screw, for operating the overload release of the motor control near the limit of the movement of the screw in each direction. Furthermore, mechanism is provided for permitting the screw to be operated manually in case of an emergency. When the gate is closed, the pin and slot connection 33—34, permits a limited movement of the screw after the closing. It is during this period that the head 55 compresses the springs 52 to operate the overload release.

In practice a controlling switch for the current is installed in the power house, in order that the circuit may be controlled from this point. This is of especial advantage when the power house is at a distance from the gate house motor, and of especial importance when the gate is used at the entrance of the passage way to a water turbine, in case the turbine governor should fail to cause the turbine guide valves to be closed. In such event, the motor could be at once operated to close the gate. This switch is shown at 75 in Fig. 2, it being understood that the switch may be arranged wherever desired. The switch is interposed in the circuit 76 of the motor, and it will be obvious that the motor may be started or stopped by means of the switch. The switch may

be arranged at any desired point, or other switches may be provided, if desired.

The positive lead wire 76 from the motor is connected with one of the terminals of the limit switch 57. A lead wire 77 connects the other terminal of the switch 57 with a terminal of the switch 58, and a lead wire 76^a leads from the other terminal of the switch 58 to the motor.

The switch 75 is interposed in this lead wire, as is also the overload switch indicated generally at 78.

What is claimed as new is:

1. In combination with a pivotally mounted hydraulic gate, means to open and close the gate, including a motor with an overload release, and a longitudinally movable screw connected with the gate, a nut threaded thereon, a driving connection between the nut and the motor, and means to overload the motor near the end of the closing movement of the gate, including a brake for the nut, and means on the screw for operating the brake as the screw nears the end of its downward movement.

2. In combination with a pivotally mounted hydraulic gate, means to open and close the gate, including a motor with an overload release, and a longitudinally movable screw connected with the gate, a nut threaded thereon, a driving connection between the nut and the motor, and means to overload the motor near the end of the closing movement of the gate, including a brake for the nut, and means on the screw for operating the brake as the screw nears the end of its downward movement, the brake including a pair of disks loose on the screw and movable with respect thereto, one disk engaging the nut, the screw having a head for engaging the other disk to press them toward the nut.

3. In combination with a pivotally mounted hydraulic gate, means to open and close the gate, including a motor with an overload release, and a longitudinally mov-

able screw connected with the gate, a nut threaded thereon, a driving connection between the nut and the motor, and means to overload the motor near the end of the closing movement of the gate, including a brake for the nut, and means on the screw for operating the brake as the screw nears the end of its downward movement, the brake including a pair of disks loose on the screw and movable with respect thereto, one disk engaging the nut, the screw having a head for engaging the other disk to press them toward the nut, and springs between the disks.

4. In combination with a pivotally mounted hydraulic gate, means to open and close the gate, including a motor with an overload release, and a longitudinally movable screw connected with the gate, a nut threaded thereon, a driving connection between the nut and the motor, and means to overload the motor near the end of the closing movement of the gate, including a brake for the nut, and means on the screw for operating the brake as the screw nears the end of its downward movement, a circuit for the motor, and limit switches for opening the circuit arranged in spaced relation, the screw having means to operate the switches in alternation near the end of the movement of the screw in each direction.

5. In combination with a pivotally mounted hydraulic gate, means to open and close the gate, including a motor, a screw connected with the gate, a nut on the screw, a driving connection between the nut and the motor, and mechanism including a brake for the nut and means on the screw for operating the brake near the end of travel of the screw in the closing of the gate for operating the brake to overload the motor.

Signed at Charlotte in the county of Mecklenburg and State of North Carolina this 19th day of April, A. D. 1927.

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