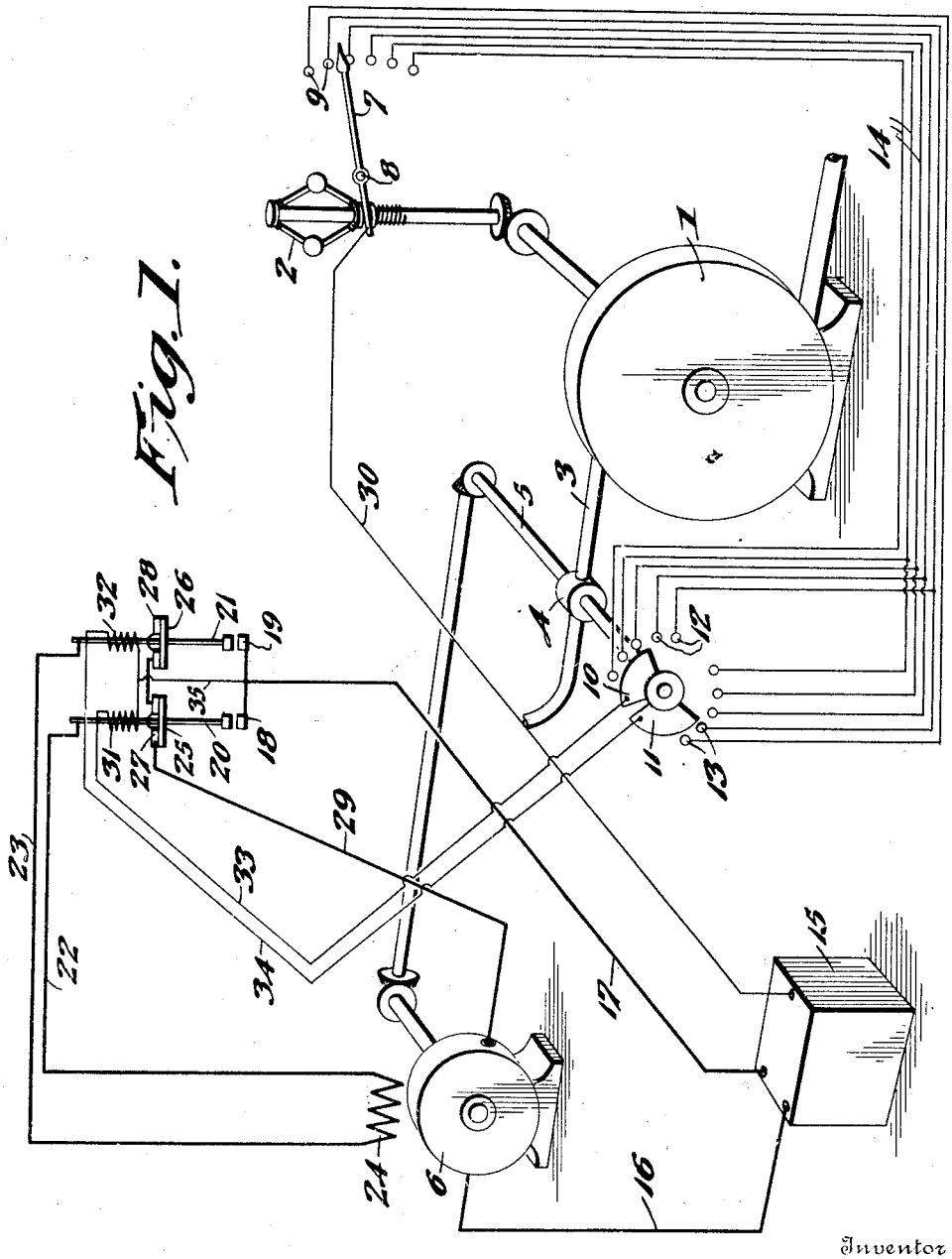
Dec. 11, 1923. 1,476,914

S. A. OAKLEY

ELECTRICALLY CONTROLLED GOVERNOR FOR WATER WHEELS

Filed Dec. 16. 1921 2 Sheets-Sheet 1

Fig. 1.



Inventor

Sterling A. Oakley

By McCrackin & Patch

his Attorneys

Dec. 11, 1923. 1,476,914

S. A. OAKLEY

ELECTRICALLY CONTROLLED GOVERNOR FOR WATER WHEELS

Filed Dec. 16. 1921 2 Sheets-Sheet 2

Fig. 2.

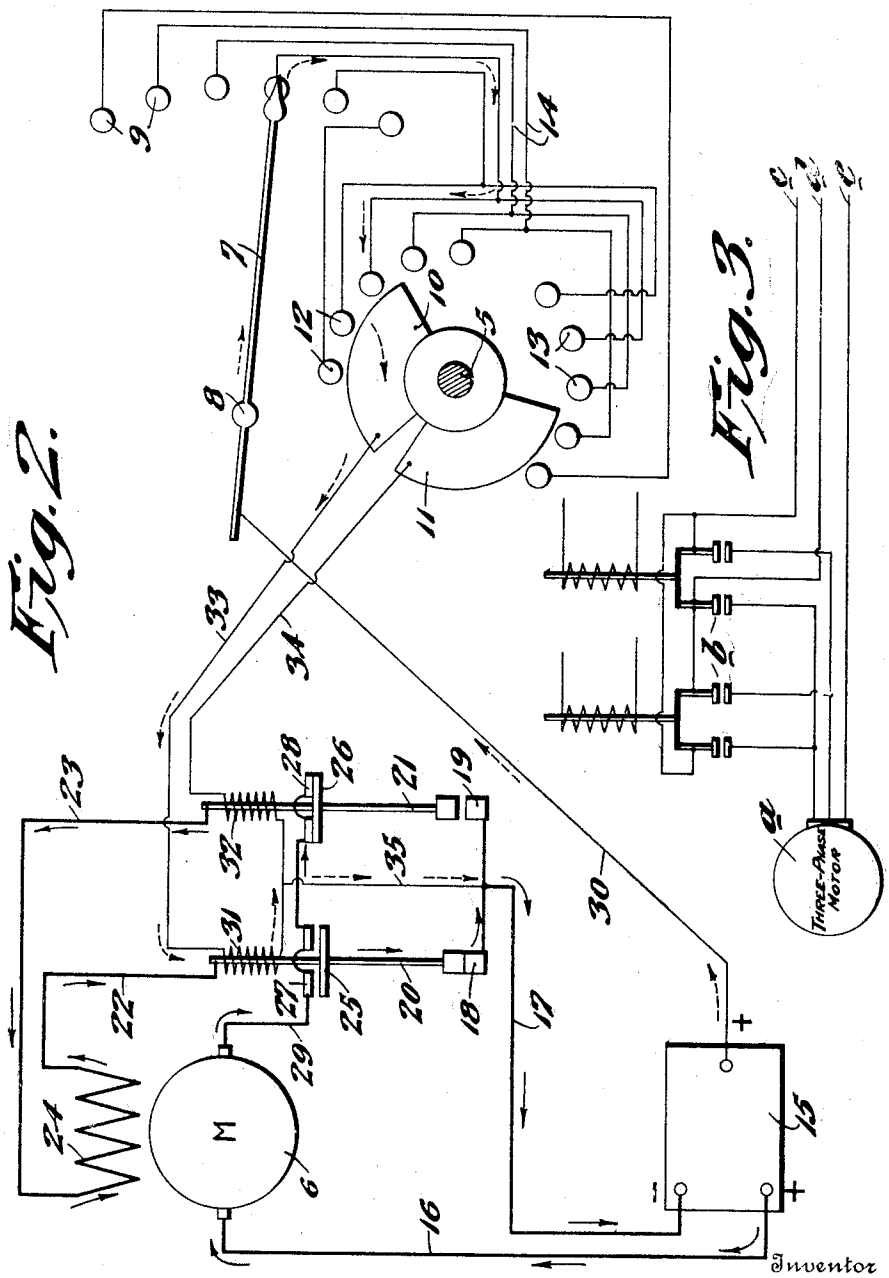


Fig. 3.

Inventor

Sterling A. Oakley

By McCracken & Patch

his Attorneys

Patented Dec. 11, 1923. 1,476,914

UNITED STATES PATENT OFFICE.

STERLING A. OAKLEY, OF BOISE, IDAHO, ASSIGNOR OF ONE-HALF TO IDA F. WARNER, OF BOISE, IDAHO.

ELECTRICALLY-CONTROLLED GOVERNOR FOR WATER WHEELS.

Application filed December 16, 1921. Serial No. 522,851.

To all whom it may concern:

Be it known that I, STERLING A. OAKLEY, citizen of the United States, residing at Boise, in the county of Ada and State of Idaho, have invented certain new and useful Improvements in Electrically-Controlled Governors for Water Wheels, of which the following is a specification.

This invention relates to electrically controlled governors for water wheels, and particularly to a speed responsive device intended for operating the gate valve on a hydraulic turbine to maintain uniform operation of the turbine.

An object is to provide a structure embracing a reversible electric motor operating the water control valve and governor actuated means to break the circuit through the motor and to establish connections in opposite directions through the motor winding to open and close the valve as may be required.

A further object resides in associating with the governer operating means an electric circuit control system for the main or motor circuit.

Another object lies in providing a structure and system which will be extremely sensitive to speed variations and which will accomplish an accurate control of the water supply to the turbine to attain and maintain the desired speed of operation.

Yet another object is to so construct the parts that adjustments can be made to suit varied conditions of operation.

With these and other objects in view, which will be apparent from the drawings, specification and claims, this invention includes certain novel features of construction and combinations of parts which will now be set forth.

In the drawings:

Figure 1 is a diagrammatic view illustrating the arrangement of a mechanism in accordance with my invention.

Fig. 2 is a diagrammatic view showing the wiring arrangement and the parts in one operative relation.

Fig. 3 is a diagrammatic view showing a modified circuit arrangement.

Referring to Fig. 1, the turbine is indicated at 1, and the governor 2 is connected with the water wheel or turbine. A water supply pipe 3 leads to the turbine and a valve 4 actuated by shaft 5 controls the supply of water to the turbine. A series motor 6 is coupled by suitable reducing gearing to turn shaft 5.

A contact arm 7 is pivoted at 8 adjacent governor 2 and has one end in engagement with speed responsive portions of the governor so that the remaining end will be swung vertically as the speed of rotation at the turbine shaft varies. A series of contact terminals 9 is arranged in position to be engaged by the contact arm 7 as it is swung by movement of the governor, and these contact terminals are so arranged that the arm is raised above the upper terminal when the governor is idle and the arm swings down past and in contact with the remaining terminals as the speed of rotation of the turbine is increased.

Shaft 5 has two segmental contact fingers 10 and 11 secured thereon, and contact terminals 12 and 13 are arranged adjacent these contact fingers and concentrically around shaft 5 to be engaged by the contact fingers as the shaft is turned. Circuit wires 14 connect contact terminals 9 with the terminals 12 and 13. Any number of terminals 9 can be provided, depending upon the delicacy of variations in the speed of the turbine which is to be accomplished, and the number of contacts 12 and 13 can be correspondingly varied.

A storage battery 15, of suitable voltage, is here shown as the source of electric current for motor 6 and a connection is established to one of the terminals of the battery by wire 16. A second wire 17 connected with the other terminal of the battery is connected with the contacts 18 and 19 of relays 20 and 21, which have connection from their remaining terminals through wires 22 and 23 to the coil 24 of motor 6.

The relays 20 and 21 are of double contact type and have the contacts 25 and 26 thereof adapted to engage with contacts 27 and 28 connected with a wire leading to motor 6. By this construction and connection of the relays electrical connections are established with the wire 29 and with wire 17 in the two extremes of movement.

A low voltage wire 30 is connected with a terminal on battery 15 of opposite polarity to the terminal with which wire 17 is connected, and this wire 30 leads to and connects with contact arm 7. Shunt coils 31 and 32 are provided for operation of the

relays 20 and 21, and wires 33 and 34 lead from contact fingers 10 and 11 to these shunt coils, a circuit wire 35 being led from both coils to connect with wire 17 of the main circuit.

The motor illustrated in the arrangement in Fig. 2 is of the series wound direct current type, and for convenience in describing the operation I have indicated the negative and positive terminals of the battery and have shown the theoretical direction of flow of current through the main circuit by full line arrows and through the secondary circuit by dotted line arrows. I have shown relay 20 in the position it will occupy when shunt relay coil 31 is built up and relay 21 in the position with shunt coil 32 neutral, and in this relation the flow of current through the motor coil 24 is in the direction of the arrow. When the turbine is stopped the balls of governor 2 drop by gravity to raise the contact arm 7 above the uppermost contact terminal 9, and as the turbine is started and the speed increases the balls of governor will be swung out by centrifugal force and arm 7 is moved around its pivot bearing to engage with the topmost terminal 9 and the lower terminals as the speed increases. Shaft 5 will be in such position that the contact finger 10 is engaged with certain of the contacts 12, and through wires 14 and 33 the secondary circuit is completed through shunt coil 31 and wires 35 and 17 back to the battery. This energization of coil 31 causes relay 20 to be shifted to the position illustrated, while relay 21 remains neutral. A primary circuit connection is thus established through wire 29 and contact 28 to wire 23 and thence to coil 24. Wire 22 leads from the coil to the stem of relay 20 and through contact 18 to the wire 17 connected with the battery. The contact fingers 10 and 11 can be set upon the shaft 5 to suit varying conditions of operation and as shaft 5 is turned to regulate valve 4 these fingers will be moved into and out of engagement with the contacts 12 and 13. Contact arm 7 is moved by governor 2 and when the speed is too high and the valve 4 is open too wide the governor will shift the contact arm to a position to establish connection through contact finger 11 and through shunt coil 32 to accomplish reversal of the flow of current through the motor coil 24 and consequently reverse the motor to turn shaft 5 in a direction to close or partly close the valve.

As shown in Fig. 3, the motor *a* and the control at *b* are connected in a three-phase line, the wires of which are indicated at *c*, *d* and *e*. The provision of the two contact points on the one relay stem permits the use of this current, and other than direct current can be used in the secondary circuit to operate the relays as before. Polyphase, alternating and direct current can be used in the two circuits.

An electric brake can be placed in series with the motor to stop the motor from spinning and hold it in place when the current is turned off should there be any vibration that might tend to open or close the valve, or other form of brake means might be used.

While, in the foregoing, I have described certain embodiments, and have mentioned only certain possible modifications, it will be appreciated that in practice I do not limit myself to such specific details as herein set forth, but may resort to any practical modifications falling within the scope of the invention as defined in the appended claims.

I claim:

1. An electrical control for fluid turbines including with a valve controlling the supply of fluid to the turbine, a speed responsive governor actuated by operation of the turbine, a reversible motor connected to open and close the valve, a source of electrical energy for said motor, a primary circuit for the motor including relays to reverse the current therethrough, a secondary circuit including means to be selectively energized to operate the relays, and means operated by the speed responsive governor to select the relay operating means and establish connections in the primary circuit to open and close the valve as low and high speeds of the turbine are attained.

2. An electrical control for fluid turbines with a turbine having a valve to be opened and closed to control the supply of fluid thereto, a shaft by which the valve is operated, a governor actuated from the turbine, a direct current series motor connected to open and close the valve, a pair of contact fingers turned with the valve shaft, a series of contacts arranged to be engaged by each of the contact fingers, a contact arm shifted by the governor, a series of contacts engaged by the contact arm, circuit connections from the contacts engaged by the contact arm to the contacts positioned to be engaged by the contact fingers, a source of direct current for the motor, a primary circuit including the motor, a secondary circuit including the contact arm and the contact fingers and having a gap closed by engagement of the contact arm with one of the contacts adjacent thereto, means in the primary circuit to reverse the current through the motor winding, and means in the secondary circuit operated as the contact arm engages the contacts to selectively set the reversing means to open and close the valve as the speed of the turbine is below and above that desired.

3. An electrical control for fluid turbines including with a turbine having a valve to be opened and closed to control the supply

of fluid thereto, a shaft by which the valve is operated, a governor actuated from the turbine, a direct current series motor connected to open and close the valve, a pair of contact fingers turned with the valve shaft, a series of contacts arranged to be engaged by each of the contact fingers, a contact arm shifted by the governor, a series of contacts engaged by the contact arm, circuit connections from the contacts engaged by the contact arm to the contacts positioned to be engaged by the contact fingers, a source of direct current for the motor, a primary circuit including the motor, a pair of relays connected in the primary circuit to be selectively shifted to close the motor to operate in one direction to open the valve and in the opposite direction to close the valve, a secondary circuit including the contact arm and having connections with the two contact fingers, and shunt coils to operate the two relays connected in the wires of the secondary circuit which have connection with the contact fingers.

In testimony whereof I affix my signature.

STERLING A. OAKLEY.