F. O. WALLENE.

HYDRAULIC APPARATUS.

APPLICATION FILED SEPT. 11, 1920.

1,411,945. Patented Apr. 4, 1922.

3 SHEETS—SHEET 1.

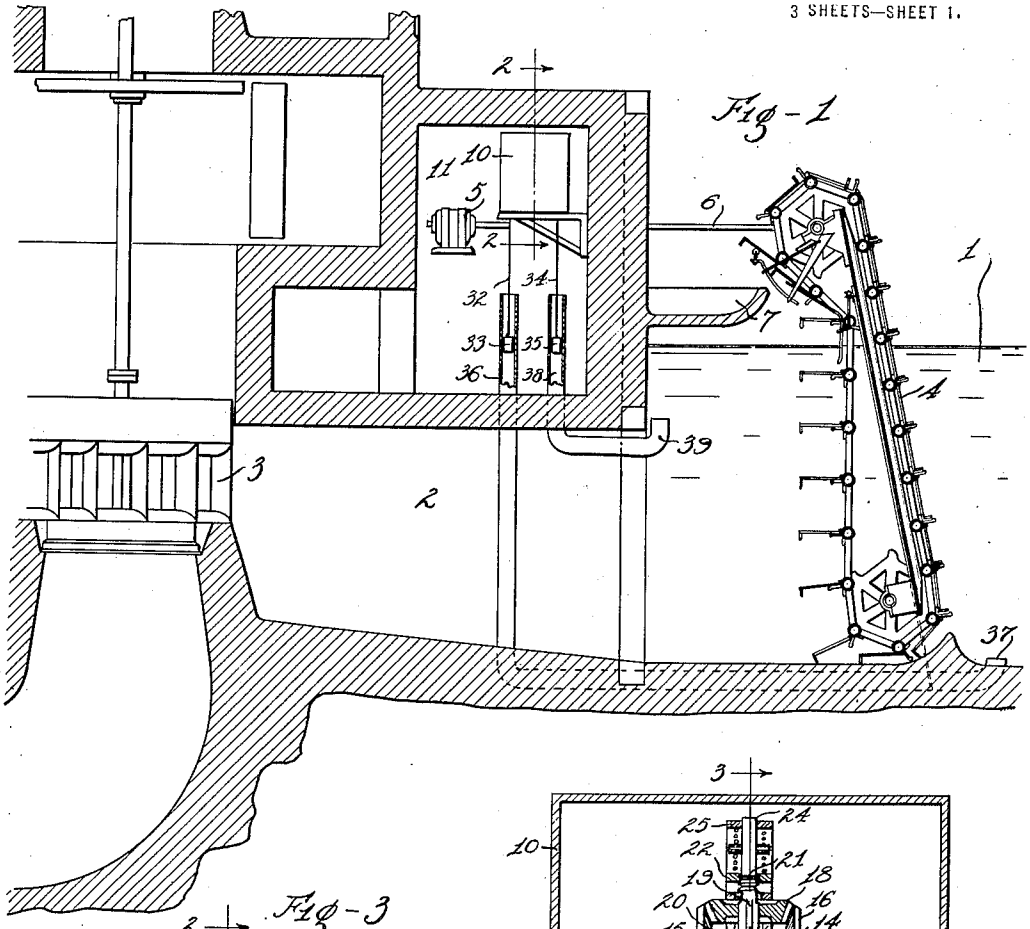


Fig-1

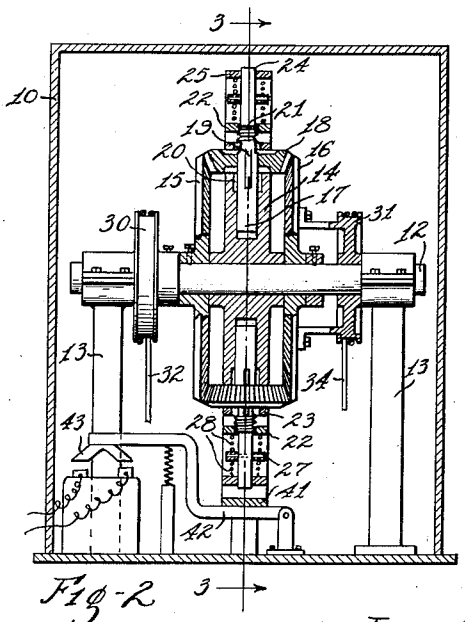


Fig-2

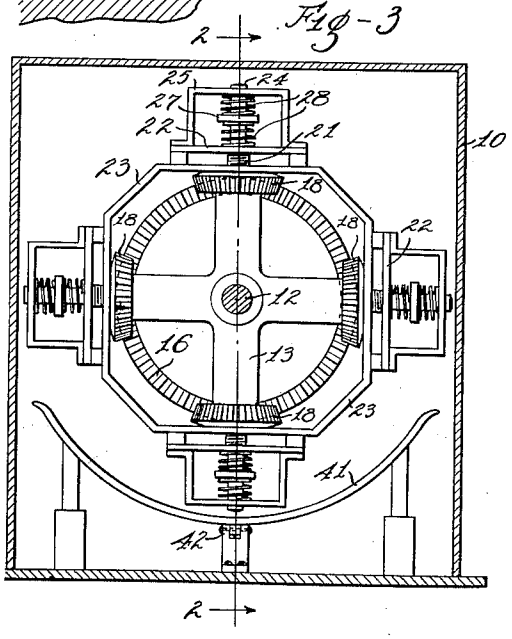


Fig-3

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3 SHEETS—SHEET 2.

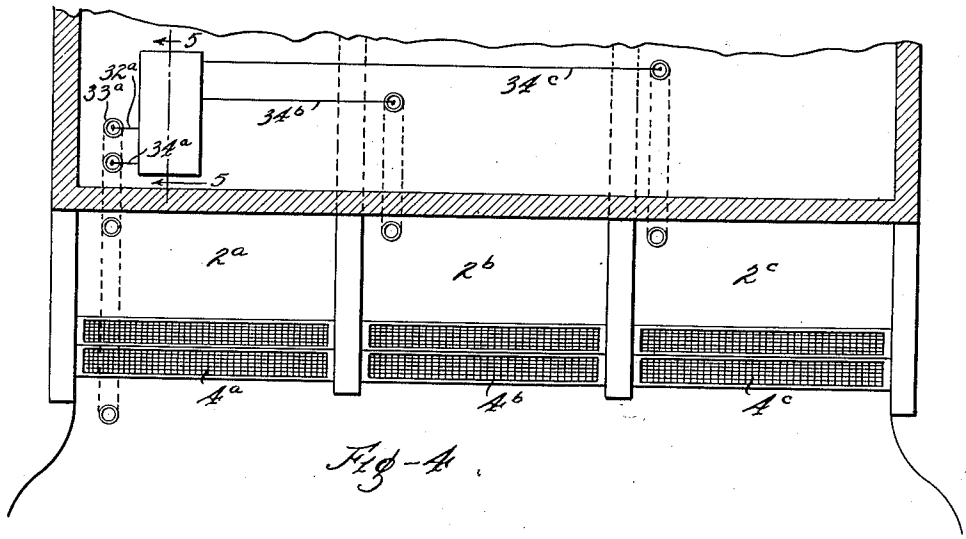


Fig-4.

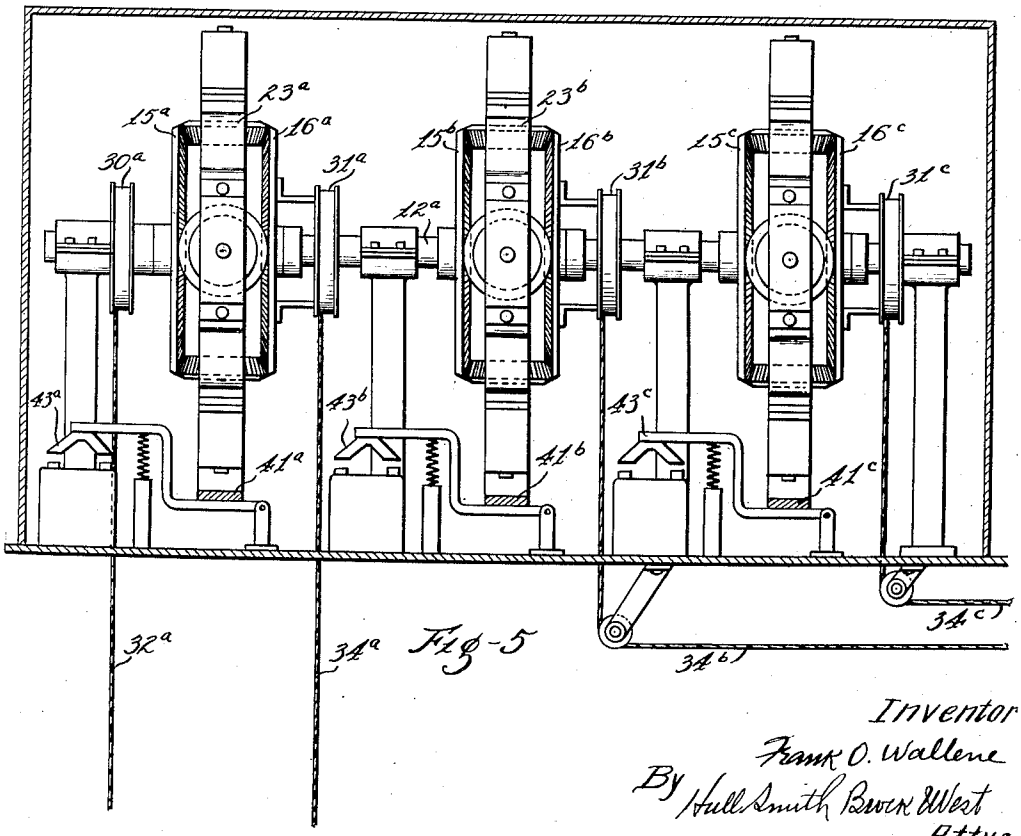


Fig-5

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3 SHEETS—SHEET 3.

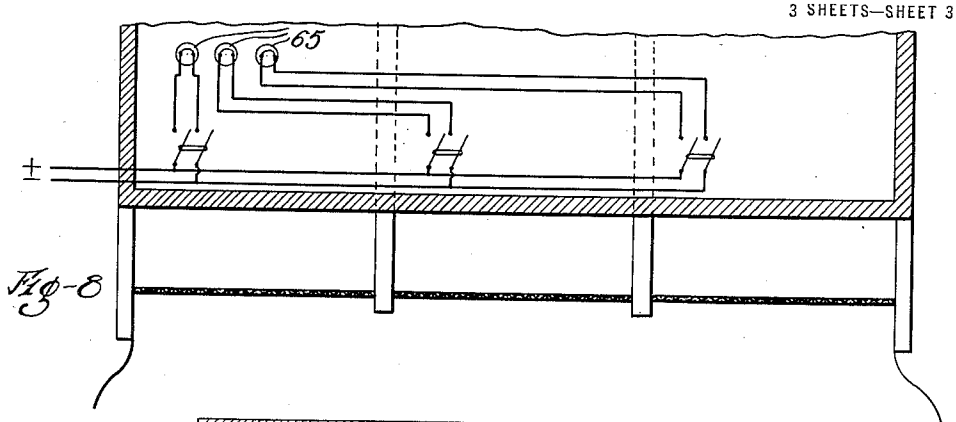


Fig-8

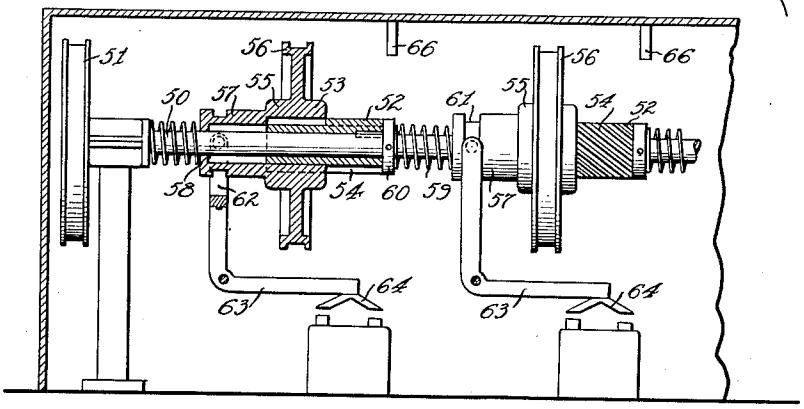


Fig-6

Fig-7

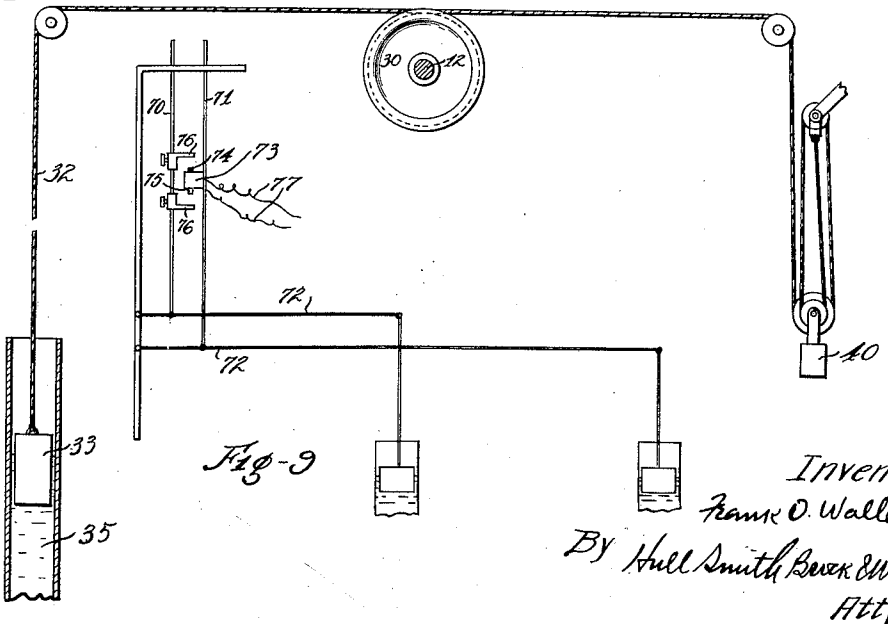


Fig-9

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UNITED STATES PATENT OFFICE.

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HYDRAULIC APPARATUS.

1,411,945. Specification of Letters Patent. Patented Apr. 4, 1922.

Application filed September 11, 1920. Serial No. 409,562.

To all whom it may concern:

Be it known that I, FRANK O. WALLENE, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Hydraulic Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to hydraulic apparatus and has especial reference to the racks or screens whereby floating litter is removed from the water and prevented from entering the turbine, pump, reservoir, or other point of use. The objects of the invention are the provision of an automatic device of this character which shall remain quiet and inactive so long as the screen is unobstructed but shall become active automatically when need shall arise and remain in action as long or often as such need continues; the provision of mechanism operative by differences in level upon the opposite sides of such a screen or rack for causing or indicating a cleansing of the same; the provision of simple and compact mechanism for controlling the operation of the cleaning apparatus; the provision of an electric switch which is operable by differences in level between two bodies of water while remaining unaffected by simultaneous changes in the level thereof; while further objects and advantages of the invention will become apparent as the description proceeds.

In the drawings accompanying and forming a part of this application I have shown certain physical embodiments of my inventive idea, although it will be understood that these drawings are intended to be illustrative merely of the principles of my invention and not to be limiting upon me. In these drawings, Fig. 1 is a sectional view through one type of hydraulic apparatus employing my invention, in this case a power generating plant; Fig. 2 is an enlarged sectional view corresponding to the line 2—2 of Figs. 1 and 3, Fig. 3 is a vertical sectional view corresponding to the line 3—3 of Fig. 2; Fig. 4 is a top plan view showing diagrammatically the application of my invention to a hydraulic plant having a plurality of separate penstocks arranged in parallel; Fig. 5 is a sectional view corresponding to the line 5—5 of Fig. 4; Fig. 6 illustrates a modified form of mechanism embodying my inventive ideas; Fig. 7 is a detail view showing the driving mechanism; Fig. 8 is a diagrammatic view showing the electrical connections employed either for signal lamps or motors; and Fig. 9 illustrates a yet simpler form of switch-operative mechanism.

Describing by reference characters the parts shown in these drawings, 1 represents the canal or forebay and 2 the flume of a hydraulic system, the same here consisting of a penstock leading to a turbine 3, although my invention is not limited to the use of closed penstocks nor to power generating plants. Traversing this canal or forebay near the end of the flume is an upright screening device 4 for the purpose of removing from the inflowing water any litter or débris that it may carry. I have here shown the particular type of self-cleaning screen described and claimed more at length in my application filed August 2, 1920, Serial No. 400,839, the same being actuated by the electric motor 5 through the agency of a suitable shaft 6 so as to remove the litter and deposit it in a suitable trough 7 or other receptacle; although my present improvements are not limited to the employment of any one type of screen or of cleaning device therefor.

Experience has shown that it is necessary to operate such a screen cleaning device only at intervals depending upon the amount of litter which the water bears, and the essence of the present invention consists in the provision of means actuated by a difference in the level of the water above and below said screen for causing an operation of the cleaning devices and to stop such operation as soon as the level becomes equalized. According to the preferred form of my invention, I employ two floats located so as to be moved by variation of the liquid level upon opposite sides of said screen, and secure these floats to a differential mechanism adapted, upon sufficient displacement, either to start the motor 5 or to illuminate a suitable lamp or to give rise to some other signal leading to a cleaning of the screen. In the embodiment shown in Figs. 1, 2, and 3 this mechanism is housed within a casing 10 located inside a chamber 11 such as is frequently provided in connection with hydraulic plants.

Inside this casing is a horizontal shaft 12 carried by suitable bearings 13—13 and hav-

ing journaled thereon a spider 14 and the two bevel gears 15, 16. Formed in the arms of this spider are radial sockets in which are loosely fitted the shafts 17, which in turn carry the bevel pinions 18 meshing with the gears 15 and 16. Relative rotation of the pinions and shafts is prevented by the splines 19 and the outer ends of the sockets are enlarged as shown at 20 to permit the free rotation of these splines. Outside of the pinions these shafts are formed for a short distance with threads 21 which engage in the cross members 22 of a movable frame 23 which surrounds said spider and holds said pinions in place. At each side of these threads the shafts are decreased in size and the outer end 24 projects through the outer walls of the brackets 25 carried on said frame. It will be seen that upon any simultaneous rotation of the gears 15 and 16 no rotation of the pinions 18 relatively to their axes will occur, but upon any relative rotation of these gears, such pinions will revolve so as to screw the shafts inwardly or outwardly as the case may be. I have shown each shaft as provided inside the limits of the bracket 25 with a fixed collar 27 having upon opposite sides the balanced springs 28—28. The threaded portion being located between two reduced portions, the end-wise travel of the shaft is limited, thus preventing any binding of the apparatus by overrunning, while the springs 28 facilitate the engagement of the threads upon reverse movement.

Secured to the bevel 15, 16 are the drums 30 and 31, respectively, the drum 30 having wrapped therearound a cable 32 which leads to the float 33 and the drum 31 carrying the cable 34 which leads to the float 35. These cables are applied to the drums in the same direction so that when pulled equally the gears will revolve together. The float 33 is so located as to be under the influence of the water in the forebay outside of the screen, preferably by being located in a vertical pipe 36 commuicating with the forebay by the passage 37, although the float can equally well be located in the forebay and a longer cable used. The float 35 is located in a similar pipe 38 communicating with the penstock-interior by the pipe 39. The opposite end of each cable is connected to a suitable take-up mechanism such as the weight 40 shown in Fig. 7, a set of pulleys being interposed if desired in order to afford a larger cable movement for a given weight-movement. The parts are so arranged that upon a falling movement of the float 35 relatively to the float 33, the shafts 17 will be protruded into engagement with a sector 41 located inside the casing 10, said sector being carried by the movable arm 42 in such wise that when displaced it will close the switch 43 and actuate the motor 5. As soon as the cleaning of the screen permits equalization of the water level, the parts will retake their original position and the motor will stop.

I have shown four shafts and a sector subtending somewhat over 90° since it cannot be foretold just which shaft will engage the same, both for the reason that a screwing out of the shafts is accompanied by a forward progressing movement thereof, and for the reason that the entire frame changes its position upon simultaneous variations in water level such as occur seasonally.

In Figs. 4 and 5 I have shown the application of my inventive idea to a system having multiple flumes arranged side by side, in which case it frequently occurs that one screen will become clogged and require cleaning independently of the others. These flumes are shown at 2^a, 2^b, and 2^c and the screens at 4^a, 4^b, and 4^c, the latter being of any suitable type since my invention is not limited to any one screening or screen-cleaning means. In this embodiment I have shown the shaft 12^a as provided with a drum 30^a which carries a cable 32^a connected to a master-float 33^a governed by the water level in the forebay. The wheels 15^a, 15^b, 15^c turn with this shaft under the control of the master-float, while the wheels 16^a, 16^b, and 16^c are connected to the separate drums 31^a, 31^b, and 31^c which are connected by cables 34^a, 34^b, 34^c respectively to the individual floats which are governed by the water level in the different penstocks. Between each pair of gear wheels 15^a, 16^a, etc., is located a frame 23^a, etc., with its corresponding shafts and pinions which cooperate with sectors 41^a, 41^b, and 41^c, to actuate the switches 43^a, 43^b and 43^c.

In Fig. 6 I have shown a simpler type of mechanism applicable either to the single-penstock installation or to a multiple installation. In this embodiment the shaft 50 is provided with a drum 51 which is under the influence of the water level in the forebay. Rigidly secured to this shaft are the sleeves 52—52, one for each penstock, a part of each sleeve having a smooth cylindrical exterior as shown at 53, and the remainder having external spiral teeth 54. Surrounding each sleeve is the hub 55 of a drum 56 suitably connected to a float (not shown) responsive to the water level in the corresponding penstock. The interior of each hub is formed with teeth adapted to fit the teeth 54, while one side of the hub is extended to form a hollow guide 57 terminating in an internal flange 58 which slides along the shaft. A spring 59 interposed between this guide and a collar 60 rigid with the shaft tends to force the hub towards the teeth 54 while the exterior of the sleeve 57 is formed with a groove 61 engaging the yoke 62 of the switch lever 63.

The cables are attached in such wise that a fall of the float in the penstock rotates the corresponding drum forwardly so as to tend to screw it to the right along the sleeve. If the water level in the forebay falls at the same rate no relative movement occurs but if the water level in the penstock becomes lower than that in the forebay, then the corresponding drum 56 moves along the threads under the combined influence of those threads and of the spring 59, thereby rocking the lever 63 and making electric contact at the corresponding switch 64. This contact can be employed either to actuate a motor directly or to operate lamps 65 or other signals heretofore described. Owing to the fact that the lateral movement of each drum is limited by the contact of the flange 58 with the end of the sleeve 52 I preferably provide some fixed part of the machine with stops 66 adapted to engage the drums at or near their extreme limit of movement and prevent their continued movement from causing such an actuation of the shaft 50 as to lead to a misfunctioning of the mechanism.

In Fig. 9 I have illustrated diagrammatically a still simpler form of switch operating mechanism comprising a pair of parallel reciprocable rods 70 and 71 operatively connected one to each of the float members heretofore described. In the present embodiment I have shown this connection as being effected by means of levers 72—72 so arranged as to decrease the amplitude of movement of the rods, although other means can be employed to this end as has already been suggested. Rigidly secured to one of the rods 71 is an electric switch 73 of the type having oppositely arranged push buttons 74—75 arranged so that upon pressing one of the buttons the contact will be established and upon pressing the other button the same will be broken. Adjustably secured to the rod 70 are a pair of laterally projecting fingers 76—76 which project one at each side of said switch in such wise that upon relative movement of the two rods in one direction the switch is closed and after a predetermined movement in the opposite direction the switch is opened. The switch is attached by means of a flexible cable 77 to the motor signal lamp or other device which is to be operated.

It will be understood that I do not confine myself to a construction in which the switch (whatever its nature) is closed by the occurrence of a difference in level between the liquids, but equally comprehends a condition in which the switch is opened thereby; it will also be seen that the screen is a kind of controlling mechanism and is typical of other kinds of controlling devices which could be used in the passageway between the two bodies of water. Also I do not restrict myself to any one construction of the switch or switch operating mechanism herein described, nor to this one use for a differential switch because the same is useful in numerous other situations. It will also be understood that many other devices of a differential nature could be employed for the purpose herein described, that any type of cleaning device can be employed, and generally that I do not restrict myself in any way except as specifically set forth in the annexed claims.

Having thus described my invention, what I claim is:—

1. The combination with two bodies of liquid and means responsive to changes in the level of each body, of an electric switch, and differential mechanism including a plurality of gears and a longitudinally movable shaft operatively connected to said means, adapted and arranged to operate said switch upon the occurrence of a predetermined amount of relative movement of said means.

2. The combination with two bodies of liquid and a float adapted and arranged to accompany changes in the level of each body, of an electric switch, and differential mechanism including a pair of gears and a longitudinally movable shaft secured to one of them operatively connected to said floats adapted to operate said switch upon the occurrence of a predetermined amount of relative movement of said floats while preventing such operation by reason of any purely simultaneous movement thereof.

3. The combination with two bodies of liquid and a passageway connecting them, of means responsive to changes in the level of each body, differential mechanism operatively connected to said means, and controlling mechanism for said passageway governed by said differential mechanism.

4. The combination with two bodies of liquid and a passageway connecting them, of float means responsive to changes in the level of each body, an electric switch, controlling mechanism for said passageway governed by said switch, and differential mechanism including cooperating gears, and a longitudinally movable shaft secured to one of them and floats operably connected to the other operatively connected to said float means adapted and arranged to actuate said switch upon the occurrence of a predetermined difference of movement between said float means.

5. In hydraulic apparatus, the combination with a screen, of automatic cleaning devices for said screen, float means responsive to changes in the level of the water upon opposite sides of said screen, and differential mechanism operatively connected to said float means and cleaning devices and adapted to start the operation of the

latter upon the occurrence of a predetermined difference of movement between the former.

6. In hydraulic apparatus, the combination with a screen, of automatic cleaning devices for said screen, means responsive to changes in the level of the water upon opposite sides of said screen, an electric switch, and mechanism connected to said switch and means adapted to operate said switch upon the occurrence of a predetermined difference in water level on opposite sides of said screen while preventing operation thereof upon any simultaneous change in level no matter how pronounced.

7. In hydraulic apparatus, the combination with a screen, of automatic cleaning devices for said screen, float means responsive to changes in the level of the water on opposite sides of said screen, and operating mechanism for said cleaning devices adapted to actuate the same during the existence of a predetermined difference in level between said float means and to prevent such actuation except when said float means are displaced relatively to each other through such predetermined amount.

8. In hydraulic apparatus the combination with a forebay, flume, a screen, and cleaning devices for said screen of means actuated by a difference in the level of the water above and below said screen for causing an operation of said cleaning devices and for stopping such operation as soon as the level becomes equalized.

9. In hydraulic apparatus, the combination with a forebay and a plurality of flumes leading therefrom, a screen for each flume, and a cleaning device for each screen, of means actuated by a difference between the water level existing in said forebay and in any flume for causing an operation of the corresponding cleaning device, and for stopping such operation as soon as the level becomes equalized.

10. In hydraulic apparatus, the combination with a forebay and a plurality of flumes leading therefrom, a screen for each flume, and a cleaning device for each screen, of a master float under control of the water in said forebay, an independent float under control of the water in each flume, and differential mechanism operatively connected to said floats and adapted upon the occurrence of a predetermined difference in level between said master float and any individual float to start, the operation of the cleaning device for the screen which corresponds to such individual float.

11. In hydraulic apparatus, in combination, a forebay, a flume, a screen therefor, a power operated cleaning device for said screen, a motor for said cleaning device, a pair of floats under the control of the water level on opposite sides of the screen, and means connected to both floats adapted to start said motor upon the occurrence of a predetermined difference in level of said floats.

12. In mechanism of the character described, in combination, a pair of floats, a pair of movable members operatively connected to said floats, and switch means operatively connected to said members through means including gears and pulleys so as to be actuated upon a predetermined amount of relative movement between said members and to remain inactive upon every simultaneous movement of said members.

13. The combination of a power-supply control and means including gears and pulleys and a longitudinally movable shaft for actuating the same upon the occurrence of a difference in the relative height of two bodies of liquid, said means being arranged to prevent actuation in case the height of the two bodies changes simultaneously.

14. In hydraulic apparatus, the combination with a screen, of float means responsive to changes in the level of the water upon opposite sides of said screen, differential mechanism operatively connected to said float means, and an electric switch operatively connected to said mechanism so as to be actuated by a predetermined relative movement of said float means and to remain unactuated upon any simultaneous movement thereof.

15. In hydraulic apparatus, the combination with a screen, of float means reponsive to changes in the level of the water upon opposite sides of said screen, differential mechanism comprising differential gears one of which is connected with a longitudinally movable shaft operatively connected to said float means, and controlling mechanism operatively connected to said mechanism so as to be actuated by a predetermined amount of relative movement of said float means.

16. The combination with two bodies of liquid and a screened passageway connecting them, of an electric switch, and means responsive to a predetermined unequal change in the surface levels of said bodies for operating said switch, said means being unresponsive to any equal change in such surface levels.

In testimony whereof, I hereunto affix my signature.

FRANK O. WALLENE.