April 17, 1928. 1,666,498

C. W. LINDEMANN

FLOAT OPERATED ELECTRIC SWITCH ACTUATING MECHANISM

Filed April 9, 1926 2 Sheets-Sheet 1

Fig. 1.

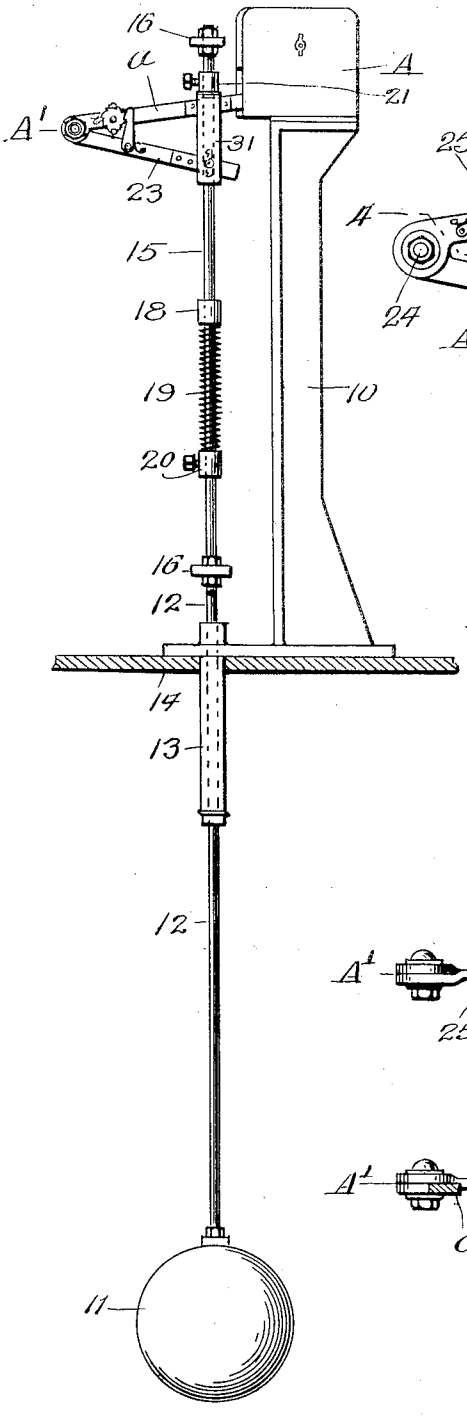


Fig. 2.

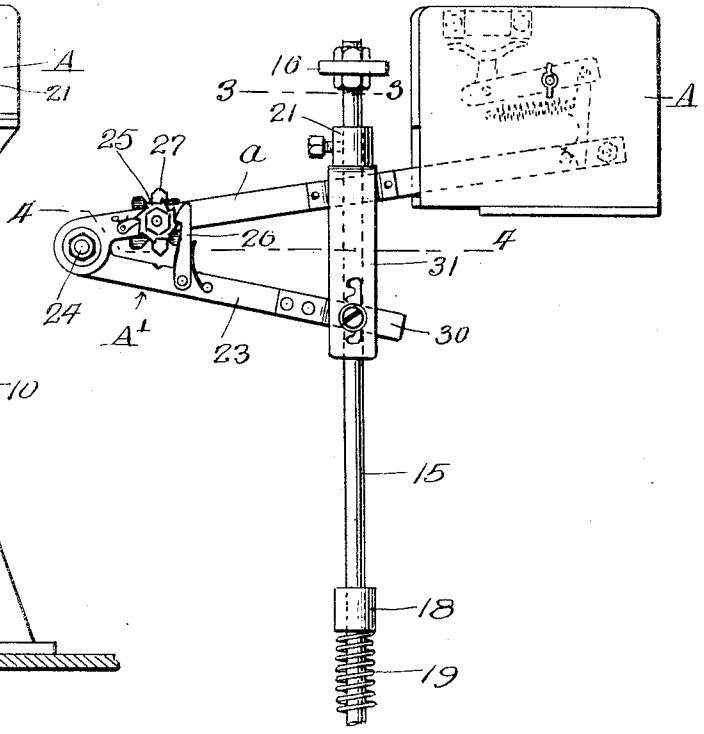


Fig. 3.

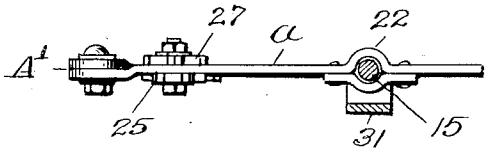
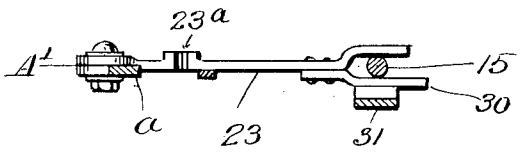


Fig. 4.



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Fig. 5.

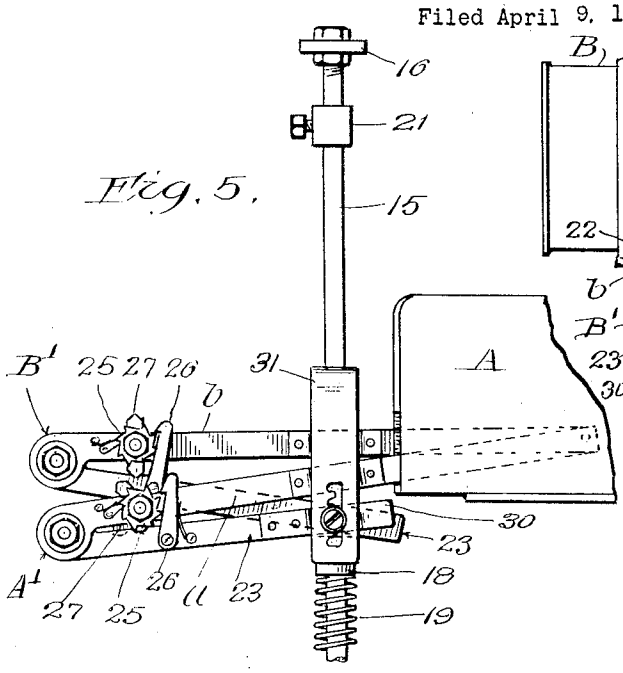


Fig. 6.

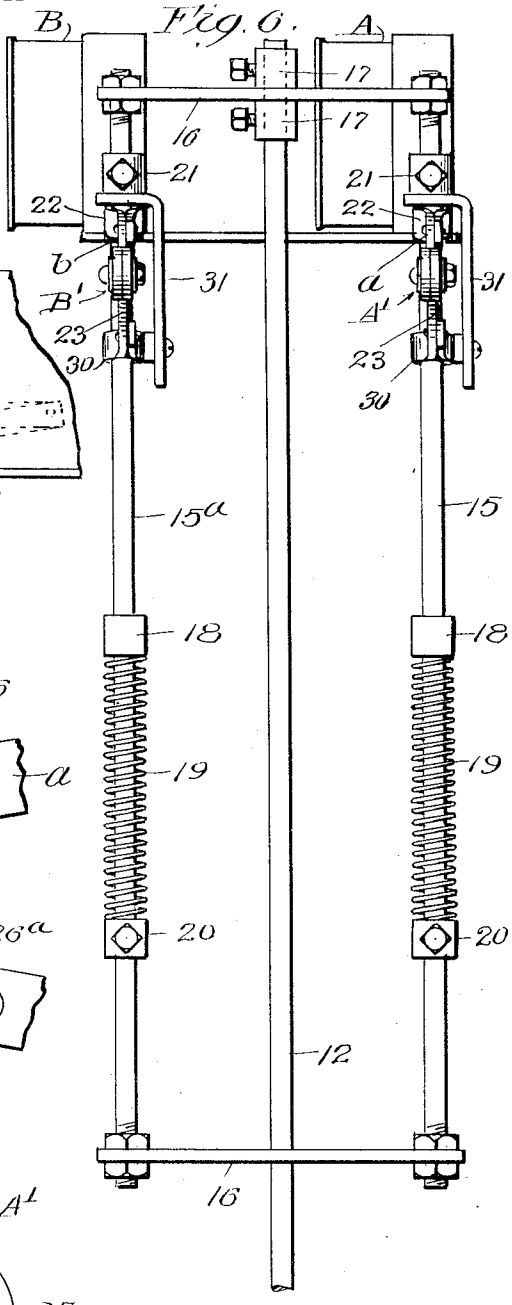


Fig. 7.

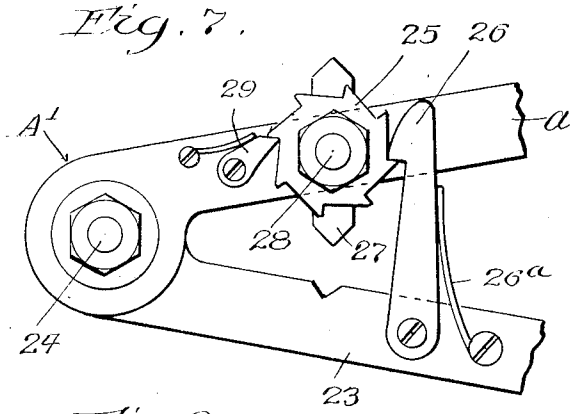
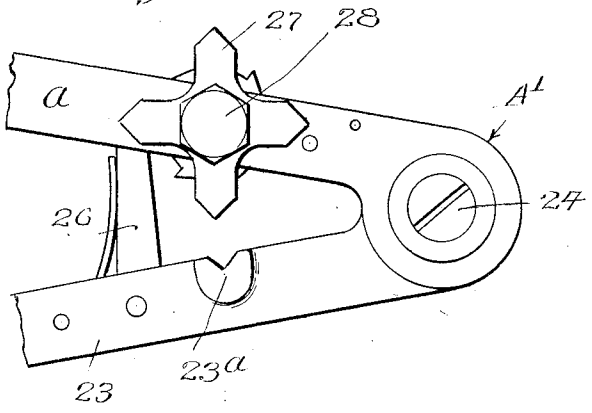


Fig. 8.



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UNITED STATES PATENT OFFICE.

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FLOAT-OPERATED ELECTRIC-SWITCH-ACTUATING MECHANISM.

Application filed April 9, 1926. Serial No. 100,795.

This invention relates to float operated electric switch actuating mechanism, and its principal object is to provide automatic means for closing the electric switches for the motors of electrically operated pumps or other apparatus, in a regular sequence, and opening said switches when the pump or other apparatus has performed its work.

In many situations it is customary to employ two pumps, as for example, bilge pumps, for the same well or reservoir, one or the other of the pumps being operated at a time, to pump excess water out of the well or reservoir when the level thereof reaches a predetermined height, the other pump serving as an auxiliary pump, in case the volume of water accumulating in the well or reservoir is greater than the capacity of the pump, the auxiliary pump thereupon serving to aid the other pump in removing the excess water.

To minimize the wear and tear on each pump, manually operated means have been provided for causing the pumps to operate alternately, the quiescent one serving as the auxiliary pump and operating only when the level of the water reaches an abnormal height. One of the objects of the present invention is to provide automatic means for alternately closing the electric switches for the two pumps and operating to close the switches of both pumps in case the water reaches a high level, whereby both pumps may operate simultaneously to discharge the excess water. Other objects and advantages will appear in the course of this specification, and with all of said objects and advantages in view, this invention consists in a float operated electric switch actuating mechanism for a plurality of the motors of pumps or other apparatus, and having automatically acting means for actuating the switches alternately. It further consists in float operated switch actuating mechanism of the kind specified, in which the automatic switch actuating means is arranged to actuate both switches on an up stroke of the float, one switch being operated when the float reaches a predetermined height, and the other switch being operated when the float reaches a higher predetermined height. The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation of a float operated switch actuating mechanism embodying a simple form of the present invention; Fig. 2 is a side elevation of the switch actuating mechanism shown upon a larger scale; Fig. 3 is a detail horizontal section taken on the line 3—3 of Fig. 2; Fig. 4 is a detail horizontal section taken on the line 4—4 of Fig. 2; Fig. 5 is a side elevation of the switch actuating mechanism showing the parts in a different position from that seen in Fig. 2; Fig. 6 is a front elevation of the switch actuating mechanism; Fig. 7 is an enlarged side elevation of one of the switch lever units employed; and Fig. 8 is a side elevation of the unit seen in Fig. 7 but looking at the opposite side thereof.

Referring to said drawings, which illustrate a simple embodiment of the present invention, the reference characters A, B, designate two electric switches of common and well known form, which are connected to the motors of two motor driven pumps (not shown) that may be used for pumping water or other liquid from one and the same well or reservoir. The capacity of each pump is usually sufficient to pump excess water from the well or reservoir when it reaches a predetermined level, and two pumps are employed so that in case one becomes inoperative the other one may function, and also in order that one may act as an auxiliary pump in case the other is unable to remove the excess water as rapidly as it accumulates. To distribute the wear evenly on both pumps they are caused to operate alternately, and the means herein described has been devised for the purpose of closing the switches A, B, alternately, upon the rise and fall of water in the well or reservoir, and for the purpose of closing both switches in case the level of the water reaches a point higher than the predetermined level at which the mechanism actuates one switch. The switches may be mounted on any suitable support 10, and are operated by a float 11, contained in the well or reservoir, and connected to the switch levers *a*, *b*, of the switches by a float rod 12 and the switch actuating mechanism forming the subject matter of this specification. Preferably the float rod 12 is guided in a tubular guide 13 mounted

on the cover or top 14 of the well or reservoir.

In the form of the invention illustrated, the float rod 12 has secured to it, two switch actuating rods 15, 15ª, arranged parallel with the float rod 12, and secured thereto by upper and lower cross members 16, secured to the rods 15, 15ª, and collars 17, one located on each side of one of the cross members and secured to the float rod by set screws, as shown. It will be understood that the switch actuating rods 15, 15ª move in unison with the float rod. Upon each rod 15, 15ª, is a collar 18, 18, either fixed thereto or yieldingly supported thereon, as by a coiled compression spring 19, surrounding the rod and resting on a collar 20, secured to the rod by a set screw. Fixedly secured on each rod 15, 15ª, at points above the collars 18, are other collars 21, 21, and between said collars 18, 21, of each rod 15, 15ª, is one of the switch levers *a*, which is arranged to be actuated by said collar 18.

Each switch lever *a*, or *b*, is part of a switch actuating unit A^1, B^1, and as both units are practically alike a description of one will suffice for both. Each switch actuating lever *a* or *b* has an eye 22 that surrounds its associated rod 15 or 15ª, at a place between the collars 18, 21. Interposed between the switch lever *a* or *b* and the associated collar 18, is automatically acting means for rendering the collar ineffective for the purpose of actuating the associated switch actuating unit on the alternate up strokes of the float rod, and for making it effective for that purpose on the intermediate up strokes, or performing said functions in any other desired sequence.

As shown, the means for effecting this result, comprises a lever arm 23 pivotally connected to the outer end of the switch lever by a bolt or other pivotal connection 24, a ratchet wheel 25 rotatively mounted on one of the members *a* or *b* and 23, a dog 26 mounted on the associated member and spring pressed into engagement with the ratchet wheel 25 by a spring 26ª, and a strut or star wheel 27, rigidly connected with the ratchet wheel and adapted to occupy an active or primary position or an inactive or secondary position with respect to the member on which the dog is mounted. In the present instance, the ratchet wheel is rotatively mounted on the switch lever and the dog is mounted on the arm 23. Both the ratchet wheel and strut or star wheel 27 are rigidly secured on a pin 28 which passes through a bearing aperture in the lever *a* or *b* and a spring pressed pawl or detent 29 engages the ratchet wheel 25 and prevents retrograde movement thereof. The strut or star wheel 27 is formed with radially extending arms, the outer end of each one of which is arranged to engage the arm 23, or a lug 23ª thereon, in the active or primary position of the strut or star wheel, and thereby form a rigid connection between the arm 23 and switch lever, whereby when the arm is moved upward, the switch lever will be moved therewith as a part of the unit. In the inactive or secondary position of the strut or star wheel the outer ends of its arms do not encounter the lug on the arm 23, when said arm 23 is moved upward, but said arm moves up idly through a predetermined distance, thereby permitting the associated switch lever to remain idle during said idle upward movement of the arm 23. To insure a positive connection between the strut or star-wheel 27, the outer ends of its arms are pointed and a V-shaped notch is formed in the arm 23 or its lug 23ª, into which the pointed end of the strut or star wheel arm enters. It will be observed that whenever the arm 23 is swung upward on its pivot 24, it first has a slight idle upward movement before it strikes the protruding arm of the strut or star wheel, and during said idle movement the dog 26 moves upward the distance between two teeth of the ratchet wheel 25, whereby on the downward movement of the arm 23 the dog 26 may turn the ratchet wheel and therewith the strut or star wheel one step, bringing a space between the arms of the strut or star wheel above the notched lug of the arm 23 and rendering the arms of the strut or star wheel inactive, so that upon the succeeding up stroke of the arm 23 it will not strike an interposed arm of the strut or star wheel but may move upward idly until it encounters the eye 22 of the switch lever (see Fig. 5), after which upward movement of the arm 23 and switch lever will proceed as a unit.

From the above it will be seen, that in one position of the strut or star wheel, the float rod may move upward for a considerable distance after the collar 18 has engaged the arm 23, before it commences to swing the switch lever upward, and that in the other position of the star wheel the switch lever is swung upward almost immediately after the collar 18 encounters the arm 23. The result is that in the active or primary position of the strut or star wheel, the switch is closed when the level of the water reaches a predetermined height in the well or reservoir, and in the inactive or secondary position of the strut or star wheel, the switch is not closed until the level of the water reaches a higher place.

The arm 23 extends to the switch actuating rod and it has an eye or fork 30 that is arranged to be engaged by the collar 18 during the up stroke of the float. Secured to the arm 23 is a strut 31 which extends upward and has a bent end that engages around the rod 15, or 15ª, and is adapted to

be encountered by the collar 21 on the down stroke of the float. When engaged by the collar 21 on its down stroke the strut and therewith the arm and switch actuating lever are moved downward. The strut may be provided with adjustment means whereby the position of its upper end may be varied.

The struts or star wheels 27 of the two switch actuating units are set so that one is in active or primary position while the other is in inactive or secondary position, and in the operation of the mechanism, the float, on reaching the predetermined height (governed by the level of the water in the well or reservoir) has raised the float rod and therewith the collars 18, brought them into contact with both arms 23, and swung upward both arms 23. The switch actuating unit in which the strut or star wheel occupies an active position, is therefore swung upward as a unit until the switch is closed, thereby closing the circuit to the associated pump motor and setting the pump in operation. This takes place before the lever of the other switch actuating unit has been swung upward any considerable distance. The pump being started, water is pumped out of the well or other reservoir, and as the level of the water lowers, the float, float rod and associated parts, including the collars 18, 21, are lowered, and the arm 23 of the inactive switch actuating unit drops to normal position. When the float reaches its lower limit the collar 21 encounters the strut 31, thereby depressing it and the arm 23 of the active unit and opening the switch. As the arms 23 move downward, their dogs 26 engage the ratchet wheels 25 and advance them one tooth, thereby reversing the active positions of the struts or star wheels 27, so that upon the next up stroke of the float, the unit which has been idle becomes the active unit and closes its associated switch. Regardless of which unit is active in closing its switch, if the water continues to rise above the predetermined level, and the one active pump is unable to discharge the excess water from the well or other reservoir faster than it accumulates, the float continues to rise and lifts the float rod until the proper collar 18 has swung upward the idle unit and closed the switch to the other pump, thereby setting both pumps in operation. When the float falls to normal position both units are swung down as before, and both switches opened. The strut or star wheels are also actuated as before. The upper movement of the switch actuating levers *a*, *b*, is limited by the housings of the switches, and the springs 19, under the collar which closes the first switch, permits the two connected switch actuating rods 15, 15ª, to move upward, and therewith the other collar 18, whereby said collar may continue to move upward and close the open switch in case of necessity. The float rod and connections between the float rod and switch actuating rods may be omitted, and each switch actuating rod may be provided with a float whereby each switch actuating rod may move independently of the other.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention; I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims, to point out all of the invention disclosed herein.

I claim as new and desire to secure by Letters Patent:

1. In float operated electric switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, and connecting mechanism between said float rod and switch lever including an operating strut interposed between the float rod and switch lever and having an active position for transmitting motion from the float rod to the switch lever when the float reaches a predetermined high level, said operating strut having a secondary position for transmitting motion from the float rod to the switch lever when the float reaches a different predetermined high level, and automatically operating means for setting said operating strut into active and secondary positions in regular sequence.

2. In float operated electric switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, and connecting mechanism between said float rod and switch lever, comprising an operating strut interposed between the float rod and switch lever and having an active position for transmitting motion from the float rod to the switch lever, and a secondary position, and automatically acting means operated by the float rod for alternately setting said operating strut in active position.

3. In float operated switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, and automatically operating means interposed between the float rod and switch lever for actuating the switch lever in two positions of the float, comprising a lever operating member, having two spaced apart operative positions at which it is operatively engaged by the float rod, and automatically operating setting means for setting said lever operating member in one of said positions.

4. In float operated switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, and automatically operating lever actuating means interposed between the float rod and switch lever, for actuating the switch lever

in two positions of the float, comprising a strut mounted on the switch lever and having an active lever actuating position and an inactive position, and automatically operating means for setting said strut in active and inactive positions, said means being operated by the float rod, and arranged to actuate the switch lever through said strut, in one position of the float, and to actuate the switch lever without said strut in a second position of the float.

5. In float operated electric switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, an arm pivotally connected to said switch lever, a star wheel rotatively mounted on said switch lever and having an active position for engagement with said arm, and an inactive position, and means operated by said arm for setting said star wheel in active and inactive positions, and a shoulder on said float rod arranged to engage and actuate said arm when moved upward by the float.

6. In float operated switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, a lever operating collar on said float rod, a lever operating arm pivotally mounted on said lever, and having two operative positions, and adapted to be actuated by said collar in two positions of the float, a star wheel rotatively mounted on said switch lever, and having an active position engaging said arm to hold it in a spaced position relative to the lever, and an inactive position, a ratchet wheel connected to said star wheel, and a dog connected to said arm and engaging said star wheel.

7. In float operated switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, upper and lower collars on said float rod, a lever actuating arm pivotally connected to the switch lever and having a part lying in the path of the upward movement of the lower collar and arranged to be actuated thereby, an upstanding member secured to said arm and having a part lying in the path of the downward movement of the upper collar and arranged to be depressed thereby, and arm holding means interposed between said switch lever and arm, having an active position engaging said arm and holding it in widely spaced relation to the switch lever, and having an inactive position permitting movement of said arm relative to the switch lever, and automatically operating means operated by said arm, for setting said arm holding means.

8. In float operated switch actuating mechanism, the combination of an electric switch and its switch lever, a float and its float rod, upper and lower collars on said float rod, a lever actuating arm pivotally connected to the switch lever and having a part lying in the path of the upward movement of the lower collar and arranged to be actuated thereby, a vertically adjustable upstanding member secured to said arm and having a part lying in the path of the downward movement of the upper collar and arranged to be depressed thereby, and arm holding means interposed between said switch lever and arm, having an active position engaging said arm and holding it in widely spaced relation to the switch lever, and having an inactive position permitting movement of said arm relative to the switch lever, and automatically operating means operated by said arm, for setting said arm holding means.

9. In a float operated electric switch actuating mechanism, the combination of a plurality of electric switches and their switch levers, a float and its float rod, and connecting mechanism, between the float rod and switch levers for operatively connecting the float rod with said switch levers in a predetermined sequence, each connecting mechanism including an operating member having an active and an inactive position, and means for actuating said operating member, the operating member of one connecting mechanism alternating with the one of the other connecting mechanism to connect the float rod with said switch levers, in a predetermined sequence.

10. In a float operated electric switch actuating mechanism, the combination of a plurality of electric switches and their switch levers, a float and its float rod, and connecting members between the float rod and switch levers for operatively connecting the float rod with said switch levers in alternate sequence, each connecting member having an alternately active and inactive strut, and the active position of one strut alternating with that of the other, whereby one connecting member actuates an associated switch lever each time the float is raised to a predetermined level, the one connecting member alternating with the other in the successive up strokes of the float.

11. In a float operated electric switch actuating mechanism, the combination of a plurality of electric switches and their switch levers, a float and its float rod, lever actuating arms, one pivotally connected to each switch lever, means mounted on the float rod for actuating said arms, an operating strut mounted on each switch lever and arranged to operatively engage the associated arm, whereby the switch lever and arm may move as a unit, each operating strut having an inactive position permitting an idle movement of the arm with respect to the switch lever, and means mounted on each arm arranged to actuate said operating strut and

alternately set it in active and inactive positions, on successive up strokes of said arm actuating means of the float rod.

12. In float operated electric switch actuating mechanism, the combination of a plurality of electric switches and their switch levers, a float and its float rod, lever actuating arms, one pivotally connected to each switch lever, means mounted on the float rod for actuating said arms, star wheels, one rotatively mounted on each switch lever and having arms arranged to successively engage the associated lever actuating arm, and a dog mounted on each lever actuating arm arranged to advance the associated star wheel in a step by step manner, said star wheel having inactive positions, wherein said lever actuating arm remains temporarily inactive.

13. In float operated switch actuating mechanism, the combination with two electric switches and their switch levers, a float, and its float rod, switch actuating rods, one for each switch lever, mounted on said switch rod, collars, one yieldably mounted on each switch actuating rod, and alternately operating switch actuating means, one for each switch lever, interposed between said switch levers and switch actuating rods, and including members arranged to be engaged by said collars.

14. In float operated switch actuating mechanism, the combination with two electric switches and their switch levers, a float, and its float rod, switch actuating rods, one for each switch lever, mounted on said switch rod, collars, one yieldably mounted on each switch actuating rod, lever actuating arms, one pivotally connected to each switch lever and lying in the path of an associated collar, and alternately acting connecting means between each switch lever and its associated actuating arm.

15. The combination with a reciprocating element and an element which is to be actuated thereby, of a connecting member interposed between said elements, and having two spaced apart operative positions for transmitting motion from said first mentioned element to the second named element and automatically operating setting means for setting said member in at least one of said operative positions.

16. The combination with a reciprocating element and an element to be actuated thereby, of a connecting member interposed between said elements, and having an active position for transmitting motion from said first mentioned element to the second named element, and a secondary active position, and setting means for intermittently setting said connecting member in active position.

17. The combination with a reciprocating element and an element to be actuated thereby, of a connecting star wheel member interposed therebetween, and having active position and a secondary active position, and automatically operating means for alternately setting said star wheel in said active positions.

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