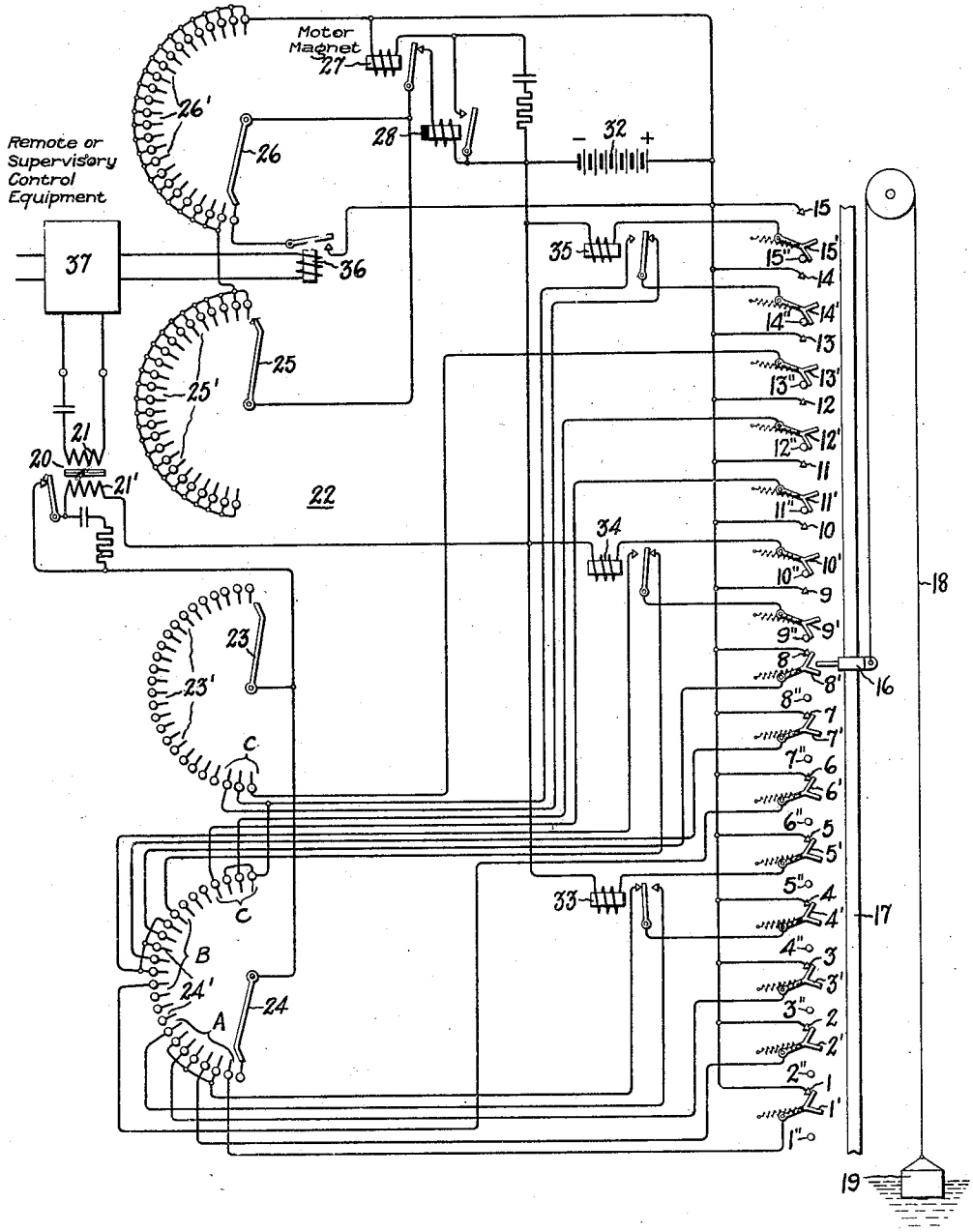
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INDICATING SYSTEM

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INDICATING SYSTEM

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My present invention relates to remote indicating systems and more particularly to improvements in means for remotely indicating the position of apparatus units which are operable to three or more positions.

Means have been proposed in the prior art for transmitting from a remote point to an operator's station a number of impulses of equal duration corresponding to the position of a water gate, for example, or other element the position of which is to be indicated. Where the position of an element which is operable to a large number of positions is to be indicated the number of impulses transmitted by means of the type indicated is such that the counting of the impulses by the operator becomes tiresome and annoying and the likelihood of error is great.

One of the objects of my invention is to provide means whereby a code of impulses may be transmitted to the operator's station corresponding to the position of the desired movable element, the code comprising a number of long and short impulses proportioned in accordance with the displacement of the element from a predetermined reference point. Thus, for example, in accordance with my invention means are provided whereby when the element is displaced from a predetermined reference point by a number of whole units a corresponding number of long impulses will be transmitted indicating the position of the element with reference to said point. If the displacement of the element is less than a whole unit a number of short impulses will be transmitted corresponding to the number of fractions of a unit of displacement of said element from the reference point. Further, if the displacement be greater than one or more whole units by certain fractions of a unit a number of long impulses will be transmitted corresponding to the number of whole units of displacement and also a number of short impulses corresponding to the additional fractions of a unit of displacement of the element from the reference point. Thus the long and short impulses are proportioned in code in accordance with the position of the movable element.

Another object of the invention is to provide means whereby the position of a unit which is operable to three or more positions may be determined from a remote point which are comparatively simple in circuit arrangement and which may be economically constructed and employed in connection with remote control and supervisory systems of types now well known in the art.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which the single figure represents an embodiment of my invention.

Referring to the drawing I have shown at 16 a movable element which is arranged for slidable engagement upon a vertical supporting member 17. This element may in itself constitute a member, the position of which is to be indicated at a remote point, or the element may be movable dependently upon some other variable the position, or condition, of which is to be remotely indicated. I have shown the member 16 as being connected, by means of a cable 18, with a float 19 which may vary in position, for example, depending upon the height of water at a dam, or density of liquid in a tank, which height, or density, is to be remotely indicated at the remote point.

Disposed along the path of movement of the element 16 are a plurality of stationary contacts indicated at 1, 2, 3—15 each of which has cooperating therewith a movable contact 1′, 2′, 3′—15′. Each of these movable contacts is pivotally supported at the left end, as shown in the drawing, and the right end thereof is arranged to oscillate about this support between the cooperating stationary contact and a lower stop 1″, 2″, 3″—15″. The right end of each of the movable contacts is forked and is so positioned with reference to the member 16 that as the member 16 travels in its path past any of the oscillating movable contacts it engages the

foremost tine of the fork and carries the fork with it over center, and into engagement either with the stationary contact or the stop, in which position the movable contact is retained by a suitable biasing spring.

Thus for example as the member 16 moves upward in its path it engages the upper tines of the respective forked contacts as it passes and carries them upward into engagement with their upper contacts where they are retained by their biasing springs. In its downward movement the member 16 engages the lower tines of the movable contacts and carries them out from engagement with their stationary contacts and causes them to rest upon the corresponding stop.

The signal transmitter, which I employ in connection with my system, comprises an oscillation generator in the form of an induction coil 20 having a secondary winding 21 and a primary winding 21′ which is connected in circuit with the usual interrupter contact. The output from the generator may be supplied through a suitable supervisory control system 37 to a supervision station. This oscillation generator is arranged to be controlled by means of the lower wipers 23 and 24 of a rotary switching device 22.

The switching device comprises an ordinary selector switch which is well known in the art, one type of which is shown in Patent No. 1,472,465 to O. E. Forsberg et al., issued October 30, 1923. As shown, the selector switch comprises four single ended wipers 23, 24, 25 and 26 and their cooperating banks of contacts 23′, 24′, 25′ and 26′. The lower two banks of contacts 23′ and 24′ and their cooperating wipers are employed in connection with the contacts 1′, 2′, 3′—15′ to control the signal device 20, whereas the upper two banks of contacts 25′ and 26′, together with their cooperating relays 27 and 28, act as a motor continuously to rotate the different wipers step by step.

The wipers 23 and 24 extend in opposite directions and alternately engage their respective banks of contacts. These wipers are connected in circuit with the primary winding of induction coil 20, which circuit includes in the different positions of the respective wipers 23 and 24, the contact 1′, 2′, 3′ etc. depending upon the number of these contacts which have been operated to their upper position by movement of the member 16. In this way a number of impulses may be transmitted depending upon the position of the member 16.

Having now generally indicated the character of the equipment to be described a better understanding may be had by reference to its operation.

The switch 22 may be set into operation by energization of the winding of relay 36, which winding may be energized through the remote control or supervisory equipment 37. Upon energization of this relay a circuit is completed which extends from the positive side of the source of potential 32 through the contacts of relay 36, normal contact of the bank 26′ and wiper 26, interrupter contacts of motor magnet 27, winding of relay 28, to the negative side of the source of potential. Operation of relay 28 completes an obvious circuit for motor magnet 27, which magnet upon operation of its interrupter contacts deenergizes relay 28, which in turn deenergizes the motor magnet. The motor magnet then advances all of the wipers on to their next bank contact. All of the remaining contacts of the bank 25′ and 26′ are connected together and are connected to the positive side of battery 32 such that when the wiper 26 engages its first off-normal contact the relay 28 again becomes energized and the cycle of operation of relay 28 and motor magnet 27 repeats itself, thereby continuously advancing the wipers of the selector switch step by step over their banks of contacts at a rate determined by the relay 28. This relay is preferably of the slow acting type whereby the operation of the system is rendered sufficiently slow to avoid confusion of the signals at the remote point.

If we assume that the member 16 is in the position shown in the drawing it will be seen that the circuit of the primary winding of induction coil 20 is completed upon the 1st, 2nd, 3rd, 4th, 5th and 6th contacts, all of which are included in a group A in the bank 24′, the circuit through the 1st, 3rd and 5th off-normal contacts extending respectively through contacts 1, 1′; 2, 2′; 3, 3′ and the circuit through the intermediate contacts extending through the left hand contact and armature of relay 33 and contacts 4, 4′. Thus as the wiper 24 passes the first six contacts of group A the induction coil will be continuously energized and will cause a relatively long continuous high frequency impulse to be transmitted through the supervisory system 37 to the remote point. The group of contacts A is spaced apart from the group B sufficiently to permit the first and second groups of impulses of the transmitted code to be distinguished. The group of contacts B and the associated relay 34 are connected to contacts 6, 6′; 7, 7′; 8, 8′; 9, 9′; and 10, 10′ in the same way as the first group and its associated relay 33 are connected to the contacts 1, 1′—5, 5′. However since the contacts 9′ and 10′ are in the lower position and relay 34 is deenergized the circuit is only completed through the 1st, 3rd and 5th contacts of group B, the circuit of the intermediate contacts being interrupted at the left hand contact of deenergized relay 34. Thus as the wiper 24 rotates over this group of contacts three short impulses of high frequency current will be transmitted.

The group of contacts C are connected in

a similar manner to the contacts 11, 11′; 12, 12′; 13, 13′; 14, 14′; and 15, 15′, but since all of the contacts 11′ to 15′ are in their lower position the high frequency generator will be deenergized when the wipers 23 and 24 engage with the contacts of group C. Accordingly the code transmitted upon each complete revolution of the rotary switching device 35 will comprise a long high frequency impulse followed by three short high frequency impulses indicating that the member 16 is in a position corresponding to contact 8 and that the water in the dam is at a corresponding height.

Let us assume now that the member 16 is moved upwardly sufficiently to operate contact 10′ into engagement with its stationary contact, but not sufficient to operate the contact 11′. An obvious circuit will then be completed for relay 34 causing this relay to operate and thereby connect each of the intermediate contacts in the group B through the left hand contact and armature of relay 34 and contact 9′ and its stationary contact to the positive side of the battery. At the same time it interrupts the connection of the last contact of the group B. Thus as the wiper 24 now passes over the bank 24′ a relatively long continuous high frequency impulse will be transmitted and the code transmitted during each revolution of the switching device 25 will comprise two long impulses. As the member now moves upwardly sufficiently to operate contact 14′ against its stationary contact 14 the code transmitted during each revolution of the switch 25 will be two relatively long high frequency impulses and four relatively short high frequency impulses, thereby indicating this position of the member 16.

It will be seen that if a greater number of positions of the member 16 are to be indicated further movable contacts 1′, 2′, etc., may be provided and connected to additional groups of contacts in the bank 23′. Since these switches are ordinarily constructed with 25 contacts in each bank it will be seen that as many as 25 positions may be indicated with a single switch employing the whole of two banks of contacts as already described. By slightly modifying the circuit additional selectors can be added to obtain a larger number of positions.

It will thus be seen that the position of the member 19 may be readily determined by means of the code. For example, it may be assumed that a long impulse represents a certain unit of displacement, as for example 10 feet, of the member 16 from the base of the supporting member 17, and each of the short impulses represents a certain fraction of said unit, as for example 2 feet. Thus the height of water can be readily indicated by the code and with much greater facility than would be the case if it were necessary for the operator to listen to a long series of short impulses, each of which corresponds to a fraction of a unit of displacement as for example in the case assumed 2 feet.

At the point where indications are to be made any suitable receiving device, not shown, may be employed to respond to the received high frequency impulses, as for example an ordinary telephone receiver, induction howler or loud speaker.

While I have shown a particular embodiment of my invention it will, of course, be understood that I do not wish to be limited thereto since many modifications both to the circuit arrangement and instrumentalities employed may be made and I therefore contemplate in the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, an element, means for moving said element over a predetermined path of movement with reference to a point, a rotary switching device having a bank of contacts arranged in groups, each group corresponding to a unit of displacement of said element from said point and each group comprising contacts corresponding to fractions of a unit of said displacement and additional contacts intermediate said last mentioned contacts, a wiper cooperating with said contacts, a circuit and means controlled in response to the position of said element for completing said circuit when said wiper engages each of said first mentioned contacts corresponding to fractions of a unit within the instant displacement of said element and for also completing said circuit through said wiper and said intermediate contacts in each group corresponding to units wholly within the instant displacement of said element, and signal means responsive to the current in said circuit.

2. In a signaling system, a rotary switch including a group of contacts, a cooperating wiper and means for moving said wiper into engagement with each contact of said group, a second group of contacts, a movable member, means for moving said movable member in accordance with predetermined variations in a variable quantity to close in sequence the contacts of said second group, and impulse transmitting means including said wiper and connections between the contacts of said groups for transmitting a single long impulse when all of the contacts in said second group are closed and a short impulse for each closed contact in said second group when less than all of the contacts in said second group are closed.

3. In a signaling system, a rotary switch including a plurality of groups of contacts,

a cooperating wiper and means for moving said wiper into engagement with the contacts of each group of contacts, a bank of contacts divided into groups corresponding to the groups in said switch, a movable member, means for moving said movable member in accordance with predetermined variations in a variable quantity to close in sequence the contacts of said bank, and impulse transmitting means including said wiper and connections through the contacts of said switch and the closed contacts of said bank for transmitting a combination of long and short impulses dependent upon the position of said element.

4. In a signaling system, a rotary switch including a plurality of groups of contacts, a cooperating wiper and means for moving said wiper into engagement with the contacts of each group of contacts, a bank of contacts divided into groups corresponding to the groups in said switch, a movable member, means for moving said movable member in accordance with predetermined variations in a variable quantity to close in sequence the contacts of said bank, and impulse transmitting means including said wiper and connections through the contacts of said switch and the closed contacts of said bank for transmitting a single relatively long impulse while said wiper is engaging the contacts of each group of contacts in said switch if all of the contacts in the corresponding group in said bank are closed and for transmitting a short impulse for each closed contact of the corresponding group in said bank while said wiper is engaging the contacts in a group of contacts in said switch if less than all of the contacts in the corresponding group in said bank are closed.

In witness whereof I have hereunto set my hand this 12th day of August, 1929.

CLYDE E. STEWART.