March 5, 1940. G. A. STONE ET AL 2,192,656

TELEMETERING SYSTEM

Filed Nov. 5, 1938 2 Sheets-Sheet 1

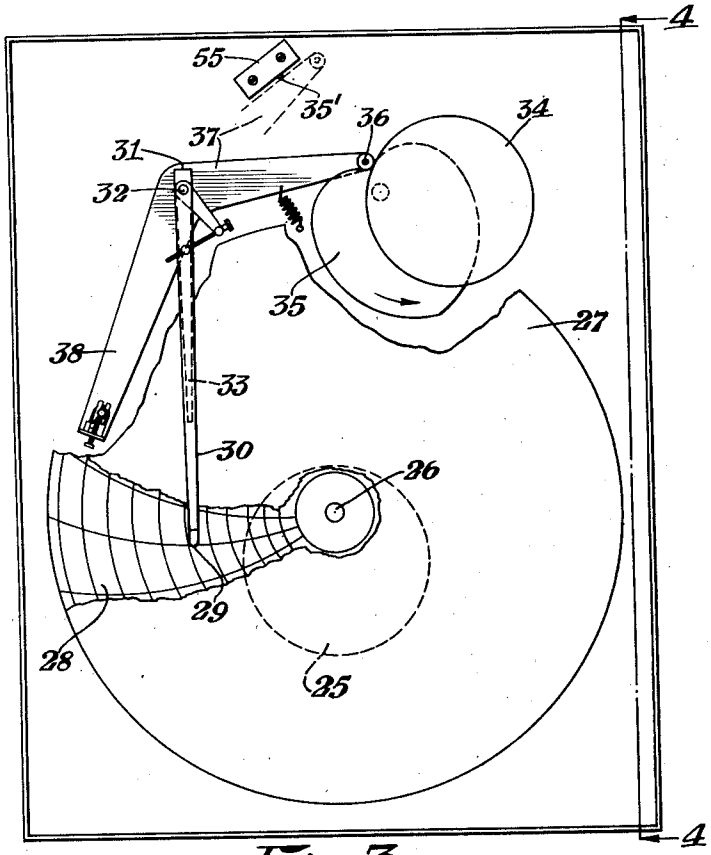


Fig. 3

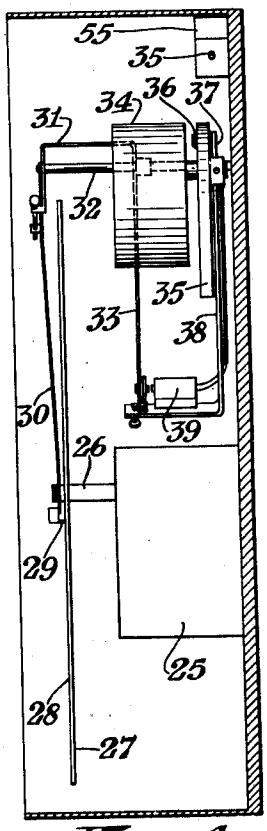


Fig. 4

Fig. 1

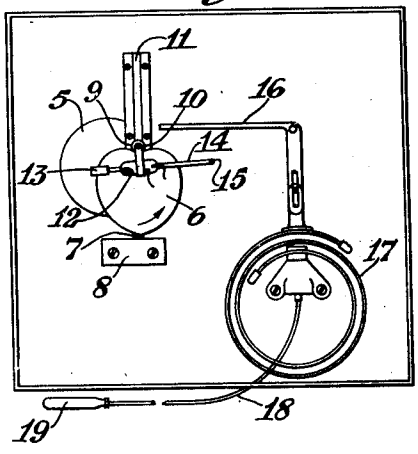
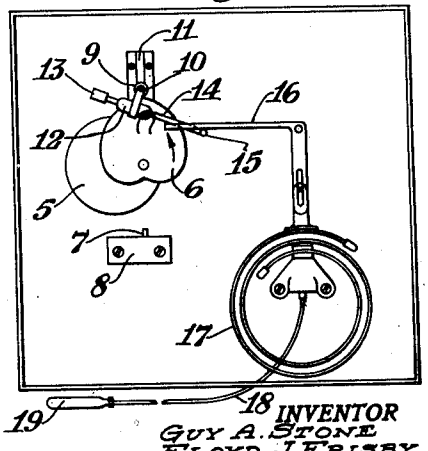


Fig. 2



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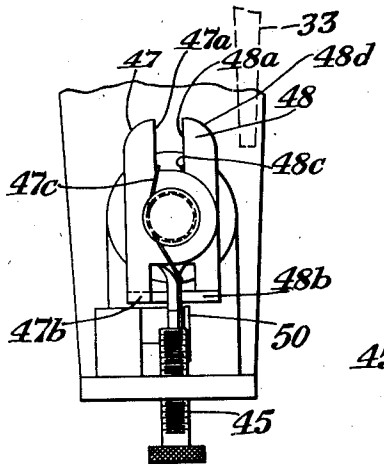


Fig. 5

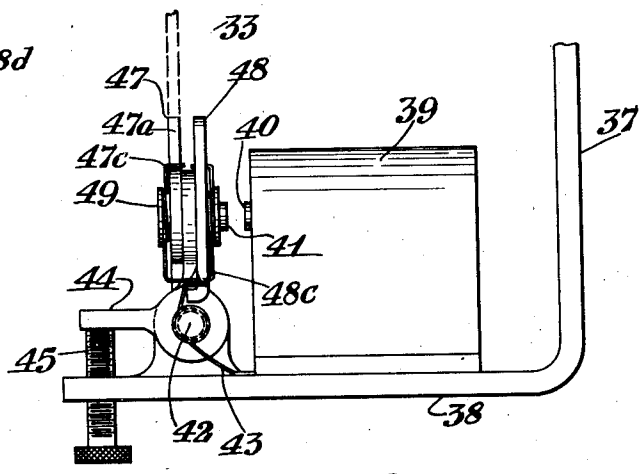
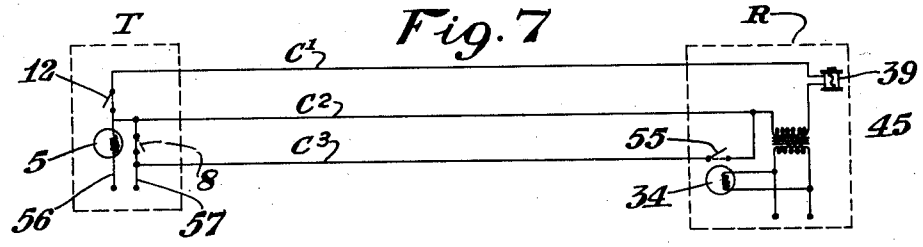


Fig. 6

Fig. 7



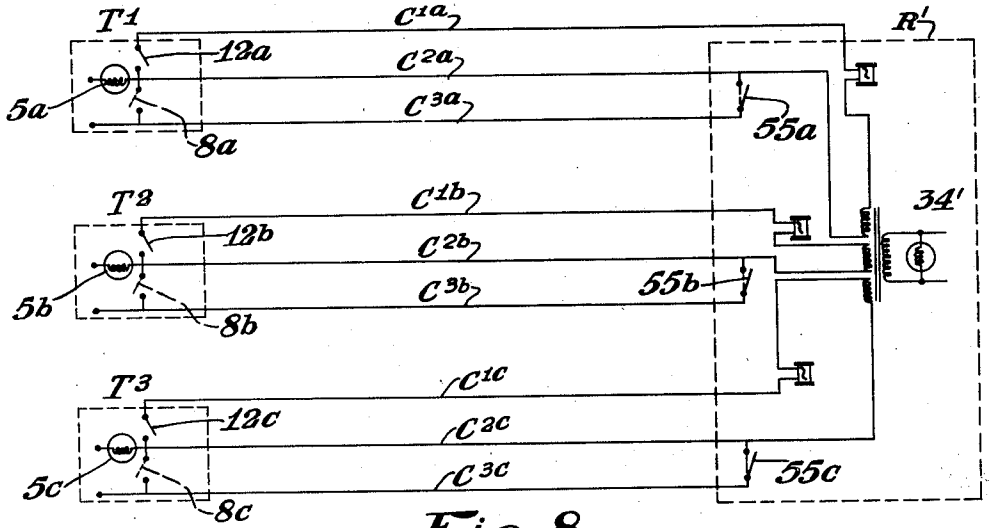


Fig. 8

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Patented Mar. 5, 1940 2,192,656

UNITED STATES PATENT OFFICE

2,192,656

TELEMETERING SYSTEM

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Application November 5, 1938, Serial No. 239,156

3 Claims. (Cl. 177—351)

This invention relates to remote position indicating arrangements and particularly to telemetering systems.

In former telemetering systems, complicated mechanisms including clutches, have been utilized. Such mechanisms are expensive to manufacture and are a frequent source of failure in service.

The present invention has for its main purpose a simplified telemetering system which employs no clutches, which is less expensive to manufacture than former systems and which is more reliable in service.

A further purpose of the invention is the provision of a telemetering system in which two correcting impulses are possible in each cycle of operation, as distinguished from present systems wherein but a single corrective impulse is possible in each cycle.

The various features and advantages of the invention will appear from the detailed description and claims when taken with the drawings in which Fig. 1 is a plan view of the transmitter employed in the system of the present invention; Fig. 2 is also a plan view of this transmitter with the operating parts thereof shown rotated at 180° from the position shown in Fig. 1; Fig. 3 is a plan view of combined receiver and recorder for use in the system, the parts thereof being illustrated in the positions which they occupy when the parts of the transmitter are in the position shown in Fig. 2; Fig. 4 is a side elevation of the receiver of Fig. 3 with the side wall of its casing omitted; Fig. 5 is an enlarged detail view of the pen arm actuating mechanism in the position illustrated in Fig. 3 and Fig. 6 is an enlarged detail view of this mechanism in the position shown in Fig. 4; Fig. 7 is a diagrammatic circuit arrangement of the electrical system in which the previously mentioned transmitter and receiver are incorporated; and Fig. 8 is a circuit diagram of a similar system in which three transmitters are incorporated to actuate a single recorder of the multiple recording type. The present system comprises a transmitter unit T and a receiving unit R, remotely located with respect to the transmitter unit but connected thereto by electrical conductors generally designated C.

The transmitter includes a synchronous motor 5 which drives a heart-shaped cam 6 in the direction indicated by the arrow of Fig. 1. The high point of the cam 6, as shown in Fig. 1, is adapted to depress a button 7 to open a normally closed switch 8 of any well-known construction, fixed on the transmitter case. The periphery of the cam is engaged by a roller 9 mounted on a travelling pivot 10 arranged for vertical movement in a vertical guideway 11. The pivot 10 also supports a rotatable saddle in which there is mounted a well-known mercury bottle-type of switch 12. This switch is normally tilted to its open position, as shown in Fig. 1, by a counterweight 13. However, an arm 14 attached to the saddle and projecting in a direction away from the counterweight is provided at its free end with a pin 15 extending at right angles thereto for closing the switch. This pin is positioned in the path of an angular arm 16 which is carried by the free end of a Bourdon spring 17, or other condition responsive means. This Bourdon spring as is well known comprises part of a fluid-filled tube system including a capillary tube 18 connected at one end to the Bourdon spring and at its other end to a bulb 19.

At the receiving station there is provided an indicating recorder as illustrated in Figs. 3 to 6 inclusive. This recorder comprises a clock motor 25 which drives a shaft 26 to rotate a chart support 27 in the well-known manner. A chart 28 is carried on the support in a position to be engaged by the stylus 29 which is carried on the pen arm 30. This pen arm is adjustably carried by the well-known pen-arm bracket 31 which is pivoted on a suitable arbor 32. The pen-arm bracket 31 is provided at the rear of the chart support with an arm 33 in spaced relation to the pen arm 30.

The actuating mechanism for the pen arm comprises a synchronous motor 34 operating in synchronism with the motor 5 at the transmitting station. The motor 34 likewise drives a heart-shaped cam in the direction indicated by the arrow in Fig. 3. The periphery of this cam is engaged by a roller 36 carried at one end of a bell crank lever 37 which is pivoted to rock about the arbor 32 from its full line position to its dotted line position, both illustrated in Fig. 3. It will be noted that the bell crank lever 37 in its upper or dotted line position, depresses the button 35 of a normally open switch similar to switch 8 (Fig. 1). The other end of the bell crank lever 37 is provided with an angular arm 38 projecting toward the chart support. This arm has secured thereon a solenoid 39 provided with a core 40. An armature 41 located in position to be attracted to the solenoid core, is pivoted at 42 on a lug carried by the arm 38. The free end of the arma-

ture is normally urged away from the projecting end of the core by the spring 43, until the armature extension 44 engages a set screw or stop 45 adjustably mounted near the free end of the arm 38. The armature has two stop bars 47 and 48 pivotally mounted thereon at 49 for limited rotation in one direction only at right angles to the long axes of the core 40. The bar 47 is provided with a flat face 47*a* to engage the end portion 33 of the pen arm bracket when the armature is attracted, while the bar 48 has a face 48*a* adapted to engage this end portion 33 when the armature is released. Stops 47*b* and 48*b* on the bars 47 and 48 normally engage the fixed lug 50 being urged to this position by their respective springs 47*c* and 48*c*. It should be understood that the friction of the pen arm bracket with the respect to the bearing for arbor 32 is such that this bracket will not be displaced when its arm 33 is engaged by the curved faces 47*d* and 48*d* of the stop bars 47 and 48 but instead, these bars will snap past the arm 33.

In considering the operation of the invention, it will first be assumed that the transmitting unit and the receiver unit just described are incorporated in a simple remote control or remote transmission system. During the operation of the system, the motor 5 at the transmitting unit and the motor 34 at the receiving unit are continuously rotated. The circuit for the motor 5 normally extends from the alternating current source, conductor 56 through the field winding of the motor, normally closed switch 8, conductor 57 to the other side of the alternating current source. The field winding of the receiver motor 34 is connected across the source of current located thereat. The mentioned switch 8 at the transmitter, is utilized in synchronizing the motor 5 and 34 in a manner to be described. As the motor 5 rotates, it rotates the heart-shaped cam 6 so that the follower or roller 9 with its mercury switch 12, is alternately elevated and lowered during each rotation of the cam.

Let it be assumed that the temperature at the bulb 19 increases, in which case the fluid medium in the tube system expands thereby causing the Bourdon spring 17 to unwind. This elevates the left-end of the bell crank lever 16 in the path of the projecting portion 15 of the arm 14 on the vertically moving mercury switch 12 to rock this switch to its closed position.

Since the motor 34 at the receiving unit is also continuously rotated, the heart-shaped cam 35 thereat, causes the bell crank lever 37 to oscillate during each cycle from its full line position to its dotted line position as illustrated in Fig. 3. As soon as the mercury switch 12 is closed at the transmitting station, it closes and energizes the circuit for the solenoid 39 at the receiving station. The circuit of this solenoid includes the secondary winding of the transformer 45, winding of the solenoid 39 and thence over conductor C′, contacts of the mercury switch 12 now closed, conductor C^2, to the other terminal of the secondary winding of the transformer. As soon as the solenoid 39 is energized, it attracts its armature to move the stop bar 47, carried thereby, into the path of the arm 33 which is carried by the pen arm bracket. If the solenoid 39 is deenergized at the time when the flat face 48*a* of the stop bar 48 is moving toward the arm 33, the pen arm bracket will be moved along with bell crank lever 37 in a clockwise direction until the solenoid is energized. However, if the solenoid is deenergized when the curved face 48*d* of the stop bar 48 is approaching the arm 33, the engagement of this arm with the stop bar will not move the pen arm bracket but instead, this stop bar will snap past the arm 33. By this arrangement, the pen arm bracket and the pen arm 30 are moved on an increase in temperature in a clockwise direction by the stop bar 48 until the pen arm reaches a position which correctly indicates the temperature at bulb 19.

If, however, the temperature at the bulb 19 decreases, the Bourdon spring 17 will wind up and the free arm of the bell crank lever 16 will be lowered so that the interval during which the mercury switch 12 is closed in each cycle, is lengthened. Thus the solenoid 39 of the receiving unit will be energized for a longer portion of the cycle. In this way the solenoid armature will be in its attracted position for a longer interval so that the flat face of the stop bar 47, carried thereby, will engage the arm 33 of the pen arm bracket to move this bracket and its pen arm in a counterclockwise direction. It will be understood that when the position of the pen arm 30 is such as to accurately indicate the temperature prevailing at the bulb 19, the solenoid will be respectively energized and deenergized during each cycle so that the flat faces 47*a* and 48*a* of the stop bars will move out of the path of the arm 33 just at the time when the edges of this arm engage their respective flat faces.

It has been mentioned that it is desirable to bring the motor 5 at the transmitter and the motor 34 at the receiver into synchronism at least once during each cycle. This is effected by the operation of the normally closed switch 8 at the transmitting unit and by the normally open switch 55 at the receiving unit. The circuit of the receiver motor 34 is not interrupted while the system is in service so that the motor 34 operates continuously. On the other hand, the main operating circuit for the transmitter motor 5 is momentarily interrupted once during each cycle at the switch 8. However, if the motors 5 and 34 are in synchronism, switch 55 will close at the instant that switch 8 opens. Under these conditions the motor 5 will continue to operate by reason of a substitute circuit traceable from one side of the alternating current source, conductor 56, field winding of the motor 5, conductor C^2, switch 55 (now closed), conductors C^3 and 57 in series, to the other side of the current source. If these motors are out of synchronism, the motor 5 will stop when switch 8 opens and will not start until switch 55 closes the mentioned substitute circuit. Thus motor 5 will be started when it is in synchronism with motor 34.

In Fig. 8 there is illustrated a modified circuit arrangement in which three transmitting units T1, T2 and T3 selectively control a remotely located receiver R1. These transmitters may be identical with that shown in Fig. 1 and Fig. 2. The receiver R1, with the exception of the common driving motor 34′, may include three units like that shown in Figs. 3 and 4. In this receiver the switches 55*a*, 55*b* and 55*c* are opened simultaneously to maintain the motors 5*a*, 5*b* and 5*c* at the several transmitters in synchronism with the motor 34′ at the receiver.

While the system has been described with particular reference to the remote recording of a thermal condition, the invention is not to be construed as limited by the description and drawings given by way of example only since it will

be obvious that the present system is adapted to many other uses such as the controlling and/or recording of temperature, pressure, flow, etc.

We claim:

1. In a receiver for a telemetering system, a pivotally mounted element, a constantly operating motor, a member continuously oscillated under the control of said motor in a path parallel to the path of movement of said element, a solenoid carried by said member, said solenoid having an armature movable from an attracted position to a normal position, and means controlled by said armature in its respective positions for setting said element.

2. In a receiver for a telemetering system, a pivotally mounted pen arm bracket, a constantly operating motor, a member continuously oscillated under the control of said motor in a path parallel to the path of movement of said bracket, a solenoid carried by said member, said solenoid having an armature movable from an attracted position to a normal position, a pair of bars on said armature, one bar being positioned in the path of the pen arm bracket in the normal position of said armature and being effective to move said bracket in one direction only, the other bar being positioned in the path of said bracket in the attracted position of said armature and being effective to move said bracket in the other direction only.

3. In a receiver for a telemetering system, an adjustable element, a motor, a member oscillated under the control of said motor, a solenoid carried by said member, said solenoid having an armature movable from an attracted position to a normal position, and means controlled by said armature in its respective positions for adjusting said element.

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