

Aug. 1, 1939.

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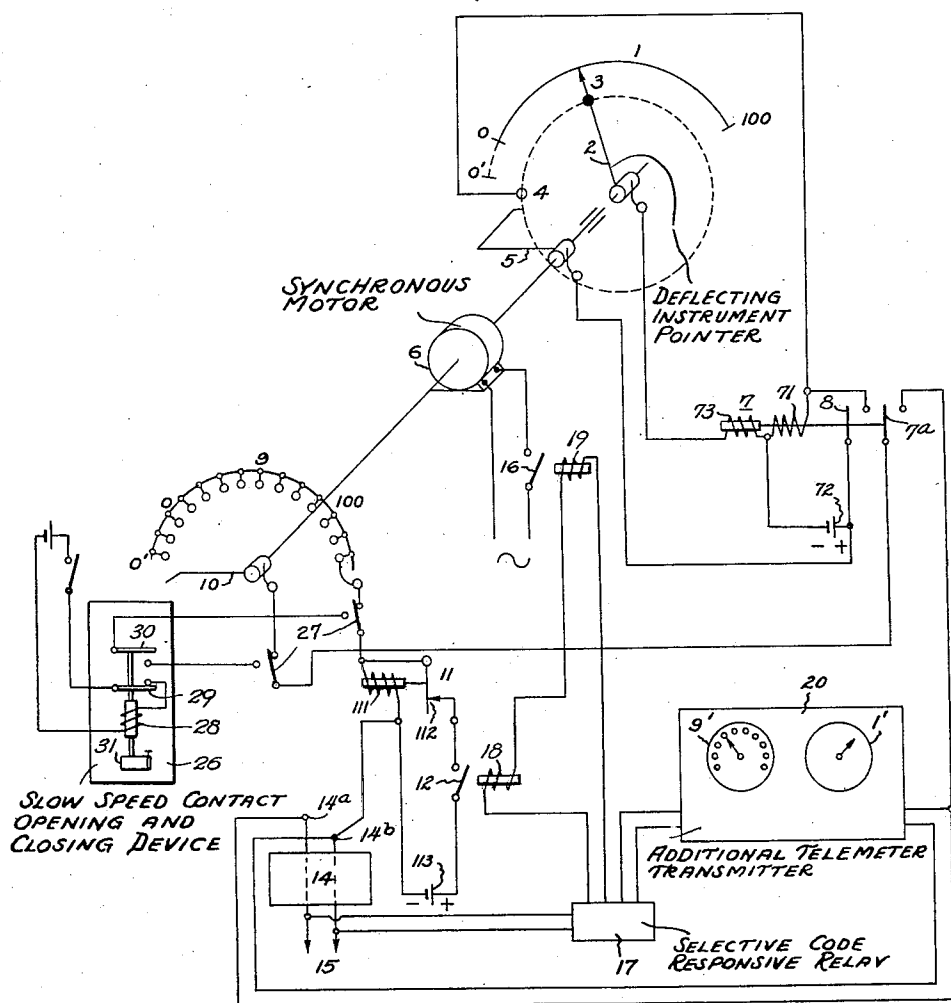
2,168,149

TELEMETERING

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2 Sheets-Sheet 1

Fig. 1.



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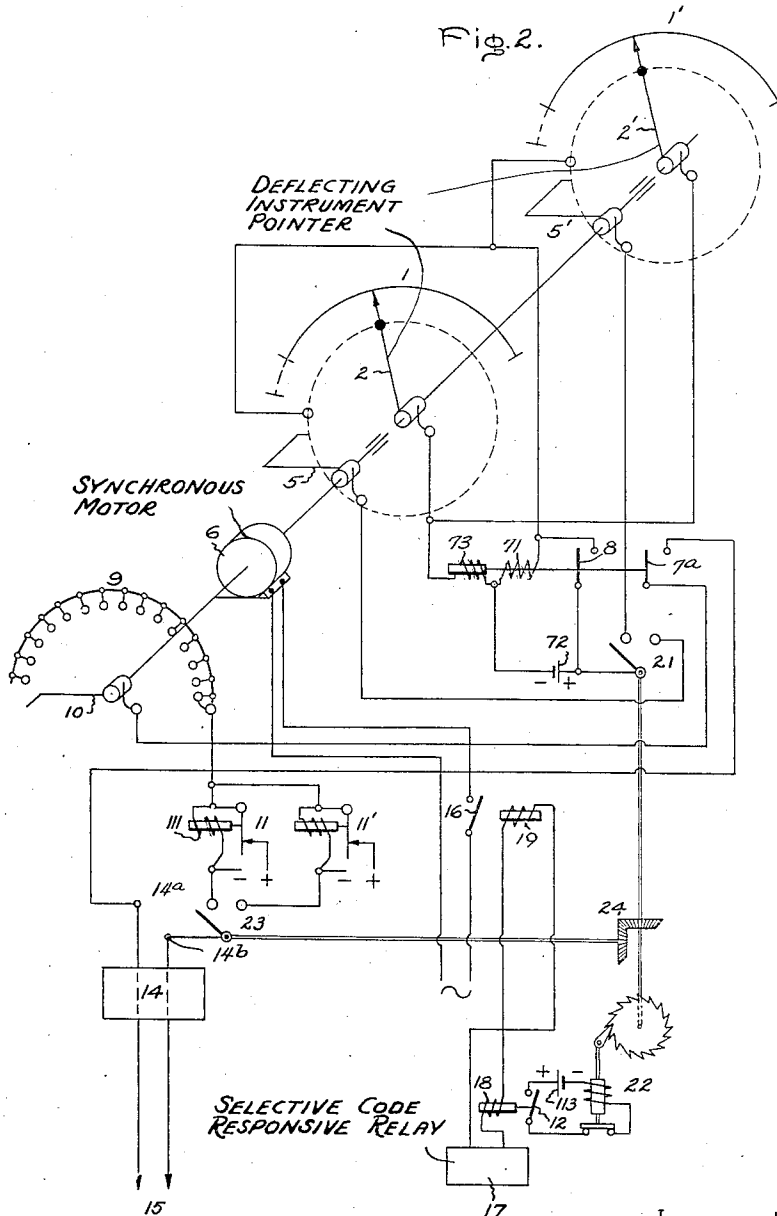
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UNITED STATES PATENT OFFICE

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TELEMETERING

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In Germany October 22, 1936

4 Claims. (Cl. 177—351)

My invention relates to methods and apparatus for transmission of measurements, positions, indications, and the like. The invention relates particularly to telemetering arrangements operating on the impulse frequency or impulse time principle.

It is an object of my invention to provide an arrangement for transmitting indications over an ordinary telephone system receivable in any part of the system by an ordinary telephone receiver.

It is an object of my invention to provide an arrangement whereby indications may be received by telephone at any telephone station by calling the station at which the telemetering apparatus is located.

It is a further object of my invention to provide apparatus whereby a plurality of measurements or indications may be transmitted without confusion.

Still another object of my invention is to provide an arrangement whereby such indications may either be received automatically or upon request.

It is also an object of my invention to provide an arrangement whereby a plurality of indications may be received automatically in rotation or selectively as desired.

Other and further objects and advantages will become apparent as the description proceeds.

In carrying out my invention in its preferred form, I provide one or more buzzers for producing tone impulses. In case more than one measurement or indication is to be transmitted, I may provide a buzzer having a distinctive tone corresponding to each measurement or indication. In transmitting each measurement or indication, I cause the buzzers to be connected to a telephone system and disconnected therefrom a number of times corresponding to the magnitude of the measurement or the position indication so that the number of tone impulses received in the telephone represents the measured quantity or the position indication.

The invention may be understood more readily from the following detailed description when considered in connection with the accompanying drawings and those features of the invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. In the drawings, Fig. 1 is a schematic diagram of one embodiment of my invention showing the electrical connections; and Fig. 2 is a schematic diagram of a modification of the arrangement of Fig. 1 particularly adapted for transmitting a plurality of indications. Like reference char-

acters are utilized throughout the drawings to designate like parts.

Referring now more in detail to the drawings, I have shown, in Fig. 1, a measuring instrument 1 having a movable pointer 2, the angular position of which is to be indicated at a distant station. The movable pointer 2 is provided with a contact 3, and a stationary contact 4 is provided at the lower end of the scale of the instrument 1 preferably beyond the zero position of the scale of the instrument in order that zero indications, as well as other indications, may be transmitted. Accordingly, the stationary contact 4 is placed at the angular position corresponding to a hypothetical reading 0', which would be less than the zero reading of the instrument 1.

In order to cause tone impulses to be transmitted for a period of time corresponding to the angular position of the pointer 2, a rotatable contact 5 is provided, which is adapted to touch the contacts 4 and 3 in succession. The rotatable contact 5 is preferably arranged to be moved at constant speed and may either be advanced up scale repeatedly or may be continuously rotated, for example, by means of a constant speed motor 6, such as a synchronous motor connected to a suitable source of alternating current. Preferably the synchronous motor 6 includes suitable speed reduction gearing.

To control the starting and stopping of the transmission of tone impulses in accordance with the touching of contacts 4 and 3 by the rotating contact 5, a relay 7 having a normally open contact 7a is provided. The relay 7 has an energizing winding 71 connected between the negative side of a suitable current source 72 and the stationary contact 4. The rotating contact 5 is connected to the positive side of the source 72 so that, when the contacts 4 and 5 touch, an energizing circuit is closed through the winding 71 of the relay 7. The relay 7 is also provided with a contact 8, which closes upon energization to form a holding circuit therefor. In order to deenergize relay 7 when the contact 5 touches the contact 3, the contact 3 is connected either directly to the negative side of the energizing winding 71 to short circuit it and thereby trip out the relay or it is connected through a separate deenergizing winding 73 to the negative side of the source 72. It will be understood that the winding 73 is so arranged as to move the contacts of the relay 7 in the opposite direction from the energizing winding 71, thereby positively opening the contacts.

For the purpose of producing a number of tone impulses corresponding to the angular mo-

tion of the contact 5 between the positions of the contacts 4 and 3, a bank of arcuately spaced stationary contacts 9 is provided. Cooperating therewith, there is a rotatable contact 10, which is also driven by the motor 6. For producing the tone impulses, a suitable tone-emitting device, such as a buzzer 11, is provided, having an energizing winding 111 operating a make-and-break device 112 and energized by a suitable source 113. If desired, a switch 12 may be provided in the circuit of the source 113 for the purpose of causing the buzzer to be operated only when a measurement is to be transmitted. The winding 111 of the buzzer 11 is operatively connected directly or indirectly to a pair of conductors 15 of a communication line through the repeating contact maker and breaker 9—10 and the contact 7a of the relay 7. For example, the connection may be to a pair of input terminals 14a and 14b of a communication system such as a telephone system, for instance, including a telephone station 14. From the telephone station 14, the usual conductors 15 may extend to other telephone stations or to a telephone central or exchange in the well known manner. However the telephone system need not necessarily be a wire line system and the communication channel used may consist of a phantom circuit, carrier current, channel or radio waves. The telephone system itself is not a part of my invention but my invention may conveniently be employed in connection with telephone systems for the reason that such systems include well-known devices for calling desired stations and the application of my invention to a telephone system makes it unnecessary to install additional conductors or communication channels between the sending and receiving stations for telemetering purposes.

The manner of operation of the apparatus will be apparent from the drawings. When it is desired to start transmission of indications over the telephone system to which the station 14 is connected, the buzzer switch 12 is closed as well as a switch 16 controlling the synchronous motor 6. Thereupon, the contacts 5 and 10 are caused to rotate. When the rotating contact 5 and the stationary contact 4 touch, the relay 7 is energized, closing the contact 7a in the circuit of the buzzer 11. As the contact 10 continues to rotate, it passes the arcuately spaced stationary contacts 9 in succession and the buzzer circuit to the telephone station 14 is repeatedly made and broken. The making and breaking of these contacts produce a series of tone impulses in the telephone system, and the production of impulses in the telephone continues until the rotating contact 5 touches the pointer contact 3 and trips out the relay 7 to open the telephone circuit of the buzzer 11 at the contact 7a.

Although the motor 6 is preferably a substantially constant speed motor, constant speed is not necessary in the arrangement shown, for it will be seen that the number of tone impulses transmitted would not depend upon the speed of the motor 6 but upon the number of contacts of the group 9 embraced between the angular positions of the contacts 4 and 3 of the instrument 1. However, in cases where some other type of repeating contact maker and breaker is substituted for the arrangement 9—10, for example, a simple timed repeating make-and-break device, it is desirable that the motor 6 run at substantially constant speed so that the time interval between the closing of contacts 4 and 3 may be representative of the angular position of the pointer 2. For

instance, a make and break device 26 may be substituted for the rotating contact device 9—10 by moving switch blades 27 to the left. The device 26 itself is not a part of my invention and may be constructed in any desired well-known manner consisting, for example, of an operating winding 28 cooperating with an armature carrying an operating contact 29, a control contact 30 and having means such as a dash pot 31 for causing the armature to operate at a slow speed. It will be understood that the make and break device 26 will be of such a design as to operate sufficiently slowly to have the contact 30 closed for sufficiently long intervals to permit tone impulses to be transmitted by the buzzer 11.

It will be understood that the buzzer 11 and the motor 6 may be run continuously in order that an indication may be received whenever the telephone station 14 is called. It will further be apparent that it is immaterial what type of telephone system is employed, and the arrangement is equally well adapted to systems having, for example, either manual or machine-switching telephone exchanges.

In case it is desired to set the apparatus in operation only upon call, a code-responsive relay 17 may be provided, which is connected to the telephone line 15 and controls closing windings 18 and 19 of the switches 12 and 16 to permit starting of the apparatus upon the transmission of a predetermined code signal over the telephone lines 15. It will be understood that, if desired, for causing the selective reception of indications from more than one instrument, one or more additional telemetering transmitting arrangements, such as the device 20 with the arcuately spaced contact bank 9' and measuring instrument 1', corresponding to the apparatus already described, may also be connected to the code-responsive relay 17 and the telephone station 14. It will be understood, of course, that the code-responsive relay 17 is, in this case, so arranged as to energize the apparatus 20 in response to a different code signal than the windings 18 and 19. The construction of the code-responsive relay 17, however, does not constitute a part of my present invention.

Where a plurality of signals or indications is to be transmitted, this may be done also without duplication of the apparatus, and the same repeating contact maker and breaker 9—10, for example, may be employed for producing tone impulses for a plurality of measuring instruments. For example, in the arrangement of Fig. 2, two measuring instruments 1 and 1' are shown with the rotating contacts 5 and 5' and the movable pointers 2 and 2' corresponding to parts designated by the same numerals in Fig. 1. A rotating selector switch 21 is provided, which connects the rotating contacts 5 and 5' in succession to the positive side of the source 72, and the time duration of each connection is such that the successive rotating contacts 5 and 5' are permitted to travel through the complete path before the connection is transferred by the selector switch 21 from the contact 5 to the contact 5'. The selector switch 21 may be driven by a suitable step-by-step arrangement, such as a uniform speed motor driving through a Geneva gear or a step-by-step ratchet motor 22.

It will be seen that, in the arrangement thus far described, the instruments 1 and 1' and any additional instruments which may be used are connected to the system in succession and that, by knowing the order in which the instruments

are connected, the readings in each successive instrument may be determined by counting the number of tone impulses received in each group of impulses.

In order to eliminate absolutely the possibility of confusion as to which measurement indication is being received, buzzers having different pitches or different characteristic tones may be employed to correspond to each of the instruments I and I'.

For example, a buzzer II corresponding to that shown in Fig. 1 may correspond to the instrument I and a buzzer II' may be used with the instrument I'. If a plurality of buzzers is employed, any suitable arrangement, such as a second selector switch 23 synchronized with the selector switch 21 as by means of direct mechanical connections or gearing 24, may be employed to cause the buzzer II to be connected in the telephone circuit when the rotating contact 5 is connected to the current source 72 and to cause the buzzer II' to be connected in the telephone circuit when the rotating contact 5' is connected to the current source 72. For transmission of simple "on" and "off" indications the arrangement may also be such that one buzzer sounds for "on" indications, and another for "off" indications.

I have herein shown and particularly described certain embodiments of my invention and certain methods of operation embraced therein for the purpose of explaining its principle and showing its application, but it will be obvious to those skilled in the art that many modifications and variations are possible and I aim, therefore, to cover all such modifications and variations as fall within the scope of my invention which is defined in the appended claims.

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

1. A transmitter for a telemetering system adapted to utilize a communication channel of a telephone system comprising in combination, an indicating instrument having a movable pointer carrying a contact, a stationary contact at the lower end of the scale of said instrument, a rotatable contact adapted to cooperate with said stationary contact and said pointer contact, a motor driving said rotatable contact, a second rotatable contact also driven by said motor, a plurality of arcuately spaced stationary contacts cooperating with said second rotatable contact, a pair of input terminals of a communication system, a buzzer, a relay having normally open contacts and having opening and closing windings and a holding circuit, and a source of current with connections to said relay windings and said first rotatable contact, said communication-system input terminals, buzzer, second rotatable contact, spaced stationary contacts, and normally open relay contacts being connected in a circuit, said lower-scale-end stationary contact being connected to said closing winding and said pointer contact being connected to said opening winding, whereby a plurality of tone impulses depending in number upon the reading of the said instrument is transmitted.

2. In a telemetering system a plurality of indicating instruments each having a movable pointer carrying a contact, stationary contacts, one at the lower end of the scale of each instrument, rotatable contacts, each adapted to cooperate with a corresponding stationary contact and a pointer contact of one of said instruments, a motor driving said rotatable contacts, a rotatable telemeter contact also driven by said motor, a plurality of arcuately spaced telemeter stationary contacts cooperating with said telemeter rotatable contact, a pair of input terminals of a communication system, a plurality of buzzers, one of said buzzers, said communication-system input terminals, said telemeter rotatable contact and said telemeter stationary contacts being connected to form a buzzer circuit, a relay having normally open contacts in said buzzer circuit and having opening and closing windings and a holding circuit, a source of current with connections to said relay windings and one of said instrument rotatable contacts, said instrument stationary contacts being connected to said closing winding and said pointer contacts being connected to said opening winding, and a selector switch for simultaneously substituting another of said buzzers and another of said rotatable instrument contacts for the buzzer and the rotatable contact in their respective circuits.

3. In a telemetering system, an indicating instrument having a scale and cooperating movable pointer, a buzzer, a communication channel in responsive relation to said buzzer, a relay having a normally open contact in circuit with said buzzer and having a closing winding and an opening winding, a current source with a pair of terminals, to one of which each of said relay windings is connected on one side, a contact connected to the other of said current source terminals rotatable along said instrument scale, a lower-end stationary contact connected to said closing winding for closing said relay when said rotatable contact crosses a predetermined position at the lower end of said scale and a contact carried by the instrument pointer and connected to said opening winding for opening said relay when said rotatable contact crosses the position of the pointer, a second rotatable contact in circuit with said buzzer, a plurality of arcuately spaced electrically connected stationary contacts cooperating with said second rotatable contact, and a motor driving said rotatable contacts.

4. A telemetering system comprising in combination, a plurality of measuring instruments, a plurality of tone-emitting devices with different tones, a telephone system, means for connecting a tone-emitting device to said telephone system and disconnecting it therefrom a number of times dependent upon the reading of one of the measuring instruments, and selector means for successively placing different tone-emitting devices and corresponding measuring instruments in operative relation with said connecting and disconnecting means.

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