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KEYING DEVICE

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Fig. 1.

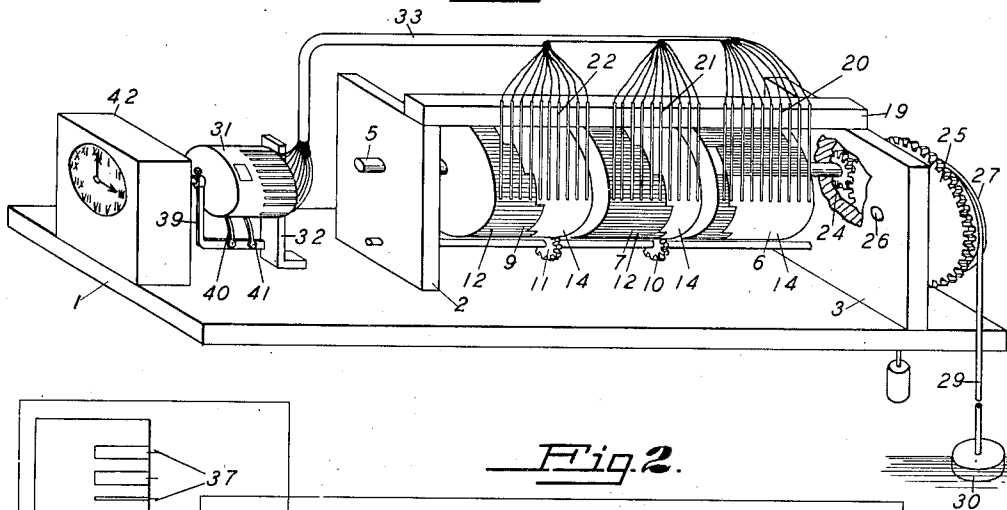


Fig. 2.

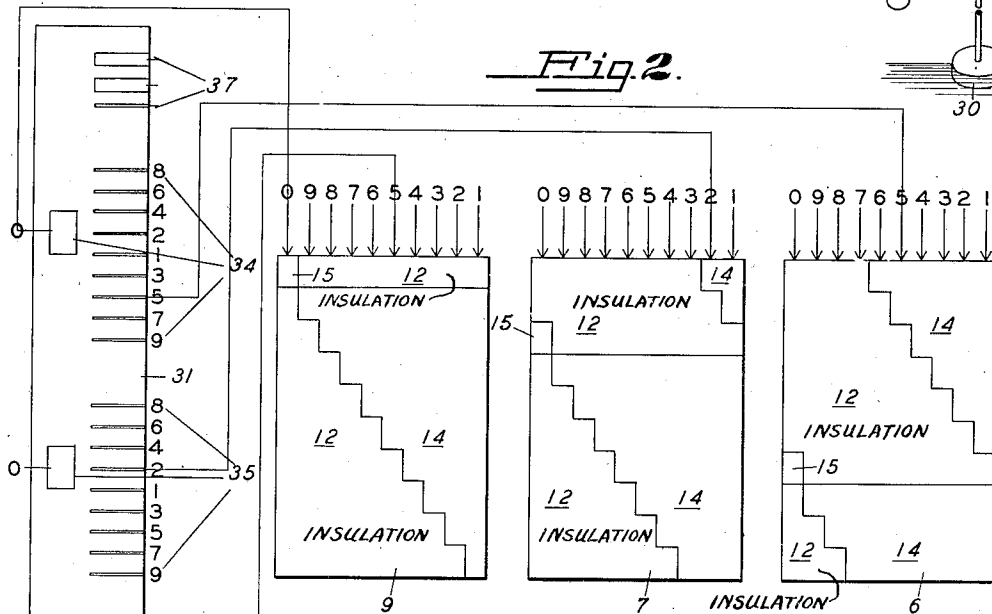
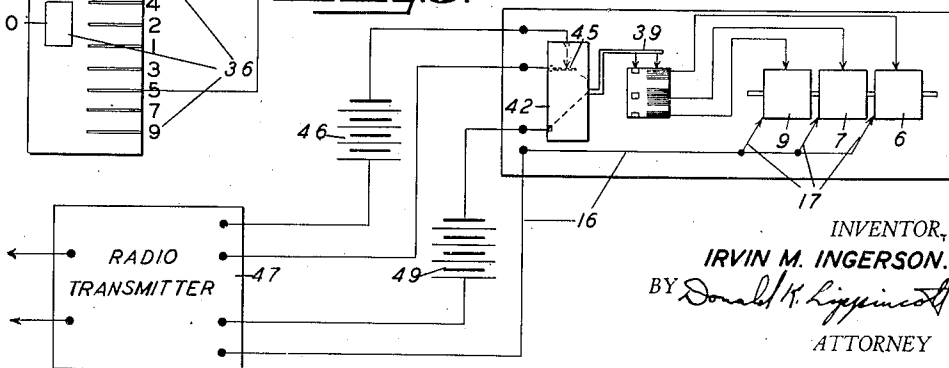


Fig. 3.



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KEYING DEVICE

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10 Claims. (Cl. 177—380)

My invention relates to devices for keying communication circuits, either wire or radio, for the purpose of transmitting mensural data such as liquid levels, wind pressures, or the like, automatically and at predetermined intervals.

Among the objects of this invention are: To provide a device which will transmit the required data with any required degree of accuracy and to any desired number of significant figures; to provide a device wherein, with a given number of significant figures transmitted, the order represented by those figures may be changed at will; to provide a device which is adaptable to any condition where numerical data must be transmitted; and particularly to provide a device which will transmit liquid level data at regular intervals over long periods without attention or supervision.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of my invention herein described, as various forms may be adopted within the scope of the claims.

There are many instances in which it is required that readings of data be taken regularly at predetermined intervals in situations where it is not convenient to maintain an observer, which are difficult to reach, and where the cost of ordinary communications would be excessive. This condition arises, for example, in connection with the reading of water levels in mountain reservoirs or streams, or in connection with the recording of meteorological data in remote situations. In the case first mentioned, there are places where the storage or flow of water to be measured is many miles from the point of utilization, and where the cost of maintaining an observer for this purpose only would be unwarranted. Under certain conditions it is highly desirable that numerous readings be taken in widely scattered places, where communication and transportation difficulties make the collection of the data by ordinary methods practically impossible.

It is such situations that this invention is primarily designed to meet. By its use a small radio transmitter may be installed at each point where readings are desired, and the keying device of this invention may be used to turn on the radio transmitter at regular predetermined intervals, transmit a signal identifying the transmitting station, and then turn the transmitter off, to repeat the operation at the next interval. The total cost of the apparatus is sufficiently low to permit

it to be freely used, and to permit the installation of a large number of stations in cases where the expense of a wire line to even a single communication point would be prohibitive.

Considered broadly the keying device of this invention comprises a plurality of circular contact pieces, connected together with transfer gears of the type familiar in odometers or other counting mechanisms, a separate contact piece being used for each order of magnitude of the system of mensuration in use, e. g., yards, feet, and inches, or tens, units, and tenths of feet. Each contact piece comprises conducting and insulating portions, which are arranged to cooperate with a plurality of brushes so that the number of brushes in contact with the conducting portion is dependent upon the position of the contact pieces, these in turn being driven or positioned by means responsive to the quantity to be measured. The zero position may be indicated by the disconnection of all of the brushes, but I prefer to provide a separate brush which is alone in contact at the zero position. Where the contact piece is in position to register a single unit, the zero brush will be out of contact while one of the other brushes is in contact, while greater indications are shown by the contacting or correspondingly larger number of brushes.

A fixed commutator is provided which has segments corresponding to the brushes and permanently connected thereto. The segments may be preferably arranged in two ranks, one rank being connected with the "zero" brushes, and these segments subtending a larger or at least a different angle from those of the other rank, which connect to the other brushes, and which are arranged in groups corresponding to the various orders of magnitude of the different contactors. Additional segments are preferably provided arranged in accordance with an identifying number or call letter for indicating the particular station from which data is being transmitted.

Contact with the commutator segments is made by a movable brush carrying arm which is swept successively over the segments by means of a clock mechanism. This term is here used in its broad sense, it being understood that an electric clock, a spring or weight driven clock, or any other device which will operate regularly to sweep the brushes over the segment at substantially regular intervals may be used. In practice, a weight driven clock has been found to be the most practical, since the clock may be wound but once in order to drive the mechanism over a period of a month or more.

In use, the clock operates the brush arm continuously, and is also used to close a switch actuating the filament circuit of a radio transmitter at the desired intervals.

5 Referring to the drawing:

Figure 1 is an isometric view of a keying device embodying this invention.

10 Figure 2 is a schematic diagram showing the contact pieces and commutator as developed surfaces, and indicating the preferred relationship between the brushes and the commutator segments.

Figure 3 is a general wiring diagram showing the method of connecting the device to actuate 15 a radio transmitter.

In terms of greater detail, the form of the device illustrated comprises a base plate 1, carrying vertical standards 2 and 3 upon which the contact piece assembly is mounted. This assembly comprises a horizontal shaft 5 extending 20 between the standards, and journaled thereon. A contact piece or drum 6 is fixed to the shaft, while two similar contact pieces 7 and 9 are journaled to turn upon the shaft and are driven 25 from the contact piece 6 by means of transfer gears 10 and 11. These transfer gears are of the well known type which is used in odometers and other counting mechanisms, to advance the successive drums by a single aliquot step for each 30 revolution of the preceding contact piece.

In the present instance the contact pieces are similar, the device being adapted to transmit the data required in decimal notation. It is obvious that instead of this system it would be possible to have the first order contact piece 6 graduated in sixteenths of an inch, the second piece 7 in inches, while the third contact piece 9 would indicate feet. For general engineering purposes the decimal notation is better, but the invention 40 itself is not thus limited.

The preferred arrangement of the contact pieces is best shown in the developed surfaces of Figure 2, wherein each of the contact pieces is shown in a different position. Each comprises 45 insulating and conducting portions, the insulating portion of each is designated by the reference character 12. Two conducting portions 14 and 15 are provided on each of the drums, the conducting portion 14 being stepped so that the 50 longest part includes $\frac{1}{10}$ th's of the circumference of the drum, the next step $\frac{1}{10}$ th's, etc., until the ninth step occupies but $\frac{1}{10}$ th of the circumference. The conducting portion 15 is of the same circumferential length as the ninth step, but is 55 circumferentially displaced from the ninth step by its own length. This portion is used to give the zero indication. All of the conducting portions of all of the contact pieces are electrically connected, as is indicated by the leads 16 and 17 60 of the general hook-up diagram of Figure 3.

A transverse bar 19 extends between the standards 2 and 3, and carries three sets of brushes 20, 21, and 22, each set of brushes engaging one 65 of the contact pieces, the contacting portions of the brushes being carefully aligned. Thus, when any of the contact pieces is so rotated that the conducting portion 15 of any of the contact pieces is connected to its brush, none of the rest of the brushes of that particular set is in engagement. A $\frac{1}{10}$ th turn of the contact piece will engage brush No. 1 of the set, another $\frac{1}{10}$ th turn will also engage brush No. 2, and so on until brushes from 1 to 9 are engaged, after which a further $\frac{1}{10}$ th turn will disengage all of the contacting brushes and reengage the zero brush. 75

I have found it convenient to utilize a gear train having 10:1 ratio to drive the shaft 5 and the contact pieces associated therewith. As shown, a small gear 24 is mounted on the shaft 5, while the larger gear 25 is mounted on a sub-shaft 26 and meshes with the gear 24. In order 5 to make water level readings, for example, a pulley 27 is driven through a cable 29 by the float 30, and this pulley may be fixed either to the shaft 26 or to the shaft 5. By this arrangement when the pulley is fixed to the shaft 5 the device may be made to indicate tenths of feet, feet, and tens of feet during seasons of floods or violent changes of water level, while transferring the pulley to actuate the gear 25 the same 10 contactor will indicate hundredths, tenths, and feet, during periods of drought or small changes in water level. The flexibility of the device is thus greatly increased, and this feature has been found very valuable in regions where during the summer months there is small change in level, while in winter and spring violent freshets may be experienced.

Each of the brushes of the groups 20, 21 and 22 is connected to a corresponding segment on a 25 commutator 31, by a lead in a cable 33. The commutator is mounted on a bracket 32 and is fixed in position. The segments are arranged in groups corresponding to the contact pieces, one group 34 connecting with the brushes of group 30 20, while the groups of segments 35 and 36 connect with brush groups 21 and 22 respectively. The contacts of each group are arranged in two ranks, one rank comprising a single contact subtending a relatively long arc, and connecting 35 with the zero brush of its corresponding group, while the other segments subtend materially smaller arcs, and connect with the other brushes of the respective groups. In order to avoid an unduly complex wiring diagram, only a single 40 lead is shown connecting the various brush and segment groups, each brush being indicated by an arrow numbered to indicate the number which it transmits. The commutator segments are identified by like numbers, these numbers being distinguished from the reference characters by being shown in vertical lettering whereas slanting lettering is used for the reference characters. 45

It will be noted that the order in which the segments are arranged on the commutator 31 is not the same order as that of the brushes. Brush No. 1, shown as being on the right of each of the brush groups, connects with commutator segment No. 1 at the center of each group. Brush No. 2 connects with commutator segment No. 2 on one 55 side of the segment 1, while brush 3 connects with commutator segment 3 on the other side of segment 1, successive brushes being connected to successive segments on one side or the other alternately. The zero commutator segments are preferably positioned approximately opposite to the center of each of the brush groups. The reason for this arrangement is to insure the maximum intelligibility of the signals, while providing maximum spacing between the signals representing 60 each order of digit.

There are also preferably provided additional contacts 37, which are arranged to transmit an identifying call letter or call letters, indicative of the station from which the data is being transmitted. 70

Contact with the commutator segments is made by means of an arm 38 carrying brushes 40 and 41, and driven by a clock 42. The arm is preferably driven by a clock gear which is so 75

chosen that the brush arm makes a complete revolution about once a minute, as it has been found that this permits the signal to be transmitted so slowly and distinctly that it cannot be mistaken by even an unskilled operator. No clutch movement or intermittent motion of any kind is used in connection with the brush arm, it traversing the commutator continuously.

Although I have found it very convenient to utilize a weight driven clock to actuate this device, particularly in remote situations, it is evident that an electric clock or even an asynchronous motor, which will drive the brush arm substantially uniformly, is a full equivalent for this purpose. The advantage of the weight driven clock is, of course, that providing a sufficiently great fall for the weight permits the operation of the device for long periods without attendance, a number of stations having now been installed where the weights may be wound but once a month.

Where full automatic operation of the device is desired, the clock preferably operates a time switch 45, which closes the circuit of the filament battery 46 of a radio transmitter 47. The keying device is used in the plate circuit, one terminal of the plate or B-battery 49 connecting through the clock 42 to the brush arm 39, and thence through the commutator segments and the brushes to the contact pieces and back to the transmitter 47 through the leads 17 and 16.

As soon as the filaments are heated the keying device comes into operation, transmitting the required information. This may occur, of course, at any time during the keying cycle, and no attention need be paid to the data until the identification signal is transmitted by the segment 37. The group of signals immediately following the identification letters indicate the lowest order digits, the contact piece 6 being shown in Figure 2 in position to transmit a succession of six dots indicating, say, 6 tenths of a foot. After a space, the brush arm sweeps the group of segments 35, and, as shown, would transmit two dots, indicating two feet. Following another space, the brush arm sweeps over group 36 of commutator segments, in this case transmitting a dash indicating no tens, after which the cycle of call letters and data is repeated. After a desired number of repetitions, the switch 45 opens and no further signals are sent until the next period of operation.

It is to be understood that the device shown and thus described in detail is merely one of the several forms in which the principles here claimed may be embodied. Disc contact pieces and commutators may obviously be substituted for the drum type here shown. Instead of transmitting the lowest order of digits first the direction of rotation of the brush arm may be reversed, and the digits transmitted in descending order. Many other methods may be utilized to close the switch 45 to start the device, and the device itself may be used to indicate pressures, velocities, or substantially any numerical data which it may be desired to transmit.

I claim:

1. A keying device for transmitting mensural data comprising a shaft rotatable in response to variations in the quantity to be measured, a contact piece mounted on said shaft and comprising a conducting portion and an insulating portion positioned in a circumferentially stepped formation, each step of said conducting portion being displaced with respect to the preceding step by

an aliquot part of the circle, a plurality of brushes positioned to engage said contact piece, one of said brushes being provided for each step so as to engage said conducting portion successively, a fixed commutator provided with a plurality of contact segments respectively connected to said brushes, a clock mechanism, and a movable brush driven by said clock mechanism and successively engaging said segments.

2. A keying device for transmitting mensural data comprising the combination with a circuit to be keyed, of a plurality of separate leads, means responsive to the quantity to be measured for connecting to one side of said circuit certain of said leads corresponding in number to the magnitude of said quantity, and means for successively connecting each of said leads to the other side of said circuit.

3. A keying device for transmitting mensural data comprising a contact piece movable from a zero position to positions corresponding to the data to be transmitted and having a leading edge, a plurality of brushes positioned to engage said contact piece and mounted at different distances from the leading edge of said contact piece when the latter is in its zero position, a fixed commutator having a plurality of segments connected respectively to said brushes, a movable brush positioned to engage said commutator, and means for driving said brush to contact said segments successively.

4. A keying device for transmitting mensural data comprising a shaft rotatable in response to variations in the quantity to be measured, a contact piece mounted on said shaft and having a leading edge, a plurality of brushes positioned to engage said contact piece and mounted at different distances from the leading edge of said contact piece when the latter is in any given position, whereby the number of brushes in contact is dependent upon the position of said contact piece and is indicative of the magnitude of the measured quantity, a fixed commutator provided with a plurality of contact segments respectively connected to said brushes, a clock mechanism, and a movable brush driven by said clock mechanism and successively engaging said segments.

5. A keying device for transmitting mensural data comprising a shaft rotatable in response to variations in the quantity to be measured, a contact piece mounted on said shaft and comprising conducting and insulating portions, said conducting portion having a leading edge, a plurality of brushes positioned to engage said contact piece and mounted at different distances from said leading edge when the contact piece is in any given position, whereby the number of brushes in contact with the conducting portion is dependent on the position of said contact piece and is indicative of the magnitude of the measured quantity, a fixed commutator provided with a plurality of contact segments respectively connected to said brushes, a clock mechanism, and a movable brush driven by said clock mechanism and successively engaging said segments at predetermined intervals.

6. A keying device for transmitting mensural data comprising a shaft rotatable in response to variations in the quantity to be measured, a contact piece mounted on said shaft and comprising a plurality of conducting portions subtending different angles corresponding to successive increments in the quantity to be measured, a plurality of brushes mounted to engage said contact piece, the successive brushes being so spaced in rela-

tionship with said contact piece that when the latter is in a position corresponding to zero the quantity to be measured a single brush is in contact therewith and the remaining brushes are positioned at different predetermined intervals in advance of the leading edge of successive portions, a fixed commutator having segments connected respectively to said brushes, the segment corresponding to said zero brush subtending a different angle on said commutator from those subtended by the segments connecting to said other brushes, a clock, and contact means driven by said clock for periodically sweeping said segments.

7. A keying device for transmitting mensural data comprising a movable contact piece having a leading edge, a plurality of brushes mounted to engage said contact piece, said brushes being positioned at successively greater intervals in advance of said leading edge when said contact piece is in position of minimum-reading, actuating means responsive to the quantity to be measured for moving said contact piece successively into contact with a number of brushes indicative of the quantity to be measured, a fixed commutator provided with segments connected respectively to said brushes, a movable contact means for making contact with said segments, and timing mechanism connected to drive said contact means.

8. A keying device for transmitting mensural data comprising a plurality of groups of contactors, the contactors of each group corresponding in number to the units of one order of magnitude of the system of mensuration employed, rotary means associated with each of said groups for successively closing the contactors thereof in response to equal increments of rotation of said means, means responsive to the quantity to be measured for rotating the first of said rotary means, transfer gears between said rotary means for advancing a succeeding means by an angle representing one unit for each complete revolution of a preceding rotary means, a fixed commutator comprising a plurality of segments each connected to one of said contactors, said segments being arranged in spaced groups corresponding to the respective groups of contactors, and clock

driven contact means mounted to sweep said segments successively.

9. A keying device for transmitting mensural data comprising a plurality of groups of contactors, a plurality of rotating elements interconnected to form a counter mechanism and each comprising means for successively closing and simultaneously opening the contactors of one group in response to predetermined increments of rotation thereof, a commutator having segments arranged in groups corresponding to the contactor groups, leads between said contactors and said segments connecting the first contactor of each group with the central segment of its corresponding group and the succeeding contactors alternately to adjoining segments on each side of the central segment, a brush positioned to contact said segments, and means for sweeping said brush over said segments.

10. A keying device for transmitting mensural data comprising a plurality of groups of contactors, the contactors in each group corresponding in number to the integers of one order of digits in the data to be transmitted plus an additional contactor in each group representing zero for each order, rotary means associated with each group for closing said contactors successively in accordance with predetermined increments of rotation, starting with the zero contactor and for opening the zero contactor upon the closure of the first integer contactor and opening the remainder of the contactors simultaneously following a final increment which again closes the zero contactor, means responsive to the quantity to be measured for rotating the said rotary means corresponding to the lowest order of digits, transfer gears between the respective rotary means to advance those corresponding to higher orders step by step, a fixed commutator having a set of segments corresponding to said integer contactors, each segment being connected to one of said contactors, said commutator also having a separate set of segments connected respectively to said zero contactors and subtending a different arc on said commutator from the segments of said first set, and mechanically driven means for contacting said segments successively.

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