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A. A. CLOKEY

SIGNALING SYSTEM

Filed Dec. 15, 1923

Fig. 1.

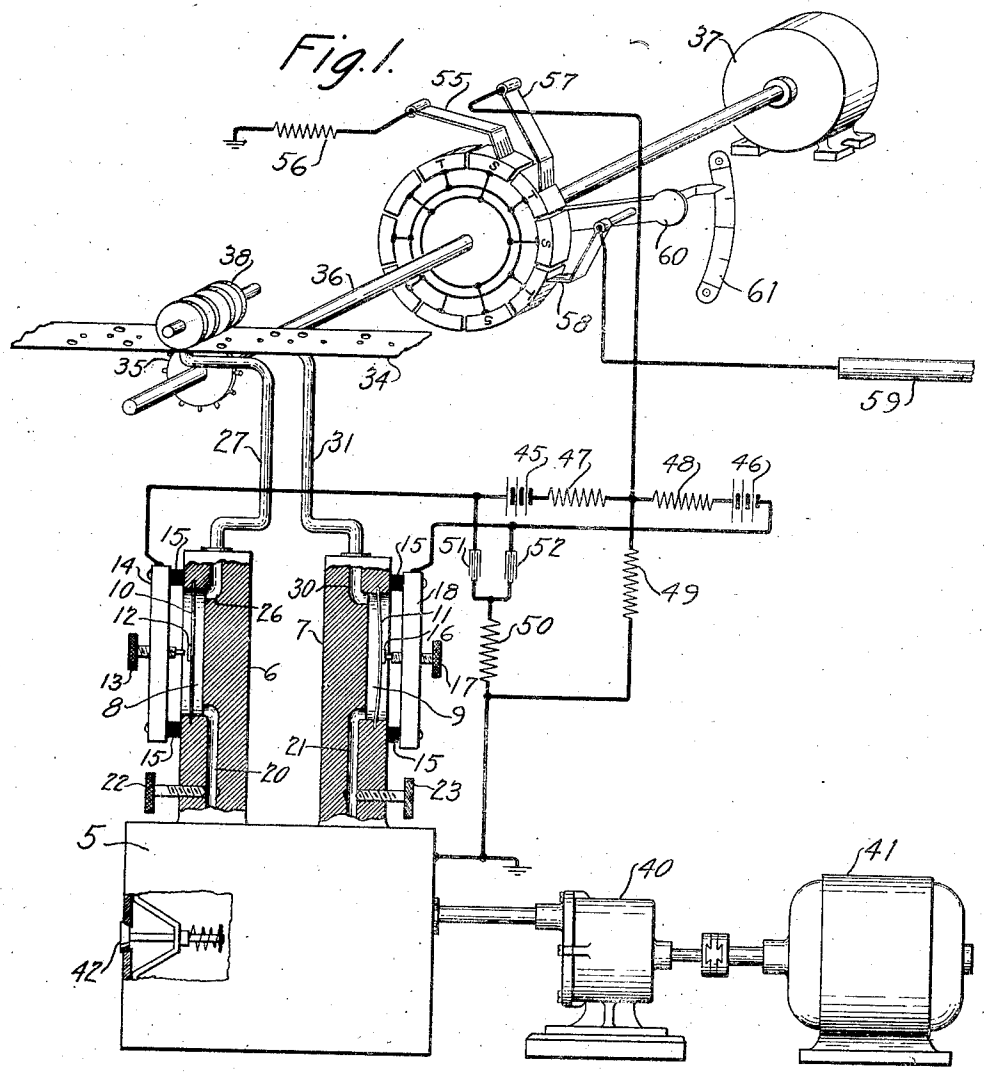
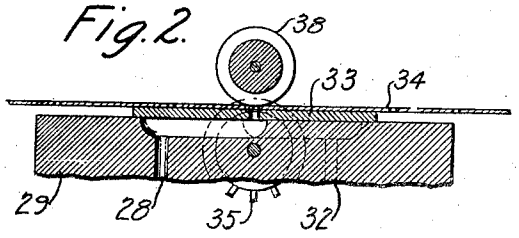


Fig. 2.



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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

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This invention relates to signaling systems and particularly to the apparatus and circuits employed for transmitting signaling impulses which are controlled by suitable perforated message tape, and for equalizing the length of such impulses transmitted to the line.

The Wheatstone type of transmitter as commonly used for submarine cable transmission is limited in its speed of satisfactory operation due to the inertia of its reciprocating contact arms and the unavoidable vibration of its moving parts. Since loaded submarine telegraph cables are capable of considerably higher speeds of transmission, it is of importance to devise a more suitable type of transmitter which will function satisfactorily at speeds of the order of those at which a well designed loaded cable is capable of transmitting.

It is therefore an object of the present invention to improve the construction of an automatic telegraph transmitter so that it will be capable of operating at a high rate of speed to cause the rapid breaking and closing of firm contacts. It is a further object of the invention to produce a transmitter of this kind that will be simple and compact, free from liability of derangement and relatively inexpensive in construction.

A further object of the invention is to make it possible to control the time interval during which each signal impulse is impressed upon the line, thus equalizing the impulses with respect to each other if desired and controlling the length of signal.

To accomplish these objects and in accordance with a feature of the invention, the movable contact members of the transmitter are operated by changes in pressure which are under the direct control of the perforated message tape.

In accordance with another feature of the invention, a commutating device cooperates with the contact members to regulate the portion of the signal impulse which is impressed upon the line.

These and other features of the invention may be more clearly understood by reference to the accompanying drawing in which Fig. 1 shows schematically a transmitter embodying the features of the invention and illustrates the method employed for controlling the length of the signaling impulses, and Fig. 2 is a sectional view showing the means by which the perforated message tape causes variation in the pressure exerted on the diaphragms.

Referring to these drawings, the transmitting mechanism comprises a suitable reservoir 5 upon which are mounted supporting members 6 and 7 provided with shallow cylindrical air chambers 8 and 9 which are enclosed respectively by means of flexible diaphragms 10 and 11. The diaphragm 10 carries a contact member 12 which is adapted to engage a contact screw 13 adjustably mounted on the plate 14 and insulated from the supporting member 6 by means of suitable insulators 15, 15. In a similar manner the diaphragm 11 carries a contact member 16 arranged to engage contact screw 17 adjustably mounted on plate 18 and insulated from support 7 by insulating members 15, 15. The air chambers 8 and 9 are connected with the reservoir 5 by means of passages 20 and 21 which are provided respectively with adjustable valves 22, 23 which permit regulation of the frictional resistance offered to the passage of air therethrough. The support 6 is also provided with an air passage 26 communicating with the chamber 8 and extending by means of suitable means such as a pipe 27 to a similar passage 28 in the tape supporting block 29. Likewise, the support 7 is provided with an air passage 30 connecting by means of pipe 31 to a second air passage 32 in tape block 29. (For the sake of clearness, the tape block is not shown in Fig. 1, but is shown in section in Fig. 2.) The passages 31 and 32 have inwardly extending horizontal portions which are covered by the platen 33 over which the message tape 34 is drawn. This platen is provided with two perforations in transverse alignment with respect to the tape and so positioned as to be in alignment with the code perforations in the tape. The perforations in the platen may be of any desired shape and are so positioned that a perforation in the tape corresponding to a dot will uncover the passage way 32 and a perforation in the tape corresponding to a dash will uncover the passage 28.

The tape feeding mechanism comprises a star wheel 35 mounted on the shaft 36 which is positively driven by the motor 37. The projections on the star wheel extend through a suitable slot in the platen 33 and engage perforations provided in the center line of

the tape. The roller 38 which serves to hold the tape firmly against the platen is provided with a center groove to permit free movement of the star wheel and with two outer grooves in alignment with the perforations in the platen to permit free escape of air when the perforations in the platen and the message tape are in alignment. A pair of springs not shown in the drawing keep the roller 38 pressed against the tape with the desired pressure.

The reservoir 5 is maintained at the desired pressure by means of the compressor 40 connected to the driving motor 41 and a pressure regulating valve 42 which maintains the pressure at a predetermined value. It has been found that a pressure of the order of three inches of mercury is sufficient to permit satisfactory movement of the diaphragms.

The application of this transmitter to telegraph transmitting systems differs somewhat from standard practice due to the fact that the contacts open instead of close in response to a perforation in the tape. The contacts 12 and 16 are connected together through the diaphragms 10 and 11, and supports 6 and 7 and are then grounded. The contact screw 13 is connected to the positive terminal of battery 45 and contact screw 17 is connected to the negative terminal of battery 46. These batteries are connected in series, balanced resistances 47 and 48 being provided as shown to limit the current drain on the batteries when both contact screws are in contact with their respective diaphragm contacts at the same time. The junction of resistances 47 and 48 is connected to ground through resistance 49, the purpose of which will be explained hereinafter. To prevent excessive sparking on the contacts, resistance 50 is connected in series with condenser 51 across the contacts 12, 13 and in series with condenser 52 across contacts 16 and 17.

In order to equalize the length of signal impulses and to provide a desired degree of curbing, a curbing device is preferably provided comprising a commutator mounted on the shaft 36 and having an even number of segments equal to the number of projections on the star wheel 35 which feeds the message tape. Alternate segments SS are connected together as are also the intermediate segments TT. Brush 55 is connected to ground through resistance 56, brush 57 is connected to the ungrounded terminal of resistance 49 and brush 58 is connected directly on the line or cable 59. Brushes 55 and 57 are fixed in position with respect to each other so that at the instant brush 55 is just passing upon a segment S, brush 57 will be just passing upon a segment T. Brush 58 is mounted upon an adjustable arm 60 which is capable of being rocked so that the brush moves over the arc of a circle equal to the length of one of the segments. An indicator 61 is provided to indicate the setting of the brush and therefore the degree of curbing.

The operation of the device is as follows: Assuming that contacts 12 and 16 are in engagement with their respective contact screws 13 and 17 and resistances 47 and 48 are equal, the tendency for current to flow in the circuit comprising battery 45, contact screw 13, contact 12, resistance 49, and resistance 47 will be equal but opposite in direction to the tendency for current to flow in the circuit comprising battery 46, resistance 48, resistance 49, contact 16, contact screw 17. Therefore, no current will actually flow through resistance 49 and there will be no difference of potential existing between the cable 59 and ground. Should the contact 12 be out of engagement with the contact screw 13 (as shown on the drawing) in response to a dash perforation in the transmitting tape, current will then flow from the positive terminal of battery 46, through resistance 48, resistance 49, contact 16 and contact screw 17 and back to the negative terminal of battery 46. The difference in potential existing across resistance 49 due to this current will be applied through brush 57, segments TT and brush 58 to the cable 59. When a contact is again established between contact 12 and contact screw 13, a circuit is completed from the positive terminal of battery 45, through contact screw 13, contact 12, resistance 49, and resistance 47 back to the negative terminal of battery 45, thus reducing the potential across resistance 49 to zero and terminating the transmission of that impulse. In a similar manner, in response to a dot signal in the perforated tape, the pressure of the inner side of diaphragm 11 is reduced thus causing contact 16 to break engagement with contact screw 17, in which case current flows from the positive terminal of battery 45, through contact screw 13, contact 12, resistance 49, and resistance 47 back to the negative terminal of battery 45. A difference in potential opposite in sign to that just mentioned now exists across the resistance 49 and is applied to the cable 59 by means of brush 57, segments T, T and brush 58.

The commutator comprising segments S, S and T, T and brushes 55, 57 and 58 is provided for equalizing the length of the current impulses impressed upon the line or changing the amount of signal curbing. As stated above, brushes 55 and 57 are fixed in position with respect to each other so that brush 55 will always be just passing upon one of the S segments at the instant brush 57 is just passing upon one of the T segments. If brush 58 is so positioned that it will also be just passing upon one of the T segments at the instant brush 57 is passing

upon the T segment, then the cable will be connected to the transmitting circuit during the entire time represented by the rotation of the commutator, through a distance equal to the length of one segment, and during this time the ground through resistance 56 and brush 55 will not be electrically connected to either the cable 59 or the transmitting network. Thus the signal transmitted to the cable is of the full length produced by the closure or opening of either the contacts 12—13 or 16—17. Now if the position of brush 58 is shifted by the rotation of lever 60 so that it is passing upon one of the S segments at the time brush 57 is just passing upon segment T, then the cable will be connected to ground through brush 58, segments S, S, brush 55 and resistance 56, and the transmitting network will not be connected to either. This represents the condition for 100% curbing or zero marking and it is obvious that intermediate positions of the brush 58, will result in applying an amount of curbing to the transmitted signal which is proportional to the displacement of brush 58 from its first described position at the beginning of segment T. One of the advantages of employing this method of altering the curbing interval is that the adjustment can be made while the transmitter is in operation and the adjusting means can be calibrated, if desired, so that the exact amount of curbing applied may be read from an indicating dial without the necessity of measurement by the longer methods involving the use of an oscillograph or other recording or indicating device.

In the transmitter as described, a compressor is employed to maintain a definite pressure in the reservoir 5, but it is obvious that this compressor might be replaced by a vacuum pump which will maintain a partial vacuum in the reservoir 5. In this case the flexure of the diaphragms due to a code perforation in the tape passing over the platen would be in the opposite direction and would cause a closure of a contact rather than an opening.

It is preferred to employ air to operate the transmitter but other gases or even liquids may be used.

The invention claimed is:

1. In a telegraph system employing a perforated message tape, a diaphragm closing an air chamber, a pair of contact members controlled by said diaphragm, means for normally maintaining the air in said chamber under pressure, and a platen having perforations therein in alignment with the perforations in the message tape and cooperating therewith to lower the pressure in said air chamber thereby controlling the movement of the diaphragm.

2. In a telegraph system employing a perforated message tape, a diaphragm closing an air chamber, a reservoir connected therewith by means of a passage offering a constant frictional resistance to the flow of air therethrough, a pair of normally engaged contact members controlled by said diaphragm, means for increasing the pressure in said air chamber, a pressure regulating valve for maintaining a uniform pressure in said reservoir, and means controlled by the perforations in the message tape for varying the pressure in said air chamber by releasing air therefrom thereby causing the separation of said contact members.

3. In a telegraph system employing a perforated message tape, a diaphragm closing an air chamber, a pair of contact members controlled by said diaphragm, means for forcing air into said air chamber through a passage affording a constant frictional resistance to the flow of air therethrough, means for regulating said frictional resistance, and means controlled by the perforations in the message tape for releasing air from and thus varying the pressure in said air chamber thereby causing the operation of said contact members.

4. In a telegraph system employing a perforated message tape, a resistance member, and pneumatic means under the control of the perforations in the message tape for impressing voltages of either polarity across said resistance.

5. In a telegraph system employing a perforated message tape, a resistance, a diaphragm under the control of perforations in the message tape, a pair of contact members operated by said diaphragm to transmit current impulses through said resistance, a second diaphragm under the control of other perforations in the message tape, and a pair of contact members operated by said second diaphragm to transmit current impulses through said resistance in an opposite direction.

6. In a telegraph system, the combination of a pneumatic transmitter with a commutating device for equalizing the length of the current impulses transmitted thereby.

7. In a telegraph system employing a perforated message tape, the combination of a pneumatic transmitter with a commutating device positively driven with respect to said message tape for controlling the length of current impulses impressed upon the line.

8. In a telegraph system, a resistance, an automatic transmitter for impressing current impulses across said resistance, and a commutating device positively driven with respect to the movement of the message tape for curbing and transmitting said impulses to the line.

9. In a telegraph system employing a perforated message tape, an automatic transmitter, a star wheel for causing movement

of the message tape and a curbing device comprising an even number of segments corresponding to the number of projections on the star wheel, alternate segments being connected together electrically, alternate intermediate segments being connected together electrically, a pair of brushes mounted in fixed relation to each other, one of said brushes being grounded, the other of said brushes being connected to the transmitter, and an adjustable brush connected to the line over which impulses are to be transmitted.

10. In a telegraph system employing a message tape, an automatic transmitter for transmitting current impulses, and a commutating device for equalizing the length of said impulses, said device being adjustable during operation to control the length of current impulses transmitted to the line.

11. In a telegraph system employing a message tape, an automatic transmitter for transmitting current impulses and a curbing device for regulating the length of such impulses as impressed upon the line, said curbing device being adjustable during operation to control the length of signals transmitted to the line from the full length of the impulses obtained from the transmitter to zero length.

12. In a telegraph system employing a message tape, an automatic transmitter for transmitting current impulses, a commutating device adjustable during operation for controlling the length of such impulses transmitted to the line, and means for indicating the amount of curbing applied to the signals.

13. A high speed telegraphic transmitter comprising two fluid conduits, means for moving a perforated message tape with respect to said conduits so that the perforations representing dots permit fluid from one of said conduits to pass therethrough and the perforations representing dashes permit fluid from the other conduit to pass therethrough, and means cooperating with the fluid passed through the perforations to set up electric currents in one direction or the other depending upon whether the fluid was passed by a dot perforation or a dash perforation.

14. In a pneumatic transmitter, a gas chamber, the pressure in which is controlled by perforated tape, and means operated in correspondence with the signals for compensating in part, at least, for variations of pressure in said chamber due to unequal distribution of the perforations.

In witness whereof, I hereunto subscribe my name this 7th day of December, A. D. 1923.

ALLISON A. CLOKEY.