No. 794,242. PATENTED JULY 11, 1905.

D. MURRAY.

TAPE CONTROLLED TELEGRAPHIC TRANSMITTING APPARATUS.

APPLICATION FILED JAN. 5, 1905.

FIG. 1.

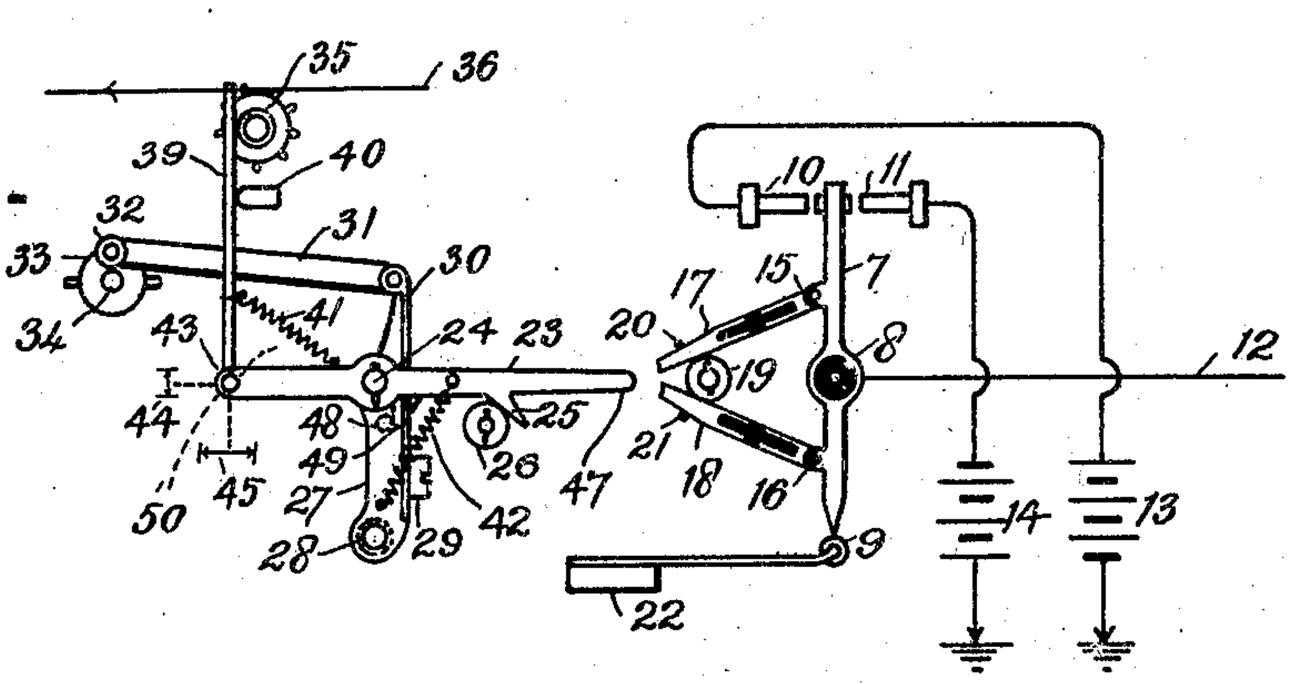


FIG. 2.

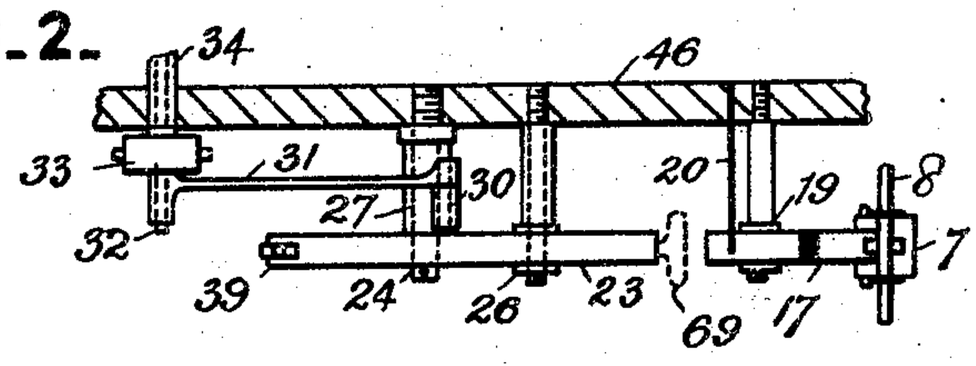
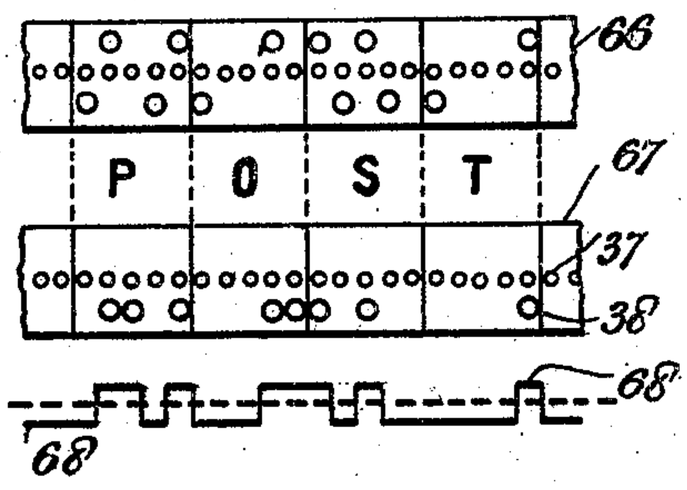


FIG. 3.



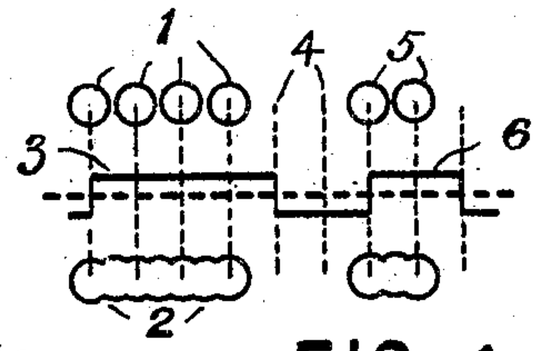


FIG. 4.

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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF LONDON, ENGLAND.

TAPE-CONTROLLED TELEGRAPHIC TRANSMITTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 794,242, dated July 11, 1905.

Application filed January 5, 1905. Serial No. 239,780.

To all whom it may concern:

Be it known that I, DONALD MURRAY, electrician, a subject of the King of Great Britain, residing at 3 Lombart Court, in the city and county of London, England, have invented new and useful Improvements Relating to Tape-Controlled Telegraphic Transmitting Apparatus, of which the following is a specification.

My invention relates to a modification of the well-known Wheatstone automatic transmitter, the object of the modification being to enable telegraphic signals to be automatically retransmitted from the perforated tape produced at the receiving-station by my system of printing telegraphy, described in Patent No. 653,936, July 17, 1900. In that system the transmitting-tape resembles the ordinary Wheatstone tape, having a row of signal-holes punched on both sides of the central line of holes by which the tape is fed through the transmitter. The receiving-tape, on the other hand, has a row of signal-holes on one side of the tape only. The improvement which is the subject of the present application enables exactly the same signals that produce this single-line tape to be again automatically retransmitted by it. In this way the single-line tape may be used for both sending and receiving, and the double-line tape is abolished. In this way also the keyboard apparatus for preparing the transmitting-tape for my printing-telegraph system is considerably simplified, only five punches with their corresponding parts being required instead of ten as at present.

As the tape produced at the receiving-station is identical in form with the transmitting-tape at the sending-station, it is obvious that when the received tape is used for retransmitting, the signals it sends out will be identical with those transmitted from the original station. It is well known that when telegraph-signals pass through ordinary repeating instruments the signals deteriorate in proportion to the speed and the number of repeating-stations and the length of line. With automatic retransmission from the perforated receiving-tape there is no deterioration of the signals. Consequently telegraph-signals can by this means be transmitted automatically at a high speed to any required distance. It also enables telegrams from any number of stations A B C to be automatically retransmitted through station D to any number of stations E F G, any one or more of which stations may again retransmit such of the messages as require to be forwarded still further. In this way a considerable saving of labor may be effected compared with the present method of manual retransmission.

In the accompanying drawings, which illustrate my invention, Figure 1 is a front elevation of the modified automatic transmitting mechanism. Fig. 2 is a plan view of the same. Fig. 3 shows the transmitting and receiving tapes at present used in my printing-telegraph system with groups of perforations representing the word "post." Fig. 4 shows, on an enlarged scale, a group of holes in the received tape and the electrical signals that produce them.

It is well known that there are two methods of automatically transmitting telegraph-signals from a perforated paper tape. The first is the direct method, in which metallic brushes make electrical contact directly through the holes in the tape. The second is the indirect method employed in the Wheatstone automatic transmitter. This utilizes the principle of the Jacquard loom, the signals being transmitted by the intervention of a number of small levers and rods controlled by the perforated tape. Experience has shown that the indirect method of transmission is more reliable than the direct method, and it has the additional practical advantage that by adjustment of the levers and contacts the relative duration of the positive and negative impulses can be regulated with great nicety. Another advantage of the indirect method of transmission is that the mechanism for preparing the transmitting perforated tape is simpler and acts more rapidly than that required for making tape for direct transmission by contact-brushes. For instance, in Fig. 4 the group of four holes 1 can be punched simultaneously by four punches, whereas the seven

overlapping holes 2 required for direct transmission of the same signal have to be punched successively.

The immediate object of the present invention is therefore to produce from a series of adjoining but separate holes 1, Fig. 4, a continuous telegraphic signal 3, such as would be produced by a contact-brush passing over the perforation 2. The mechanism has also to break or reverse the current when one or more unperforated units of tape 4 intervene and to maintain this zero or reversed current in the line until one or more perforated units of tape 5 present themselves. In practice the Wheatstone automatic transmitter is usually worked with reversals of current. The modified transmitter here described may be worked in the same way, as indicated by the heavy zigzag line 6 in Fig. 4, zero being indicated by the heavy dotted line.

Turning to Fig. 1, 7 is the usual Wheatstone contact-lever pivoted at 8 and pressed by the jockey-roller 9, so as to make sharp and firm contact either with the marking or spacing contacts 10 or 11. In the drawings it is shown midway between the two contacts; but in practice it cannot maintain this position, as the jockey-roller forces it over against either 10 or 11.

In Fig. 1, 12 is the main-line wire connected to the contact-lever 7. 13 and 14 are the two halves of a split battery, connected to earth and to the two contacts 10 and 11. Pivoted to the lever 7 at 15 and 16 are two light thrust-bars 17 and 18, which are lightly pressed against the friction-roller 19 by the springs 20 and 21. The free ends of the two thrust-bars are slightly recessed to conform with the free end 47 of the lever or pusher 23. This lever 23 is free to oscillate on the pin 24, which is fixed in the upright piece 27, which in its turn oscillates on the axis 28. Attached to 27 by a screw 29 is a flat spring 30, having at its upper end a link to unite it by a pin to the connecting-rod 31. This connecting-rod at its other end fits onto a pin 32, driven into the face of a small eccentric wheel 33, which is fixed to the shaft 34. Pivoted at 43 at the end of the lever 23 is a small rod 39, which is held against the stop 40 by the spring 41. This rod 39 is arranged to be in line with the message-holes 38, Fig. 3, in the paper tape. Beneath the lever 23 is a tooth 25, which forms an inclined plane resting on the friction-roller 26. The pivot 8 is insulated from the contact-lever 7, and the thrust-bars 17 and 18 are also divided into two parts by insulation, as shown. The supporting-block 22 of the jockey-roller 9 is likewise insulated. In this way the contact-lever 7 and the main-line wire are insulated from the frame of the machine.

The action of the mechanism is as follows: When the eccentric wheel 33 revolves, the connecting-rod 31 makes the upright piece 27 oscillate on the axis 28. Horizontal reciprocating motion is in this way imparted to the lever 23; but as this lever moves to the left the inclined plane 25, resting against the roller 26, causes the lever 23 to oscillate on the pin 24. This depresses the opposite end of lever 23 and causes rod 39 to be withdrawn from the tape 36. As the motion of wheel 33 continues the lever 23 begins to turn in the opposite direction and the rod 39 is thrust against the paper tape 36. The wheel 33 is geared to make one revolution for each tooth of the star-wheel 35, and in this way the rod 39 reciprocates in and out of each message-hole or strikes the tape where a message-hole has been omitted, as will be seen by inspection of 67, Fig. 3. If there is a message-perforation in the tape, the rod 39 passes through the hole and the tip 47 of the lever 23 strikes against the recessed end of the thrust-bar 18. This throws over the contact-lever 7 onto the marking-contact 10. If at the next oscillation of the lever 23 the rod 39 again passes through a hole in the tape, the actions just described are repeated; but the lever 7 being already in contact with 10 no change takes place. Consequently so long as a succession of holes, such as those shown at 1, Fig. 4, present themselves in the tape a continuous marking-current, like 3, Fig. 4, is transmitted through the main line 12; but if the rod 39 strikes an unperforated portion of the tape then the tip 47 of the lever 23 is held up and the oscillation of 27 causes it to strike against the recessed end of the thrust-bar 17, thereby causing lever 7 to leave contact 10 and cross over to contact 11. This throws spacing-current into the line 12. If the rod 39 again strikes an unperforated portion of tape, the same actions are repeated; but lever 7 being already in contact with 11 no change is made and spacing-current continues to be sent. The movement of the lever 7 therefore depends on the change from perforated tape to non-perforated tape, or vice versa. No further change is produced by a succession of perforations or by a succession of non-perforated portions of tape. The object of the spring 30 is to give when the lever 7 has been thrust over against contact 10 or 11. Otherwise there would be danger of the mechanism breaking. The spring 42 keeps lever 23 down upon the roller 26 and causes rod 39 to be thrust against the paper tape. This spring can be made quite light, because it will be noticed that the tape 36 merely controls the direction of the thrust of the lever 23. In the Wheatstone transmitter the strength of the thrust against the lever 7 depends entirely on the strength of the paper tape, whereas in the mechanism shown in Fig. 1 the tape can be quite thin, a strong thrust being obtained direct from the driving mechanism. This has the advantage of insuring very firm contacts of the lever 7 with 10 and 11, a point

of great importance in practical telegraphy. The double arrows 44 and 45 show the directions in which the end of the lever 23 moves.

In place of the friction-roller 26 and the inclined plane 25 a slight modification (shown in dotted lines in Fig. 1) may be employed as follows: 48 is a pin fixed in the piece 27, and 49 is a tooth projecting downward from the lever 23 and resting against the pin 48. When 48 and 49 are employed, 25 and 26 are omitted, and vice versa. Assuming that 25 and 26 are omitted, then the levers 23 and 27 oscillate as if they were one piece, and so long as there are perforations in the tape the tip 47 of the lever 23 strikes against thrust-bar 18; but when non-perforated tape intervenes rod 39 is held down and the tip 47 rises as the result of the oscillation of 27 and strikes thrust-bar 17. It will be seen from inspection of the dotted arc 50 of a circle described about the center 28 that when the pin and tooth 48 and 49 are employed there is sufficient up-and-down movement in the oscillation of the lever 23 to cause the rod 39 to reciprocate vertically against the tape. Actually rod 39 also oscillates on the stop 40 as a center; but this assists rather than retards the action. Both the pin-and-tooth arrangement 48 and 49 and the roller-and-tooth arrangement 26 and 25 work well. The former is simpler and the latter gives more range of adjustment, as the roller can be mounted on a movable piece.

It is to be noted that in the Wheatstone transmitter the position of the contact-lever is not affected by the difference between perforated and non-perforated portions of tape. Its change of position depends on the occurrence of holes on one side of the tape or on the other, as in 66, Fig. 3. With the Wheatstone tape the signals depend on the relative positions of a series of perforations. In the invention forming the subject of this application the signals depend on the relative positions of perforated and non-perforated portions of tape.

In Fig. 3, 66 shows the tape with a double line of perforations at present employed for transmitting in my printing-telegraph system. 67 shows the way in which the signals transmitted by 66 are recorded on the receiving-tape. The invention which is the subject of this application enables the double-line tape 66 to be abolished and the single-line tape 67 to be substituted for it. In this way the sending and receiving tapes become identical. The positive and negative currents transmitted by tape 67, or which are effective to produce tape 67, are shown by the zigzag line 68, the dotted line representing zero. The tape as perforated shows the four letters of the word "post."

Instead of the spring 30, Fig. 1, the connecting-rod 31 may be connected direct to the upright lever 27, the spring 30 and the lever 27 then being formed as one solid piece. The function of the spring 30 may then be performed by a spring-wire loop, (shown dotted at 69, Fig. 2,) fixed in the end of the thrust-lever 23. This arrangement works well, and it has the advantage that it is easy to make and to replace when worn out. It is possible to work without either spring 30 or 69; but in this case the contacts 10 and 11 require to be very carefully adjusted to prevent injury to the mechanism, and the jockey-roller 9 has to be relied upon to complete the contacts.

What I claim is—

1. In an automatic telegraph-transmitter, the combination of a tape perforated with a series of signal-holes arranged in a single line along the tape, a contact-lever, a pivotal support for said lever, two contacts, and intermediate reciprocating and oscillating rods and levers such that a perforation in the tape causes the intermediate mechanism to strike the contact-lever on one side of its pivot, thereby throwing it over onto one contact, and a non-perforated portion of tape causes the mechanism to strike the contact-lever on the other side of its pivot, thereby throwing it over onto another contact.

2. In an automatic telegraph-transmitter, the combination of a lengthwise-moving tape perforated with a series of signal-holes arranged in a single line along the tape, a single reciprocating rod adapted to enter the perforations or to strike against the non-perforated portions of the tape and a contact-making lever and means for operating the same, the free reciprocating motion of the rod permitted by perforations in the tape causing the contact-making lever to be thrown over against a marking-contact, and the obstruction of the motion of the rod by non-perforated portions of the tape causing the contact-lever to be thrown over against a spacing-contact.

3. In an automatic telegraph-transmitter, a lengthwise-moving tape perforated with a series of signal-holes arranged in a single line along the tape, combined with a system of reciprocating and oscillating rods and levers, and a contact-lever with two converging thrust-bars, all so arranged that a perforation in the tape permits the system of rods and levers to throw the contact-lever over to a marking-contact, where it remains until the free motion of some of the rods and levers is obstructed by a non-perforated portion of the tape, the obstruction causing the system of rods and levers to throw over the contact-lever from the marking-contact to the spacing-contact, where it remains until again thrown over to the marking-contact by the occurrence of a perforation in the tape.

4. In an automatic telegraph-transmitter, the combination of a lengthwise-moving tape perforated with a series of signal-holes arranged in a single line along the tape, and a

single reciprocating rod adapted to enter the perforations or to strike against the unperforated portions of the tape, the tape and the rod controlling the direction of action of a lever adapted to thrust a contact-lever over from a marking to a spacing contact or vice versa, the thrust being delivered direct from the motor mechanism of the transmitter and being independent of the strength of the tape.

5. In an automatic telegraph-transmitter, the combination of a tape 36 perforated with a single row of message-holes, a single reciprocating rod 39, an oscillating thrust-lever 23, two converging thrust-bars 17 and 18, and a contact-lever 7.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DONALD MURRAY.

Witnesses:
GEORGE HUGHES,
JOHN A. JORDAN.