(No Model.) 5 Sheets—Sheet 1.

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SUBMARINE TELEGRAPHY.

No. 577,534. Patented Feb. 23, 1897.

Fig: 1.

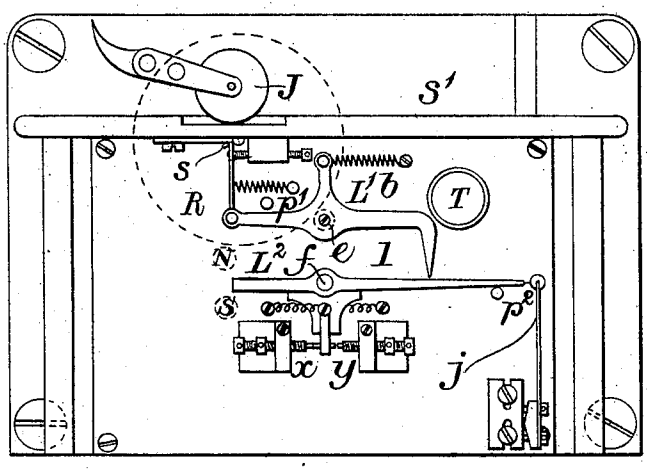


Fig: 6.

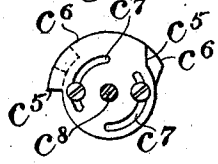


Fig: 5.

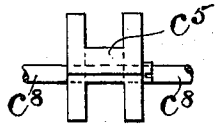


Fig: 7.

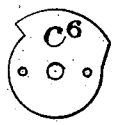


Fig: 8.

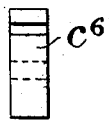
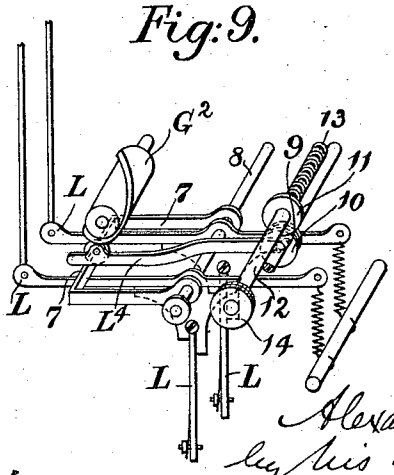


Fig: 9.



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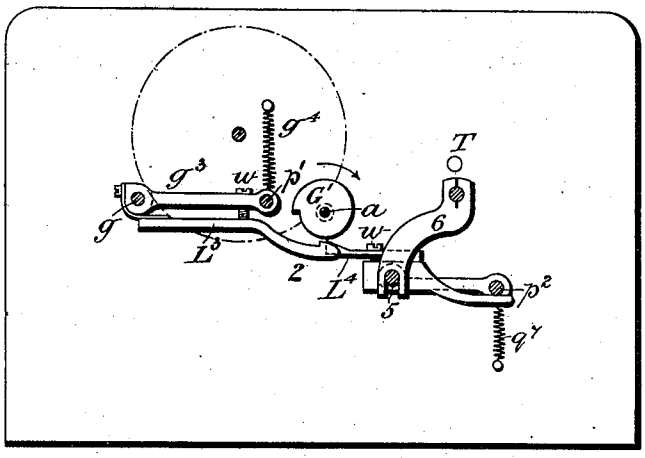
A. MUIRHEAD.

SUBMARINE TELEGRAPHY.

No. 577,534. Patented Feb. 23, 1897.

Fig. 2.



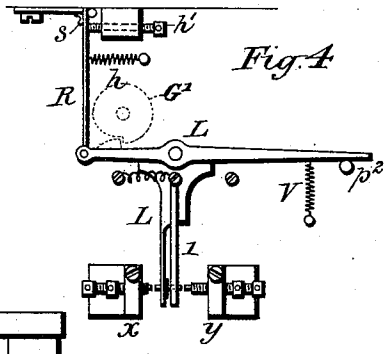


Fig. 4.

Fig. 3.

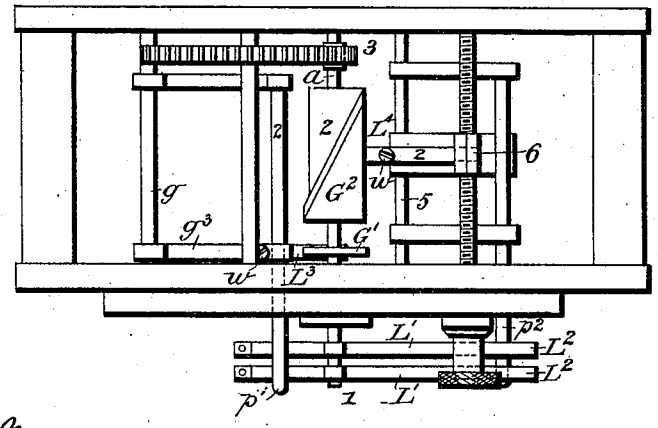


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Fig. 10.

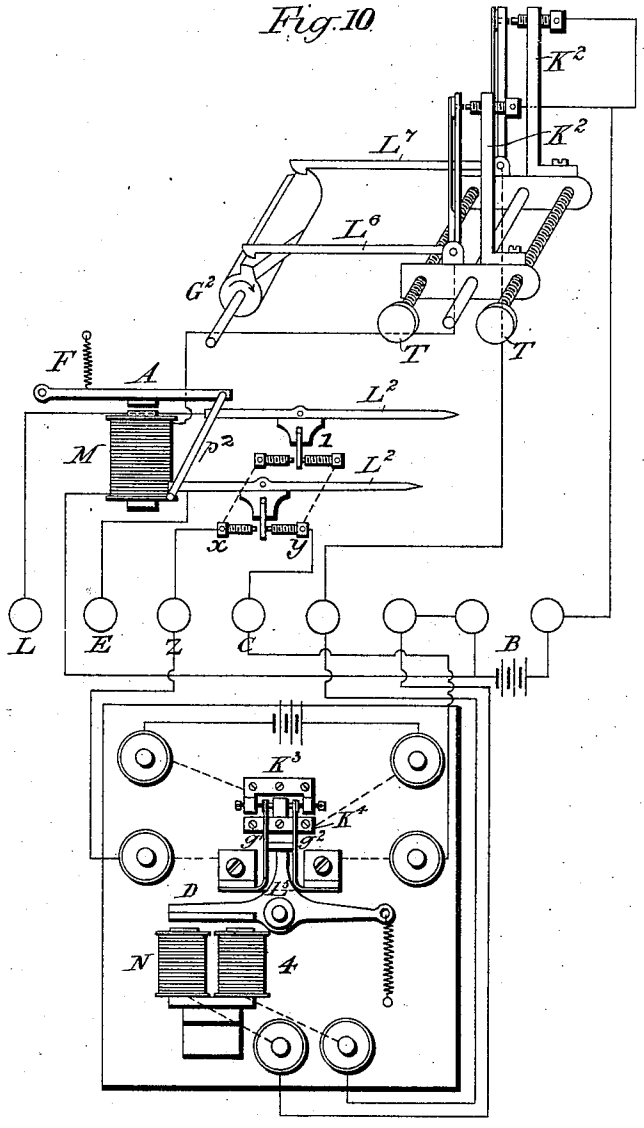

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Fig. 12.

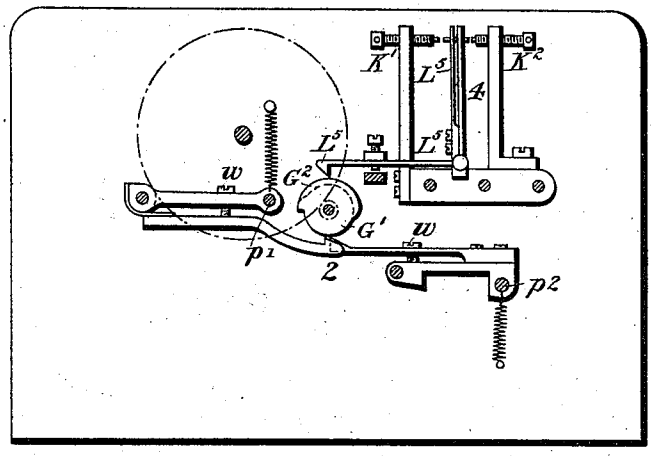


Fig. 11.

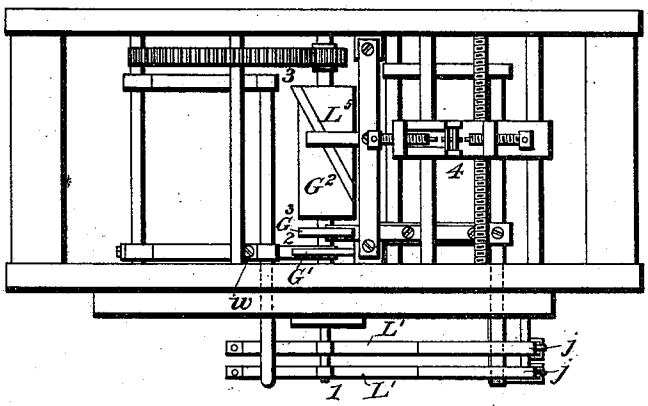
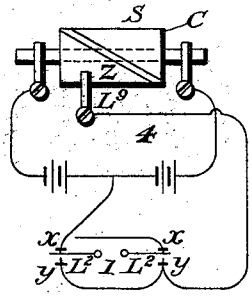


Fig. 16.



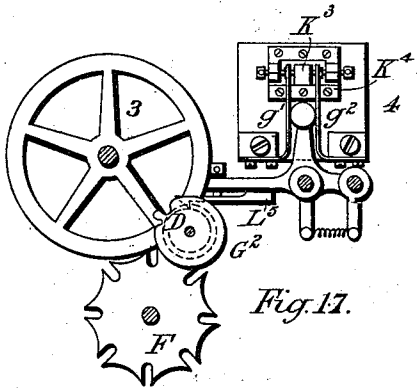


Fig. 17.

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No. 577,534. Patented Feb. 23, 1897.

Fig. 13.

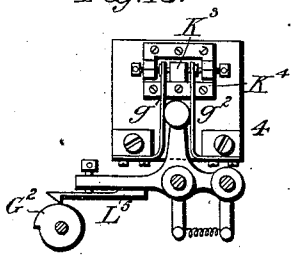
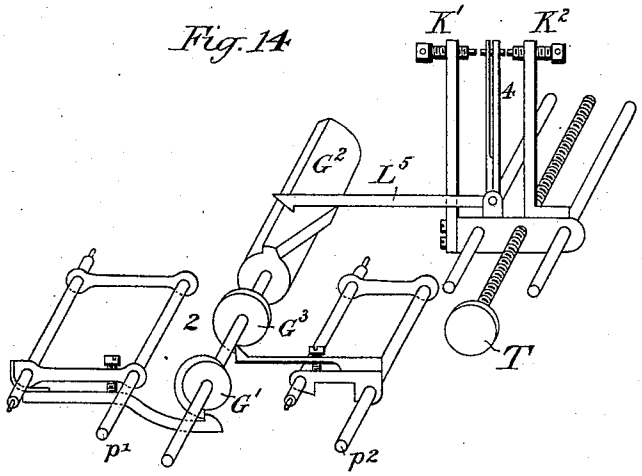
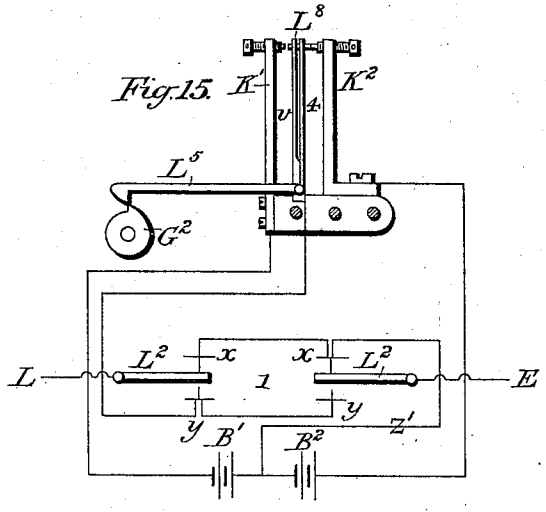


Fig. 14





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UNITED STATES PATENT OFFICE.

ALEXANDER MUIRHEAD, OF LONDON, ENGLAND.

SUBMARINE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 577,534, dated February 23, 1897.

Application filed November 18, 1895. Serial No. 569,323. (No model.) Patented in England March 16, 1894, No. 5,508, and June 7, 1894, No. 11,069.

To all whom it may concern:

Be it known that I, ALEXANDER MUIRHEAD, a subject of the Queen of Great Britain, residing at London, in the county of Middlesex, England, have invented certain new and useful Improvements Relating to the Transmission of Signals through Submarine Telegraph-Cables, of which the following is a specification.

Letters Patent of the Kingdom of Great Britain, No. 5,508, dated March 16, 1894, and No. 11,069, dated June 7, 1894, have been granted to me and show subject-matter comprehended by claims herein made.

My invention relates to improvements in the mode of automatically making and breaking the contacts between battery, line, and earth in the transmission of electric impulses or currents through submarine cables and is specially applicable to those forms of automatic transmitters, such as the Wheatstone automatic transmitter, in which use is made of a strip of paper with a central line of holes having on either side other holes which have been previously punched in positions according to the Morse code and through which side holes the points of levers or rods connected to the contact-lever mechanism of the instrument rise and fall as the paper strip travels. The strip is carried along by means of a spur-wheel, the spurs or teeth of which engage with the line of central holes, the spur-wheel being generally driven by an electromotor or clockwork mechanism. The two contact-levers of such an instrument are connected to line and to earth, respectively, and they oscillate between two adjustable limiting-stops connected to the two poles of the line-battery, respectively. As is well known, the function of the traveling perforated paper strip is to govern the movements of the said contact-levers. In ordinary or what is known as "plain" signaling the movement of one or other of the levers from the normal position in which the cable is connected to earth causes a current in one direction or the other from the line-battery to pass into the cable, which current lasts until that lever returns to the normal position, when the cable is again put to earth. By the adoption of what is known as "curb" signaling in connection with this mode of transmission an increase in the rate of progress and an improvement in the character (and therefore in the legibility) of the signals are effected. "Curbing" consists in sending after every signal a current of opposite polarity to that which produces the signal for the purpose of neutralizing the effect of the previous or signaling current.

My invention has for its object the better government of the movements of the levers, the improvement and the regulation of the periods of the electrical contacts made by the levers, and also the provision of improved means by which curb signals may be transmitted.

In the accompanying drawings, Figure 1 is a front view or elevation, Fig. 2 a sectional elevation, and Fig. 3 a plan, of an automatic transmitter made according to this invention and adapted for plain signaling. Figs. 11 and 12 are respectively plan and sectional elevations of a form of instrument adapted for curb sending. Figs. 4, 5, 6, 7, 8, 9, 13, 14, and 17 are detail views; and Figs. 10, 15, and 16 are diagrammatic illustrations hereinafter fully referred to.

Automatic transmitters of the character the subject-matter of this invention comprise the following principal parts, namely: the means (marked with the numeral 1 in the accompanying drawings) for making and breaking the electrical contacts for signaling purposes; the means (marked 2) through the intervention of which the parts 1 are actuated; the parts 3, gearing with an electromotor or other convenient source of power and through which the parts 2 and 4 are brought into operation, and, in the case of a curb instrument, the parts 4, actuated by the parts 3 for the purpose of curbing.

When it is desired to put such an instrument as the present into operation, the previously-punched paper strip is fed between the roller J and the spur-wheel *s*, and, the machine having been set running, the paper is carried by the spur-wheel *s* along the platform *s'*. The side perforations in the paper strip traverse over the points of the rods R, and the presence or absence, as the case may be, of such perforations admit or prevent one or other of the rods rising and so causing

the corresponding levers to be moved from their contact y to the one x. The arrangement of the part 2 is such that immediately after one or other of the rods R of the instrument has or may have risen such rod is returned to its normal position; but the electrical contact is prolonged upon x until another portion of the part 2 operates to return it to its normal position upon y. In this way impulses of positive and negative sign are sent into the cable and the cable afterward put to earth. It is a great advantage in an instrument of the character now being described to have the moment of operation of the part 2 capable of variation or adjustment and that while the instrument is running. My present invention provides very efficiently for this being accomplished with great precision.

In an instrument constructed for curb signaling extra contacts or arrangements are provided, located between the above-mentioned contacts x and y and the battery-terminals, whereby in the interval during which one or other of the contact-levers is kept applied to its limiting-stop x the battery is reversed in polarity until by means of part of the apparatus marked 2 in the drawings the contact-lever which has been deflected onto its limiting-stop x is returned to its normal resting-point upon the limiting-stop y. In this way each signaling-impulse is followed by a curb, and according to my present invention means are provided whereby the duration of the curb relatively to that of the signaling-contact is effectively adjusted and that while the instrument is running. The rendering of the curb capable of adjustment while the instrument is running is of great advantage in an instrument such as herein described, since to obtain the most rapid working and the best signals the proportion of curb to signaling-current must be determined with great exactness. Moreover, the condition of a cable is liable to constant variation owing to atmospheric and other influences, necessitating the readjustment of the curb to secure the best results. This cannot be done unless the curb mechanism is capable of ready adjustment.

According to one method of carrying this invention into practice the two sets of lever contact mechanism of the automatic transmitter are each constructed by preference in two parts or arms L' L^2, mounted on separate axes e and f, as shown in Fig. 1 or independently on the same axis. Only one pair of levers is visible in Fig. 1, the other pair being immediately behind and precisely similar to the pair shown, as seen in Fig. 3. Both the arms L' L^2 are shown crank-shaped, the crank-arm of L' being pulled by the spring b in the direction to bring lever L' into contact with lever L^2. The crank-arm of L^2 plays between the adjustable limiting-stops x and y, which are connected, respectively, to the two battery-terminals and against one or other of which such crank-arm is kept firmly applied by means of the roller or jockey springs j, or by means of a strong permanent magnet placed so that iron extensions of the arms L^2 play between its poles N S, as shown in broken lines in Fig. 1. The levers L' L^2 may, however, be composed of any number of parts, as in the well-known Wheatstone transmitter, but so arranged that though they all move together as one in the one direction the parts corresponding to L' are free to return independently of L^2, L^2 remaining carried over into contact with the limiting-stop x until it is replaced by mechanism hereinafter described.

Mounted on an axis a, which is suitably geared to that of the spur-wheel s, as shown, so as to revolve once on the passage of every tooth or spur of the spur-wheel, that is to say, on the passage of every space in the perforated paper strip, is a cam G'. (See Figs. 2 and 3.) On this cam trails a lever or pawl L^3, connected to a bar g^3, oscillating on an axis g and to which is connected a spring g^4. The bar g^3 carries a pin p', which, owing to its movement being governed by the rotation of the cam G', comes into contact with one or other of the arms L', which may have become raised owing to the attached rod R or its equivalent having entered a perforation in the paper strip. A second cam (a graduated cylindrical one) G^2 on the same axis as and immediately behind the cam G', operates through the medium of a lever L^4, similar to the lever L^3 in construction and to which a pin p^2 is attached to return one or other of the levers L^2 to the normal position on the limiting-stop y after deflection. Fig. 1 shows the one set of lever contact mechanism in the position it assumes immediately after the entry of the rod R into a perforation of the paper strip and before either cam had come round to actuate either of the levers L^3 L^4. The instant of movement of the lever L^4, and consequently the return of the levers L^2, is dependent upon the position of the lever L^4 on the face of the cylindrical cam G^2. It is advantageous that the position of the one relatively to the other should be capable of ready and accurate adjustment and that while the instrument is in operation. This may be effected by rendering the lever L^4 capable of movement laterally along the face of the cam G^2 by means of the tangent-screw T, working in the saddle-piece 6, which rides on the axle 5; or the cam G^2 might be arranged in a similar manner to be capable of lateral adjustment, the lever L^4 being capable only of radial oscillation.

The position of the pins p' p^2 relatively to the levers L' L^2 is accurately adjusted by means of the screws w w, which screws are also useful to correct for any alteration of distance between the ends of the levers L^3 L^4 and the cams G' G^2 on which the levers rest, through wear and tear of parts. This latter wear and tear can be greatly diminished by

fixing small steel rollers, as seen in Fig. 9, at the ends of the levers L^3 L^4, which work on the cams G′ G^2, respectively.

In some instruments made according to this invention each contact-lever is constructed of one arm only, as shown at L in Fig. 4, that is to say, in one piece, carrying the rod R loosely jointed to it at the end next to the spur-wheel, which rod is kept just clear of the paper strip by the action of the spring V and by the pin p^2, which is operated by the graduated cam G^2, as seen in Fig. 3. The rods R are free to move forward after entering a perforation and are pulled back by the spring h onto the stop h', after the lever L has been reset by the pin p^2. The lever L^4, with pin p^2 working on the graduated cam G^2, is employed in this case to regulate the movements of the single-arm contact-levers in the manner above described with reference to Fig. 3, as in the case of the compound levers L′ L^2, and the regulation can be effected without stopping the transmitter.

Obviously the levers L of Fig. 4 or the levers L′ L^2 of Fig. 1 might be controlled in their movements by means of cams coming into direct contact with them instead of through the intervention of the pin p^2 in the former case or pins p' p^2 in the latter case. Such an arrangement in the case of single levers L is indicated in broken lines in Fig. 4, where the cam G′ is geared and adjusted relatively to the spur-wheel, so that it comes into direct contact with the incline on the lever at any required moment after the commencement of a space in the perforated paper strip. Figs. 5 to 8 illustrate a convenient method of constructing an adjustable cam. Two outside faces are braced together by the step-piece c^5 and keyed or otherwise secured to the axle c^8, to which motion is imparted. Located between these two outside faces is a similarly-shaped single cam-disk c^6, adjustable radially with reference to the outside faces and suitably secured in position, as, for example, by the screws in the slots c^7. By adjusting the position of the part c^6 the length of the "step" of the cam, and consequently its period of work, may be varied.

A simpler method of adjusting the action of the cam is that shown in Fig. 9 and is an adaptation of the mechanism of the graduated cam G^2 with its lever L^4, as hereinbefore described. In place of the pin p^2, projecting from the lever L^4, a separate riding frame-piece or arm 7, pivoted at 8 and resting on the levers to be acted upon, is employed. The graduated cam G^2 is mounted upon an axle suitably geared to that of the spur-wheel and which extends beyond the side plate of the instrument to a point above the levers L. The lever L^4 is free to oscillate about the axis 9 and its free end is between the riding frame-piece 7 and the cam G^2. At its axial end it is provided with a groove or slot 10, into which works a disk 11, forming part of an internally-threaded sleeve 12, passing over a tangent screw 13. By turning the milled edged nut 14 of the sleeve the lever L^4 is adjusted laterally along the riding frame-piece 7 and brought for a longer or shorter period of each revolution under the influence of the cam G^2.

The cam G′ on which the lever L^3 works is adjusted relatively to the spur-wheel s, so that the ends of the upright rods R or their equivalents can only enter the perforations in the paper strip at the instant when such perforations are opposite to them.

Upon a previously-punched paper strip being passed between the roller J and the spur-wheel s and the instrument set into motion the spur-wheel will cause the paper strip to traverse over the ends of the rods R. The mechanism is so timed that at the moment when a perforation is or might have been immediately over one or other of the rods R the position of the cam G′ is such as to allow the needle-levers to rise. If a perforation is present, the needle or rod R rises therethrough and the contact-lever leaves its stop y and rests upon the stop x. If there is no perforation in the paper strip, then the needle or rod R rests momentarily on the under surface of the paper strip and the contact-lever will not have been moved. Immediately afterward the cam G′ operates, either directly or indirectly, to lower the needle or rod R clear of the paper strip, but (premising that there has been a perforation) the contact-lever still remains on the stop x until (at a moment dependent upon the position of the lever L^4 relatively to the cam G^2) the cam G^2 operates to return the contact-lever to its normal position upon the contact y.

Whenever it is required to reverse the signaling-battery or to send curbing currents into the cable during the period of a contact or a space in the perforated paper, I modify the construction of the transmitter, as illustrated by Figs. 10 to 17.

Referring first to Fig. 10, on the graduated cam G^2 are adjusted two angle-levers L^6 and L^7, working against the upright bars K^2 K^2. The two levers L^6 and L^7 are joined up electrically, as shown in the figure, to the coils of two electromagnets M and N, respectively, and the local battery B. To the armature D of the electromagnet N is attached a lever L^5, working between two spring-contacts g' g^3 and limiting-stops K^3 K^4. These limiting-stops are connected to the two poles of the line-battery, respectively, and the spring-contacts g' g^2 to the limiting-stops x y of the automatic transmitter, between which the contact-arms L^2 L^2 play. When the armature D or its attached lever L^5 is in its normal position, the spring g'' is in contact with K^4 and g^2 with K^3. On the passage of a current through the coils of the electromagnet N the armature D is drawn down, pushing the spring g' into contact with K^3 and allowing g^2 to fall on K^4, thus reversing the line-battery. The spring F holds the armature A with its pin p^2 away from contact with the signaling-levers L^2 when no current

flows through the coils of the electromagnet M. When the transmitter is running, the levers L^6 and L^7, with the two upright bars K^2, complete, successively, two circuits with the local battery B—first, the one through the coils of the electromagnet N and then that through the coils of the electromagnet M. During every revolution of the graduated cam G^2 the first electromagnet, through its armature D, moves the lever L^5 and keeps the spring-contacts g' g^2 over to one side, thus reversing the battery until the end of each revolution. The second electromagnet M after an interval, depending on the position of the lever L^6 on the graduated cam G^2, (and which is adjustable while the instrument is in operation, as hereinbefore described, with reference to similar parts acting on the lever contact mechanism,) draws the pin p^2 against that lever L^2 which happens to be deflected on the passage of a perforation in the paper and knocks it back onto the limiting-stop y.

The curbing, instead of being effected by electromagnetic means, might obviously be achieved mechanically, and in that case I may prefer to revert to the mechanism hereinbefore described for operating the lever contact mechanism in which the movements of the levers L′ and L^2 are controlled by the two cams G′ and G^2. Such an arrangement is shown in Figs. 11, 12, and 13. In place of the graduated cam G^2 of Fig. 3 for operating the lever contact mechanism is substituted a fixed cam G^3, Figs. 11 and 14, and the graduated cam G^2 is utilized to operate a lever L^5, Fig. 13, which works between two spring-contacts g' g^2 and adjustable limiting-stops K^3 K^4. The limiting-stops K^3 K^4 are connected electrically to the two poles of the line-battery, respectively, and the springs g' g^2 to the limiting-stops x y, Fig. 1, between which the contact-arms L^2 play.

For the purpose of varying the amount of the curb the position of the lever L^5 on the cam G^2 may be adjustable by means of a tangent-screw, or, conversely, the lever might, together with the springs g' g^2 and limiting-stops K^3 K^4, be fixed and the cam G^2 adjustable laterally in relation thereto, but I prefer the first arrangement as being the simpler in construction and the more prompt in action.

By employing a split battery instead of a single-line battery the spring-contacts g' g^2 may be dispensed with and the simpler arrangement shown in Figs. 11 and 12 and in perspective in Fig. 14 (and diagrammatically in Fig. 15, as regards the curbing part of the mechanism) adopted, in which the lever L^5 itself plays between the two limiting-stops K′ K^2. These limiting-stops K′ K^2 are connected electrically to the poles of the split battery B′ B^2, the middle of the battery and the lever L^5 being respectively connected to the limiting-stops x y, between which the contact-levers L^2 play. Fig. 15 illustrates diagrammatically the electrical connections between the graduated cam G^2, the lever L^5, the contact-arm L^2, and the split battery B′ B^2. L^2 L^2, the two contact-levers of the transmitter, are connected to line and earth, respectively. Along the length of G^2 the lever L^5 is adjustable by means of a tangent-screw for the purpose of varying the relative lengths of primary and secondary or curbing contacts. K′ is connected to the pole B′ and K^2 to the pole B^2 of the split battery B′ B^2. The contact-point, as shown at L^8 in Figs. 14 and 15 of the lever L^5, is mounted on a spring v in order to give a slight rubbing on the limiting-stop K^2. When the transmitter is at work, the line and earth levers L^2 L^2 are kept pressed against the limiting-stops x or y by jockey-springs. The cam G^2, as it revolves, puts the lever L^5 into contact first with K′ and then with K^2, sending signaling and curbing currents alternately to line through the contacts K′ and K^2, respectively. The position of the wire z', Fig. 15, on the battery B′ B^2 can be altered to get any relative powers of the primary and the curbing currents. In this figure the battery is shown divided into two equal parts by the wire z', so that the curbing current arises from the same number of cells as the primary current. This arrangement is found to answer well on most cable-circuits.

Sometimes instead of the graduated cam G^2, I may prefer to employ a revolving commutator S, Fig. 16, mounted on the same shaft as the cams G′ and G^3. The spring or roller contact bar L^9, which rests on the commutator-wheel S and the two separate and insulated metallic surfaces of such commutator-wheel (marked Z and C) are joined up electrically to a split battery, as shown, and the two limiting-stops x y, between which the levers L^2 play in such manner that, during every revolution of the commutator-wheel S, the polarity of the line-battery is reversed. The instant of reversal of the battery is determined by the position of the spring or roller L^9 on the commutator-wheel S. A tangent-screw, such as shown at T in Figs. 3, 10, and 14, or similar device, may be employed to move the spring or roller contact bar laterally on the commutator-wheel; or obviously a single-line battery might be reversed by means of the revolving commutator, in which case a second spring or roller contact would be necessary.

In order to adapt the mechanism for curbing, as herein described, to those instruments in which the contact-levers are constructed of one arm only, as shown in Fig. 4, intermittent motion is given, preferably by means of the well-known Geneva-stop-wheel mechanism hereinafter described, to the cam G^3, which operates the pin p^2, so that whenever one or other of the levers L is deflected on the passage of a side perforation in the paper strip it is kept deflected during the whole or the greater part of a period or space of the perforated paper by the pin p^2, the battery being reversed during such period by the graduated cam G^2 and its attendant levers.

Sometimes the contact-levers of the automatic transmitter may take the form of light levers pressing constantly on the perforated band of paper and making or breaking contact with limiting-stops, or they may be springs or brushes of wire pressing constantly on the perforated band of paper and falling through the perforations into contact with a wire brush or cushion or a revolving contact-wheel beneath to operate a local transmitter, as in the various well-known forms of the "Bain" automatic transmitter. In these cases, among others, I find it advantageous to give intermittent motion to the spur-wheel which carries along the perforated paper strip by means of mechanism such as the said "Geneva-stop-wheel movement," or its equivalent, when it is desired to adapt to them the mechanism for curbing, herein described. The Geneva-stop-wheel arrangement consists, as shown in Fig. 17, of a wheel D, having a single tooth engaging in the notches of another wheel F.

In carrying out the above arrangement the wheel D is mounted on the same shaft as that which carries the graduated cam G^2 and engages with the wheel F, which is mounted on the same shaft as the spur-wheel and in which there are as many notches as there are spurs in the spur-wheel. For every revolution of the single-toothed wheel the spur-wheel is intermittently advanced one notch or spur corresponding with the period of one space in the paper strip, and during each period the battery is reversed by the action of the adjustable cam G^2 and its appendages (or by the equivalent means of a revolving commutator, Fig. 16, as above described) whenever one or other of the armatures of the local transmitter is attracted on the passage of a perforation in the paper strip beneath one or other of the brushes or springs of the Bain transmitter.

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

1. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices and the lever contact devices adapted to respectively enter perforations in the traveling ribbon and by their movement thus adapted to establish battery-contacts, of a rotating cam acting after a determined interval of time to restore the contact-lever devices to their normal position.

2. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices and the lever contact devices adapted to respectively enter perforations in the traveling ribbon and by their movement thus adapted to establish battery-contacts, of rotating cams acting respectively to release that lever contact device that may have entered a perforation in the traveling ribbon and after a determined interval of time to restore the corresponding contact-making device to its normal position.

3. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices and the lever contact devices adapted to respectively enter perforations in the traveling ribbon and by their movement thus adapted to establish battery-contacts, of rotating cams acting respectively to keep the lever contact devices clear of the traveling ribbon except at the moment that a perforation is, or might be, immediately over one of them, to release that one that may have entered a perforation in the traveling ribbon and, after a determined interval of time, to restore the corresponding contact-making device to its normal position.

4. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices and the lever contact devices adapted to respectively enter perforations in the traveling ribbon and by their movement thus adapted to establish battery-contacts, of a rotating cam governing the movements of the contact-lever devices, and means for varying the operative periods of such rotating cam.

5. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, rods adapted to enter perforations in the tape, and battery-contact devices controlled thereby, whereby a battery-contact is effected when a rod enters a perforation in the tape, of means for restoring the rod to its normal position while the battery-contact is still maintained, and means for operating such contact devices after a definite interval of time to open the battery-contact, substantially as and for the purpose set forth.

6. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts and means for returning said parts independently one of the other whereby the length of the signaling-contacts are rendered capable of variation relatively to the earthing period.

7. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in one direction to establish battery-contacts, and cams operating to return said parts independently one of the other whereby the length of signaling-contacts are rendered capable of variation relatively to the earthing period.

8. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts, a cam, a lever or pawl operated thereby, and a pin whose movements are governed by such lever or pawl serving to return one part of the lever contact devices

while the battery-contact is still maintained, and a graduated cam, a lever or pawl operated thereby, and another pin whose movements are governed by such last-mentioned lever or pawl serving after a determined interval of time to reëstablish earth-contacts.

9. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts, and one or more cams with levers or pawls serving to return such lever contact devices, the moment of return of the last part thereof being capable of variation by adjustment of the lever or pawl and the cam relatively to one another.

10. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, the lever contact devices adapted to respectively enter perforations in the paper ribbon whereby battery-contacts are established, and a rotating cam serving to restore the contact-lever devices to their normal position, of means for curbing or reversing the current from the battery during the maintenance of the said battery-contact, substantially as and for the purpose set forth.

11. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, rods adapted to enter perforations in the tape and battery-contact devices controlled thereby, whereby a battery-contact is effected when a rod enters a perforation in the tape, of means for restoring the rod to its normal position while the battery-contact is still maintained, means for operating such contact devices after a definite interval of time to open the battery-contact, and means for curbing or reversing the current from the battery during the maintenance of said battery-contact, substantially as and for the purpose set forth.

12. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts, means for returning said parts independently one of the other, and means for curbing or reversing the current from the battery during the maintenance of the signaling-contact, substantially as and for the purpose set forth.

13. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts, cams operating to return said parts independently one of the other, and means for curbing or reversing the current from the battery during the maintenance of the signaling-contact, substantially as and for the purpose set forth.

14. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, of lever contact devices brought into operation by said perforated ribbon formed of a plurality of parts moving as one mechanism in the one direction to establish battery-contacts, a cam, a lever or pawl operated thereby, and a pin whose movements are governed by such lever or pawl serving to return one part of the lever contact devices while the battery-contact is still maintained, another cam, a lever or pawl operated thereby, another pin whose movements are governed by such last-mentioned lever or pawl serving to reëstablish earth-contacts and means for curbing or reversing the current from the battery during the maintenance of the signaling-contact, substantially as and for the purpose set forth.

15. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, the lever contact devices adapted to respectively enter perforations in the paper ribbon whereby battery-contacts are established, and mechanism for restoring the contact-lever devices to their normal position, of means for curbing or reversing the current from the battery during the maintenance of the said battery-contact and means for varying the duration of the curbing or reversing period, substantially as set forth.

16. In an automatic telegraph-transmitter, the combination with the perforated-ribbon-actuating devices, the lever contact devices adapted to respectively enter perforations in the paper ribbon whereby battery-contacts are established, and mechanism for restoring the contact-lever devices to their normal position after a determined interval of time, of a rotating cam acting to curb or reverse the current from the battery during the maintenance of the said battery-contact, substantially as and for the purpose set forth.

In testimony whereof I have hereunto subscribed my name.

ALEXANDER MUIRHEAD.

Witnesses:
A. F. SPOONER,
C. J. SUMMERS.