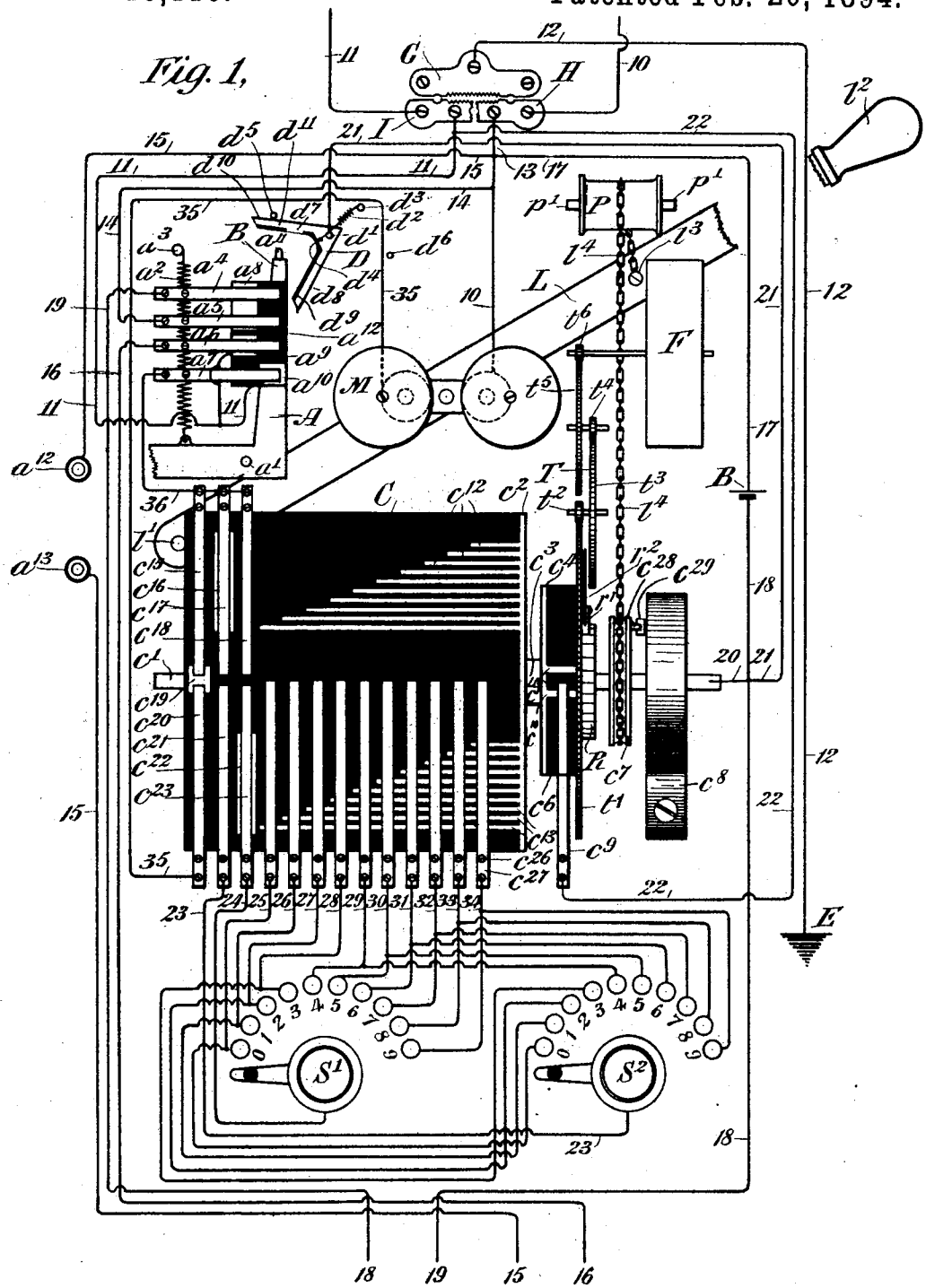
(No Model.) 2 Sheets—Sheet 1.

R. CALLENDER.

AUTOMATIC SIGNALING TRANSMITTER.

No. 515,110. Patented Feb. 20, 1894.

Fig. 1.



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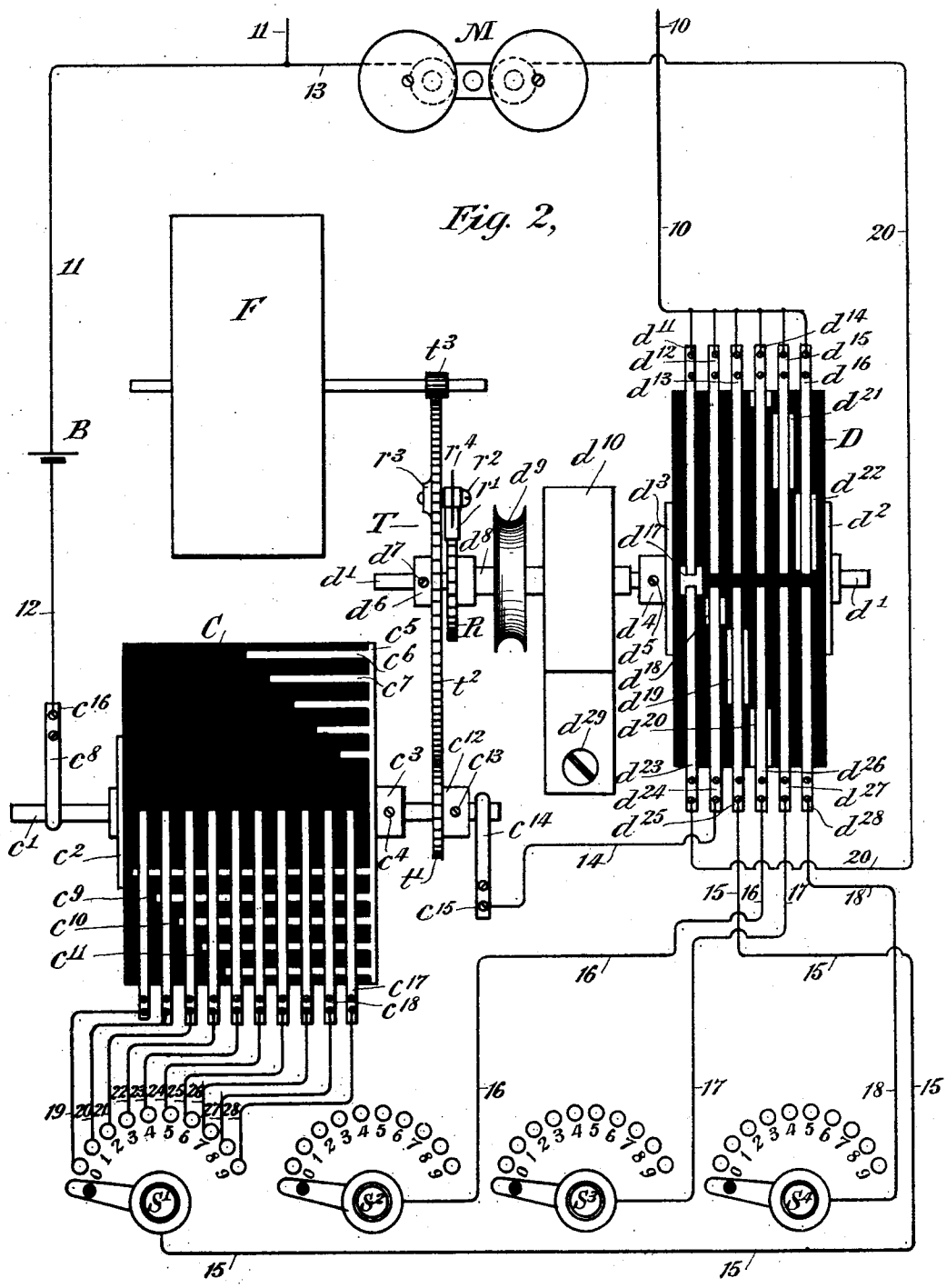

Fig. 2,

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UNITED STATES PATENT OFFICE.

ROMAINE CALLENDER, OF BRANTFORD, CANADA.

AUTOMATIC SIGNALING TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 515,110, dated February 20, 1894.

Application filed November 2, 1893. Serial No. 489,878. (No model.)

To all whom it may concern:

Be it known that I, ROMAINE CALLENDER, a subject of the Queen of Great Britain, residing at Brantford, in the Province of Ontario, Dominion of Canada, have made a new and useful invention in Automatic Signaling Transmitters, of which the following is a specification.

The present invention is directed to that class of signaling transmitters adapted to transmit any predetermined number of electrical impulses and in which the number of these impulses may be readily varied at will by simple means. It is particularly directed to improvements in the form of signaling transmitter described in connection with my former application for a patent on improvements in telephone exchange systems filed the 13th day of August, 1892, and bearing Serial No. 442,948. In that application I show a signaling transmitter adapted to transmit electrical impulses in series or sets, each series separated from the other by a brief time interval, and I also describe a method of utilizing the time interval for the purpose of automatically separating and classifying the various series of impulses, as they are received at the receiving apparatus, into units, tens, hundreds, &c.

The present invention is designed to improve the signaling means described in the former application just referred to, by rendering the signaling act wholly automatic, and thus reduce to a minimum the possibility of error through unskillful manipulation.

Figure 1 is a diagrammatic front elevational view showing the automatic transmitter and its circuit connections. Fig. 2 is a diagrammatic front elevational view of a modified form of said transmitter and its circuit connections.

Referring now to Fig. 1 of the drawings, C is an insulating cylinder adapted to rotate on its axis c'. c^{12} c^{12} and c^{13} c^{13} are groups of contact strips on the surface of said cylinder. c^{16} and c^{22} are commutator contact strips held on the surface of the cylinder and adapted to bring the sets of strips c^{12} c^{12} and c^{13} c^{13} into electrical connection with their switches S^2 and S' as the cylinder rotates. c^{19} is a plate on said cylinder completing a circuit through the bell when the cylinder is in its normal position, that shown in the drawings. c^{15}, c^{17}, c^{18}, c^{20}, c^{21} and c^{23} are contact brushes for completing the circuits over the contact plates just described. c^{26} and c^{27}, &c., are additional contact brushes leading to the contact points controlled by the switches S' and S^2. c^2 is a metallic end-plate bringing all of the contact strips c^{12} c^{12} and c^{13} c^{13} into electrical connection with the axis c' and through it by conductors 20 and 18 to the battery B. c^{10} and c^{11} are additional contact strips held on the insulated cylinder c^5 and brought into electrical connection with the axis c' by the metallic end-plate c^4. c^9 is a contact brush working in connection with the contacts just described. c^7 is a grooved pulley adapted to be turned by the chain l^4. This pulley is rigidly secured to the shaft or axis c' as are also the coil spring c^8 and the ratchet R. The cylinder C is rigidly connected to the small cylinder c^6 and to the train wheel t' by the end plates c^2 and c^4 and the intermediate hub c^3. This whole member is adapted to turn freely on the axis c' when under the influence of the energy stored in the coil spring and applied by the ratchet R at the pawl r' secured to the train wheel t'. r^2 is a flexible spring adapted to press the pawl r' against the ratchet R. t^2, t^3, t^4, t^5 and t^6 are the remaining wheels of the train T. A fan F is secured to the axis of t^6 to regulate the speed of the cylinder C when the latter is turned by the coil spring c^8. L is a lever pivoted at l' and having a chain l^4 attached to it at l^3. This chain passes over a roller P and is attached at its lower end to the grooved pulley c^7. A handle l^2 projects at the right hand side which when pulled down is adapted to store energy in the coil spring c^8 and cause the cylinder to rotate when said handle is released. p' p' is the axis upon which turns the roller P. B is the battery supplying the electrical energy which passes in impulses over the conductors 10, 11 when the switches S' S^2 are operatively set and the cylinder C is rotated. A is the usual telephone receiving commutator, the broken part at the left representing where the receiver hook is placed. a^8, a^9 are the usual contact plates carried by the commutator A. a^{10} is an additional contact plate for connecting the cylinder C to said commutator A. a^4, a^5 and a^6 are the usual brushes. a^7 is an additional brush acting in

conjunction with the plate a^{10}. a^2 is the usual tension spring secured to the pin a^3 for altering the position of the commutator A when the telephone receiver is in use. D is an automatic release for sending a final current impulse over the conductors 10, 11 when the telephone receiver has been in use and is replaced on its hook or other suspensory device. d' is the pivot upon which turns the release D. d^2 is a tension spring secured at one end to the point d^3 and at the other end to the point d^4 in such a manner as to cause the release D to remain against either the limit pin d^5 or the other limit pin d^6. d^7 is the metallic contact point uncovered by insulation and adapted to act in conjunction with the point a^{11} of the commutator A. M is the usual magneto bell connected to the conductors 10 and 35. G is the ground plate or lightning arrester leading to the earth E by conductor 12. H and I are the terminal plates for the conductors 10 and 11; a^{12} and a^{13} are the connectors for the telephone receiver. 18 and 19 are conductors leading through the primary of a telephone transmitter, while 15 and 16 are the conductors leading through the usual secondary circuit of said telephone transmitter. S′ and S^2 are switches for determining the number of impulses that are to be transmitted, while 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are contact points acting in conjunction with the switches S′ and S^2 to produce the desired effect. 24 and 23 are conductors leading to the switch handles S′ and S^2, while 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34 are conductors leading from the individual contact brushes c^{26} c^{27}, &c., to the corresponding contact points 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Referring now to Fig. 2. C is the principal or impulse transmitting cylinder and c^6, c^7, &c., are contact strips held on the said cylinder. c' is the axis of the cylinder C to which is secured the metallic end-plate c^5 by the hub c^3 and screw c^4. c^8 is a contact brush connected on one side to the battery B and on the other to the axis c'. 19, 20, 21, 22, 23, 24, 25, 26, 27 and 28 are conductors leading from the contact brushes c^{17}, c^{18}, &c., to the contact points 0, 1, 2, 3, &c. T is the clock train and F the fan for regulating the speed of the cylinders C and D. D is the commutator cylinder for bringing the switches S′, S^2, S^3 and S^4 successively into electrical connection with the contacts of the rotary cylinder C as the latter goes through its phase of four revolutions.

I will now describe the operation of the apparatus. In Fig. 1 it will be noticed that the cipher 0 contact point near the switch S′ is connected to that brush which will cause one impulse to flow over the line as each one of the two sets c^{12} c^{12} or c^{13} c^{13} passes under it. It will be understood that some definite signal is necessary to correspond with the cipher 0. One impulse is used, and consequently each of the signals corresponding to the numerals 1 to 9 has one more impulse sent over the line than is actually indicated by its value over the switch handles S′ and S^2. If the operator desires to send a signal corresponding to a number of two numeral places, say 56, he turns the arm of the switch S′ on to the contact point 5, and the arm of the switch S^2 on to the contact point 6. He then draws the lever L down to its lowermost position by means of the handle l^2 and releases it. The energy expended by the hand in drawing down the lever L acts through the chain l^4 upon the grooved pulley c^7 and by means of the axis c' connected with said pulley it is transferred to the coil spring c^8. This coil spring c^8 is normally under a certain amount of tension which tends to hold the grooved pulley against a stop c^{29} by means of the pin c^{28}. When the lever L is being drawn down the tension of the spring c^8 tends to draw it up again but this tendency is resisted by the action of the hand in its downward motion. The coil spring c^8 therefore accumulates the energy of the hand, as it cannot re-act until the lever handle is released. When therefore the lever L has been drawn down and has been released the energy of the spring c^8 is caused to re-act on the cylinder C turning it by means of the ratchet R acting on the pawl r' and carrying round with it the wheel l' of the train T which wheel is rigidly attached to the small cylinder c^6, this small cylinder being attached to the cylinder C by means of the plates c^2, c^4 and intervening hub c^3 the cylinder thus rotates with the wheel l' of the train T. In order that the motion may be regular and not too rapid, the train T has attached to its remote member l^6 a fan F which may be of any size or bent at any angle necessary to obtain the desired speed of rotation for the cylinder C. The cylinder therefore rotates and as it does so it opens the branch bell circuit running through brushes c^{15} and c^{20} by moving from under the point of the latter brush the contact plate c^{19} carried on the cylinder C. This cuts out the bell M. Immediately following this act and previous to the contact strips c^{13}, c^{14}, &c., being brought under the brushes c^{26}, c^{27}, &c., a circuit is closed over the conductors 10, 11 as follows:—from the battery B by conductor 18 and branch conductor 20 to the axis c' of cylinder C, thence by end-plate c^4 of small cylinder, which it will be remembered is in constant electrical connection with the axis c', to contact plate c^{10} on said small cylinder. From thence it passes by way of brush c^9, conductor 22 and conductor 11 to the distant station. From thence returning by way of conductor 10 it passes to branch conductor 17 back to the starting point, the battery B. This sends a single current impulse over the line, independent of any that may be sent by means of the switches S′ or S^2, and this impulse I term the preliminary impulse. A brief interval of time elapses by which time the rotation of the cylinder has brought the strips c^{13} c^{13}, &c., under the brushes c^{26}, c^{27}, &c., at the same time bringing the commutator strips c^{22} into connection with

both of the brushes c^{18} and c^{23}. As the contact strips c^{13} c^{13}, &c., are brought into electrical connection with the brushes c^{26}, c^{27}, &c., the circuit over the line is closed as many times as correspond with the position of the switch S′. The arm of switch S′ being set upon contact 5, as previously described, six impulses will flow over a circuit as follows:—from battery B by conductor 18 and branch conductor 20 to the axis c' of cylinder C. Thence by metallic end-plate c^2 to the contact strips c^{13} c^{13}, &c., and through brushes c^{26}, c^{27}, &c., to the points 0, 1, 2, 3, 4, &c., of switches S′ and S^2. The switch S^2 although on one of the contact points near it, need not be noticed here as the conductor 23 leading from it affords no path for an electrical circuit by reason of the contact plate c^{16} not yet having been brought under the brushes c^{17} and c^{21}. The path of the impulses previously referred to has thus far been traced from the battery B to the contact points of switch S′. The conductor 24 will therefore lead away as many impulses as correspond with that point on which its switch arm is placed. The further path of the six impulses flowing by way of contact point 5 and switch S′ will be by brush c^{23}, contact plate c^{22} now under it, brush c^{18}, conductor 36, brush a^7 of telephone receiver commutator, contact plate a^{10}, conductor 11 through plate I and out over line to the distant station from whence it returns by conductor 10, plate H and conductors 13 and 17 back to the battery B. A brief time interval again ensues after which the remaining contacts c^{12} c^{12}, &c., are brought under the brushes c^{26}, c^{27}, &c., and another series of impulses will flow over a circuit as follows:—from battery B by conductor 18 and branch conductor 20 to the axis c' of cylinder C, thence by metallic end-plate c^2 to contact strips c^{12}, c^{12}, &c. From thence by brushes c^{26}, c^{27}, &c., to the switch S^2 which by this time has been brought into operative connection with the line by means of brushes c^{21}, c^{17} and contact plate c^{16}, which contact plate is now under the last named brushes. The switch S^2 having its arm on the point 6, impulses, seven in number, will flow by way of conductor 23, brush c^{21}, contact plate c^{16}, brush c^{17}, conductor 36, brush a^7, contact plate a^{10}, conductor 11 through plate I and out over line to the distant station from whence it returns by conductor 10, plate H and conductors 13 and 17 back to the battery B. The cylinder C has now nearly finished its rotation but before coming to a position of rest by means of the limit pin c^{28} against the check or stop c^{29} it closes a circuit and sends one more impulse over the line, what I term a final impulse, as follows:—from battery B by conductor 18 and branch conductor 20 to the axis c' of cylinder C. From thence by end-plate c^4 and contact plate c^{11} in connection with it and over brush c^9 and conductor 22 to plate I. From thence by conductor 11 to the distant station, returning over conductor 10, plate H and conductors 13 and 17 back to the battery B. The cylinder then ceases its rotation and it and the lever L have returned to their normal positions, that shown in the drawings. It will thus be seen that a preliminary impulse was first caused to be transmitted. This was followed by two series of impulses separated from the preliminary impulse and from each other by brief time intervals. The two series of impulses it will be remembered corresponded to the number 56. Following the transmission of these signals, and separated from them as was the preliminary impulse there was sent a final impulse. It will readily be understood that either one or both of these preliminary and final impulses could be omitted if desired. The arrangement and number of the contact plates and brushes could also be varied considerably without departing from the spirit of my invention. I have illustrated this special form in Fig. 1 as being peculiarly applicable to my telephone and other signaling systems as described in other applications filed by me in the United States Patent Office at various times.

The transmission of a signal that could be represented by one numeral place will readily be understood from the foregoing description. This number, say 8, could be set on either one of the switches S′ or S^2, the only precaution necessary being to see that the other switch was at its normal position, that is to say, not in connection with any of the points 0, 1, 2, 3, &c. When the conductors 10, 11 are used for conveying a call signal from the distant station the circuit is as follows:—by conductor 10 to plate H and from thence to the bell M, through the coils of said bell and by conductor 35 to brush c^{20}, plate c^{19}, brush c^{15} and conductor 36 to brush a^7, plate a^{10} and conductor 11 through plate I back to the distant station. The circuits of conductors 18 and 19 through the primary, and conductors 15 and 16 through the secondary of the usual telephone transmitter, together with the usual telephone receiver connectors a^{12} and a^{13} need not be described here; nor is it necessary to describe the brushes a^4, a^5 or a^6 as these are all arranged in the customary way and are only shown in the drawings in order that the other features may be clearly shown.

The release mechanism D or one-way contact maker acts in conjunction with the lever A as follows:—When the telephone receiver is taken off the hooked end of the commutator A that part of it lettered a^{12} comes in contact with the insulating covering of the release D and pressing against it under the influence of the spring a^2 causes the end d^8 of the release D to move in the direction of the limit pin d^6. As soon as the pin d^4 is moved to that position in which a straight line drawn from d^4 to d^3 would fall on the other side of the pivot d' the action of the release spring d^2 causes the side d^8 of the release D to be brought against the limit pin d^6. The position of the release D is so related to that of

the commutator A that the contact point d^7 of the former cannot touch the contact end a^{11} of the latter on its movement as just described. In other words the arrangement is such that the commutator A does not throw the release D past its dead center until it, the commutator, has nearly reached its limit of motion. Consequently the commutator reaches the end of its journey in that direction first, and it is followed immediately by the other end d^{10}. No contact can ensue between the parts a^{11} and d^7 by movement in this direction as although the contact d^7 follows the point a^{11} it cannot touch it by reason of the limit pin d^6. As soon as the receiving telephone is restored to its commutator hook, the action just described is reversed and the following ensues, the end a^{11} of the commutator A presses against the metallic part d^7 of the release D, and closes a circuit momentarily as follows:—from the point a^{11} of the commutator A to the point d^7 of the release D, thence by conductors 21 and 18 to the battery B. From thence it passes by conductors 17 and 13 to the plate H and out to line by conductor 10 to the distant station. Returning over conductor 11 through plate I and plate a^{10} in metallic connection with the commutator, it reaches the common point from which the circuit was traced, the point a^{11}. The action of the spring d^2 causes the release D to return to its normal position, that shown in the drawings, thus rupturing the circuit after sending a momentary impulse over the line as just described.

The modified form of apparatus shown in Fig. 2 illustrates its application to the transmission of a preliminary signal followed by four series of impulses. The apparatus there shown has a capacity equal to the transmission by one operation, of impulses corresponding to a number represented by four numeral places. It can transmit signals the equivalent of any number from 1 to 9,999. As the construction there shown employs just one set of contacts on the main cylinder C with controlling commutator strips on the auxiliary cylinder D for changing the circuit through the several switches S′, S^2, S^3 and S^4 in succession it will be understood that this form may readily be used for any number of switch handles S′, S^2, &c., either less than four in number or more. In order to avoid multiplication of circuits I have not connected the conductors 19, 20, &c., to the switches S^2, S^3 and S^4. It will be understood that these circuits have a multiple connection with all of the switches S′, S^2, S^3 and S^4 in the same manner as the circuits 25, 26, &c., in Fig. 1 are connected to the switches S′ and S^2 there shown.

The operation of the apparatus shown in Fig. 2 is as follows:—The lever and chain not shown in this figure operate on the grooved pulley d^9 increasing the tension of the coil spring d^{10} and acting through it upon the sleeve d^8 carrying the ratchet R. The teeth of this ratchet engage with the pawl r' pivoted at r^2 to the enlarged part r^3 of the train wheel t^2 of the train T. When the controlling lever is released as previously described in connection with Fig. 1 the train T is put in motion and the train wheel t^2 secured to the axis d' by the hub d^6 and screw d^7 turns the commutator cylinder D secured to the same shaft d' by means of the hub and set screw there shown. The same motion causes the propelling wheel t' secured to the shaft c' of the cylinder C by the hub c^{12} and screw c^{13}, to be turned, carrying round with it the cylinder C secured to the same shaft by means of the end-plates c^3, c^5 and hub and locking screw c^3 and c^4. The relative diameters of the wheels t^2 and t' is such as to cause the latter to revolve four times during the time the former revolves once. The contacts c^6, c^7, &c., are thus presented to the brushes c^{17}, c^{18}, &c., four times in succession and the commutator cylinder D governs the consecutive electrical connection of the strips c^6, c^7, &c., with the switches S′, S^2, S^3 and S^4.

I will presume that a signal is to be transmitted the equivalent of the number 8,603. In this event the switches counting from left to right will be set to correspond with the desired number, that is to say S′ on 8, S^2 on 6, S^3 on 0 and S^4 on 3. It will readily be understood from the description of the previous figure that the impulses are transmitted in the corresponding order by battery B, conductor 12, brush c^8, axis c' of cylinder C, metallic end plate c^5, contact strips c^6, c^7, &c., brushes c^{17}, c^{18}, &c., switches S′, S^2, S^3 and S^4 in succession, by conductors 15, 16, 17 and 18 to the brushes d^{25}, d^{26}, d^{27} and d^{28}, contact plates d^{19}, d^{20}, d^{21} and d^{22}, brushes d^{13}, d^{14}, d^{15} and d^{16} and common conductor 10 out to line, to distant station and returning by conductor 11 to the starting point the battery B. Should a signal require to be sent having only three numeral places, say 196, the combination is set on any three switches, the only precaution necessary being to always set the number from left to right. In the same manner a signal equal to one or two numeral places may be transmitted as will be apparent from the foregoing description. The contact brushes d^{12} and d^{24} together with the contact plate d^{18} act to transmit a preliminary signal by way of battery B, conductor 12, brush c^3, axis c' of cylinder C, brush c^{14}, conductor 14, brush d^{24}, contact plate d^{18}, brush d^{12}, conductor 10 to distant station and returning by conductor 11 to the starting point, the battery B.

The circuit for an incoming signal through the bell M when the apparatus is at its normal position as shown in Fig. 2 is as follows:—by conductors 11 and 13 to and through the coils of the bell M and by conductor 20 to the brush d^{23}, contact plate d^{17}, brush d^{11} and conductor 10 to distant station.

I have not shown any means in Fig. 2 for sending a final impulse over the line as was described in connection with the operation of

the apparatus shown in Fig. 1, as it will be apparent that either or both of the means for sending preliminary and final impulses may be present or absent in both forms of the apparatus. It will also be evident that the number of contact strips in either of the two series shown on the cylinder C in Fig. 1 may be varied to suit different requirements. In the same manner the single set of contact strips carried by the cylinder C in Fig. 2 may also be varied.

I have purposely illustrated one form of the apparatus in Fig. 2 free from circuits and connections implying telephone appliances, in order to clearly show the utility of my invention for general signaling purposes.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. An electrical circuit including a controlling commutator and a rotary circuit making and breaking device timed to have a definite relative speed of rotation, means for giving the circuit closer any predetermined number of revolutions, and additional means for varying at will the number of circuit closures in each revolution.

2. A signaling transmitter for transmitting impulses in series or sets, consisting of a revolving agent carrying means for making and breaking the circuit, individual switches for varying the number of impulses transmitted in each series together with a commutator, controlled by the revolving agent, for changing the path of the transmitted impulses through the various switches successively, and in any desired order.

3. An electrical circuit including a rotating circuit making and breaking device and a circuit controlling commutator therefor; said commutator controlling two or more branch circuits leading to a point of common connection with the main circuit and having means for directing the circuit closures over the several branch circuits in any desired order.

4. An electrical circuit including a rotating circuit making and breaking device and a circuit controlling commutator therefor; said commutator controlling two or more branch circuits passing through individual switches and leading to a point of common connection with the main circuit and having means for directing the circuit closures over the several branches and through the individual switches in any desired order.

5. A signaling transmitter for transmitting impulses in series or sets consisting of a rotating contact making and breaking agent, switches for varying the number of impulses in each series, a commutator for controlling the electrical connections through the switches successively and in any desired order together with a hand operated lever for setting the apparatus in motion.

6. The combination with a telephone receiver commutator of an independent contact making device, consisting of a pivoted oscillating agent having tensional means applied in a line with and beyond its center of oscillation for retaining it and completing its motion to either side when it passes said center of oscillation, said contact making device having an insulated surface normally presented to the moving contact of the receiver commutator and having such relation of parts that when the receiver is removed the commutator contact will engage with the insulated surface of and will oscillate the contact making device to its opposite position, thereby causing a metallic surface carried by said contact making device to be moved into position for obtaining an electrical connection between the contact making device and the receiver commutator when the latter is returned to its normal position.

In testimony whereof I have hereunto subscribed my name this 31st day of October, 1893.

ROMAINE CALLENDER.

Witnesses:
C. J. KINTNER,
M. M. ROBINSON.