June 14, 1932. D. MACADIE 1,862,601

IMPULSE SENDER FOR USE IN AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE

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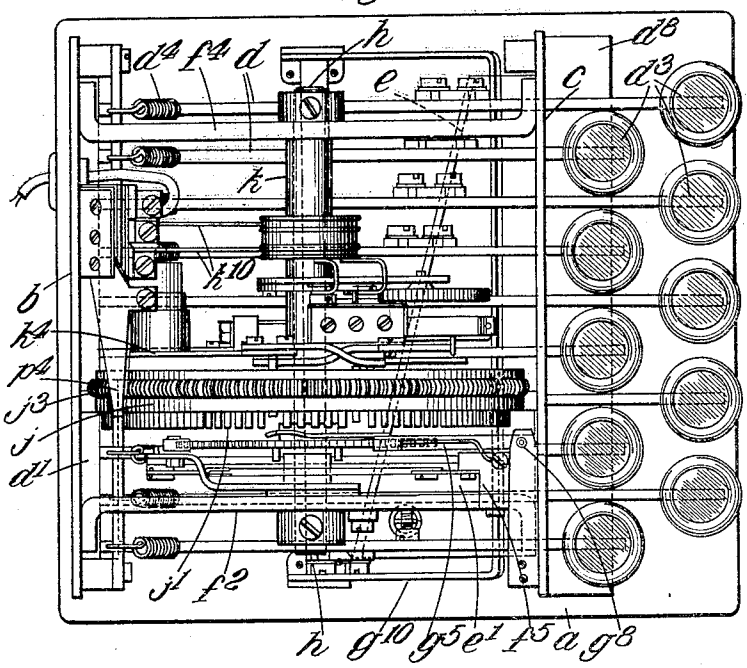
Fig. 1.



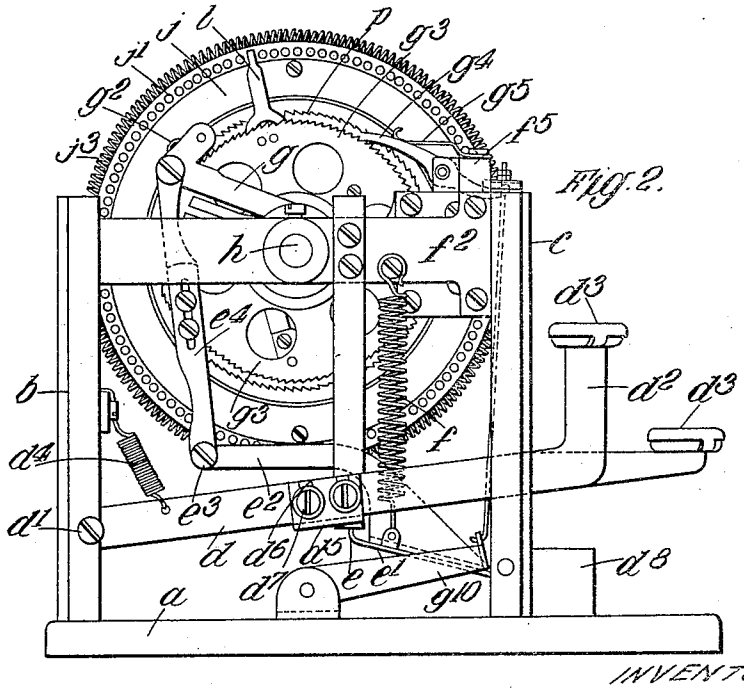


Fig. 2.

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IMPULSE SENDER FOR USE IN AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE

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Fig. 3.

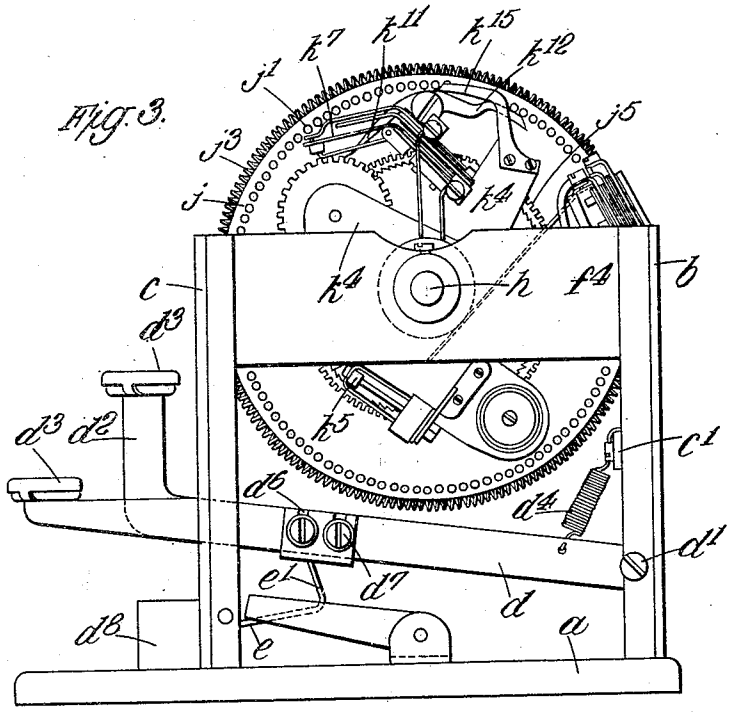
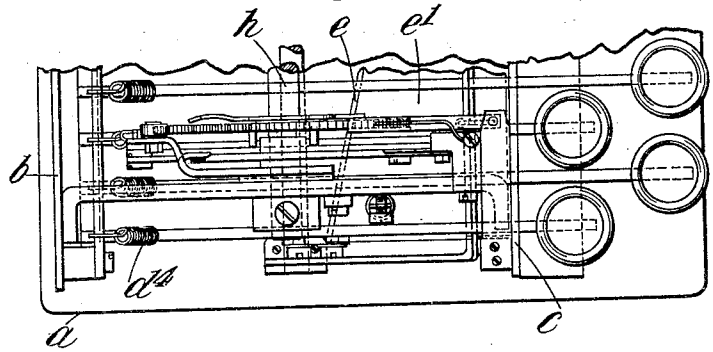


Fig. 4.



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IMPULSE SENDER FOR USE IN AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE

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Fig. 5.

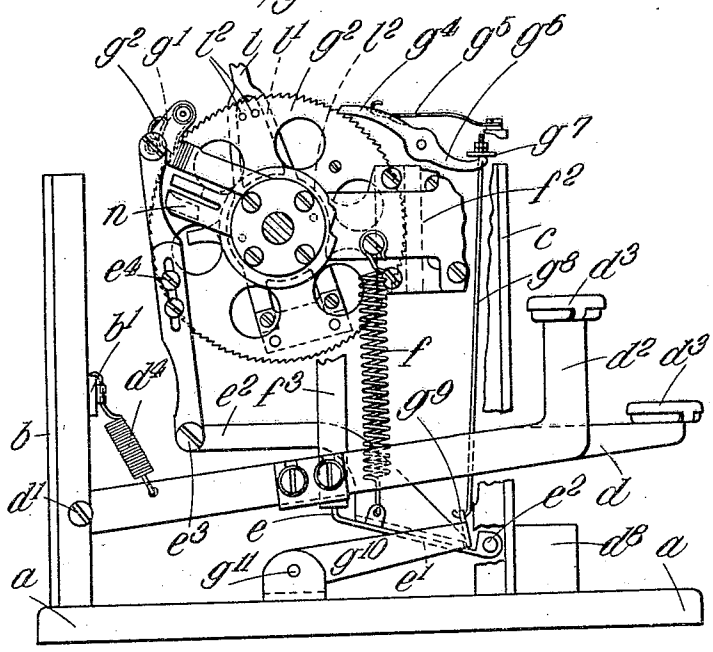
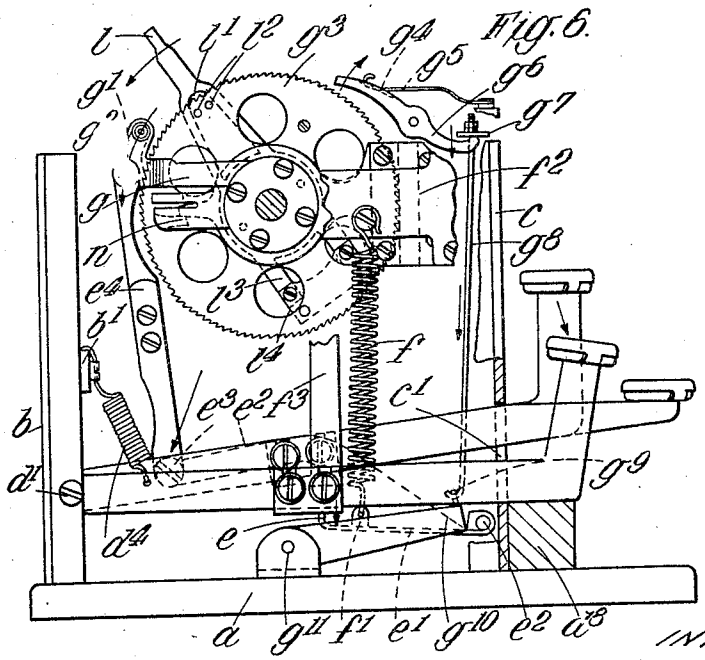


Fig. 6.



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IMPULSE SENDER FOR USE IN AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE

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Fig. 7.

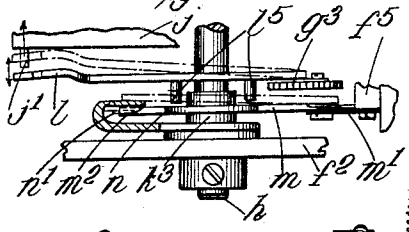
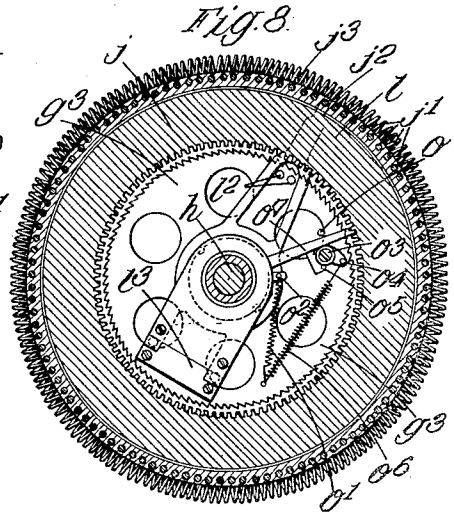


Fig. 8.



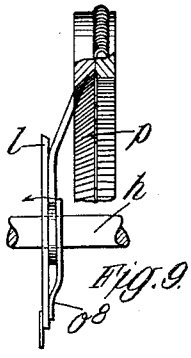


Fig. 9.

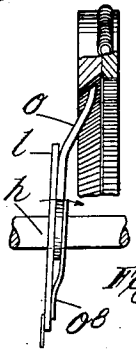


Fig. 10.

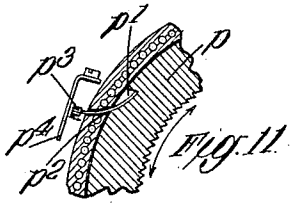


Fig. 11.

Fig. 15.

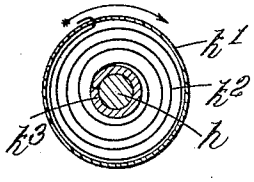


Fig. 12.

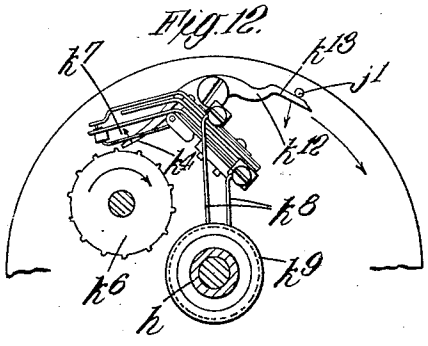
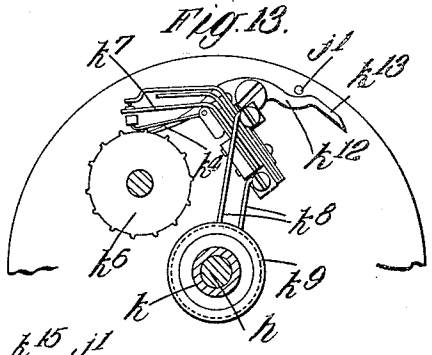


Fig. 13.



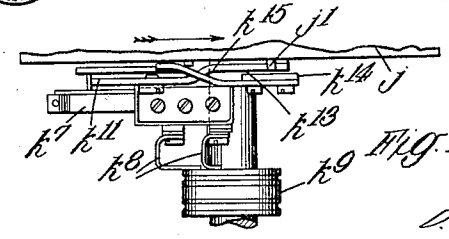


Fig. 14.

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Patented June 14, 1932

1,862,601

UNITED STATES PATENT OFFICE

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IMPULSE SENDER FOR USE IN AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE

Application filed March 12, 1931, Serial No. 522,060, and in Great Britain April 4, 1930.

This invention relates to improvements in impulse senders for use in automatic telephone systems and the like. Impulse senders as heretofore proposed have usually comprised an apertured plate which is rotated by hand when it is desired to call a number. It has been necessary with these devices to wait for the dial to come to rest after each individual letter or digit has been dialled, this resulting in quite a considerable loss of time, particularly when a large number of calls have to be handled by a single operator as in a private branch exchange. Further, time has been lost with these apparatus due to the fact that the spacing between each digit, which should be of a duration equal in time to five individual or signal impulses in order to enable the selecting apparatus to function, is of varying length, the dial having to be turned through a different space for each individual aperture (corresponding to a digit or letter) on the dial. The chief objects of this invention are, therefore, firstly to avoid the loss of time consequent upon the wait for the dial to return to rest and secondly to fix the length of spacing between the digits irrespective of the signal transmitted.

According to the present invention, the impulse sender comprises a plurality of depressible keys and a set of contacts which are intended to transmit the impulses over the line, means being provided to cause the said contacts to operate a number of times equal to the number corresponding to any key plus a predetermined fixed number when any given key is depressed, and means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number.

The keys are preferably attached to key levers which are adapted to operate one or more pivoted members operatively connected to a ratchet wheel, the movement of which controls the movement of the contacts through suitable mechanism.

A check pawl is provided for preventing overthrow of the ratchet wheel, the said check pawl operating in a manner hereinafter described.

The means for suspending action of the impulse contacts comprises an arm which is adapted to be rocked in order to press the contacts clear of an interrupter wheel.

The impulse sending means are held until after the ratchet wheel has been operated, in order to determine the amount of movement to be made by said impulse sending means and to select a member for splitting the impulses up into the signalling impulses and the spacing impulse. The preferred means for securing this end will be fully described in the following detailed description.

The selection members for splitting up the impulses comprise, in the preferred form of the present invention, a plurality of pins which are carried friction-tight in a suitable member although these pins may be replaced by balls or the like as hereinafter described.

By means of a simple arrangement of the parts, the machine according to the present invention may be made self winding so that it will not require any attention when once installed.

Several other novel and advantageous features both from a constructional and operating point of view are provided by this invention and will be described fully in the following detailed description and claimed in the appended claims.

In order that this invention may be the more clearly understood and readily carried into effect, I will proceed to describe the same with reference to the accompanying drawings which illustrate by way of example and not of limitation one convenient embodiment of this invention, and in which

Figure 1 is a plan view of the impulse sender according to this invention with the cover removed.

Figure 2 is an end elevation of the device also with the cover removed and as viewed from the left hand end of the device.

Figure 3 is a similar view to Figure 2 as viewed, however, from the right hand end of the device.

Figure 4 is a fragmentary plan view of the lower portion of the device showing the setting and key operation parts.

Figure 5 is a partial end elevation showing the ratchet and pawl, and the various parts

connecting the keys therewith, the parts being shown in the normal position with all keys raised.

Figure 6 is a view similar to Figure 5 showing the parts, however, in the position which they assume when one of the keys has been depressed.

Figure 7 is a fragmentary view showing the means for securing the transverse movement of the pin operating arm.

Figure 8 is a central vertical section through the pin carrying disc.

Figures 9 and 10 are two fragmentary sectional views showing the operation of the stop arm.

Figure 11 is a view showing the means for operating the contacts employed for cutting out the transmitter and receiver while the impulses are being sent.

Figures 12 and 13 are fragmentary elevations showing the impulse sending contacts and the manner in which they are operated.

Figure 14 is a plan view of the parts shown in Figures 12 and 13.

Figure 15 is a sectional detail showing the self-winding mechanism of the impulse sending portion of the device.

Referring to the drawings, I provide a base plate a from which rise back and front plates b and c respectively, the back plate b being disposed at the back edge of the base plate a, and the front plate c being spaced behind the front edge of the base plate a, as shown in Figures 2, 3, 5 and 6. A cover (not shown) is provided to take over the tops of the front and back plates and to cover the ends between the front and back plates b and c so as to enclose all the mechanism which is arranged between the front and back plates b and c. The front plate c is provided with vertically arranged slots c^1, conveniently ten in number, each adapted to receive a key lever d. The key levers are all pivoted freely on a transverse spindle d^1 arranged close to the back plate b, and the forward ends of the levers are turned upwardly as at d^2 to receive the keys d^3 which are preferably arranged in two banks of five keys each (see Figure 1), the keys of the banks being laterally staggered, as shown. A tension spring d^4 is connected between each key lever d and a fixed point or bar b^1, carried by the back plate, in order to return the key d to its normal raised position when depressed.

Each of the key levers d is provided with a right-angled bearing plate d^5, the vertical part of which is slotted as at d^6 and secured with two screws d^7 to the lever d whilst the horizontal part bears on the upturned edge e of a plate e^1 which is pivotally carried on a transverse spindle e^2 arranged just behind the front plate c. The edge e of the plate e^1 is inclined to the front plate c in the manner shown in Figure 1 so that at the right hand end it is closer to the front plate c than it is at the left hand end. The bearing plates d^5 are provided in order to enable the correct adjustment to be obtained for each individual key.

Separate arms may replace the plate e^1, if desired.

In order to enable the plate e^1 to be depressed through an arc by an amount corresponding to the key depressed, while at the same time maintaining the desirable feature of equal depression of the keys, the bearing plates d^5 are secured to the key levers d at different points from the fulcrum (see Figure 1), and above the sloping edge e of the plate e^1. Thus it will be seen that the bearing plates corresponding to the lower numbers (left hand end of the device) are closer to the fulcrum of the key levers d than the bearing plates on the key levers corresponding to the higher numbers. It will thus be readily appreciated that the arc of rotation will depend upon the key depressed, it being greater for the keys corresponding to the higher numbers than for the keys corresponding to the lower numbers.

A tension spring f is provided to raise the plate e^1 to its normal position after it has been actuated by the depression of any one key, the said spring f being connected between an eye f^1 on the plate e^1 and a stretcher bar f^2 extending between the front and back plates b and c near the upper ends of the same (Figure 6). A stop f^3 is also provided, extending downwardly from the stretcher bar f^2, in order to limit the upward movement of the plate e^1, the lower end of the stop f^3 being arranged at such a level that in its raised position the edge e of the plate e^1 is maintained in such a position that it is clear of the under edges of the key levers d.

Secured to the plate e^1 and extending upwardly and then rearwardly is an arm e^3, to the free end of which at e^3 is pivoted a link e^4 extending upwardly. This link e^4 is pivoted at its upper end to an arm g which is freely mounted on a spindle h which extends transversely across the centre of the machine and is carried in the stretcher bar f^2 at one end of the machine and a similar stretcher bar f^4 arranged at the other end of the machine.

The end of the arm g is provided with an upward extension g^1 on which is pivoted a pawl g^2 which is spring-controlled by means of a spring g^3 (see Figure 6). This pawl g^2 is adapted to co-act with a ratchet wheel g^3 which is also freely rotatable on the spindle h.

It will be appreciated that since the arc, through which the plate e^1 is swung, is dependent upon the particular key depressed, so also will the arc, through which the pawl (and hence the ratchet wheel g^3) is swung, be dependent upon the key depressed. In this manner I obtain the desired amount of rotation by depression of the required key.

Instruments of this kind, in which manipulation is secured by depression of a key, are subjected often to very rough usage, the keys being depressed with great force. This would tend to cause the ratchet wheel to overthrow. Any overthrow must, of course, be avoided to secure successful operation, and accordingly I provide means for preventing the overthrow. Such means comprise a check-pawl g^4 which is pivoted on a member f^5 carried by the stretcher bar f^2 and which is spring-controlled by means of a light spring g^5 so as normally to be held in engagement with the teeth of the ratchet wheel g^3. The check-pawl g^4 extends rearwardly as at g^6 so as to be engaged by a projection g^7 carried by a rod g^8 which extends up the front of the machine and is connected at its lower end to a loop g^9 carried by a U-shaped arm g^{10} pivoted as at g^{11} to the base a of the machine, this arm being arranged above the plate e^1 and below the key levers d (see Figures 5 and 6). Thus when a key lever has been almost completely depressed, the lower edge engages the arm g^{10} to depress the same. Depression of the arm g^{10} will cause the rod g^8 and hence the projection g^7 to be lowered and so will raise the pawl to the position shown in Figure 6. This frees the ratchet wheel and enables the same to run back should the same overthrow. In addition, a block of hard rubber d^8 may be arranged in front of the front plate c, in order to form a resilient buffer for the keys.

It will be seen that the projections g^7 will not be raised off the rear extension g^6 of the pawl g^4 until after the key has begun to rise again; hence if the plate e^1, arm e^2 and ratchet wheel g^3 should overthrow, due to great force being applied to any one of the keys d^3, the plate e^1 and its associated parts will return to take up the overthrow before the pawl g^4 engages with the ratchet wheel g^3. Hence the ill effects of any overthrow are nullified.

This method of nullifying the ill effects of any overthrow has the advantage that very little extra resistance against depression of the keys is provided by the same. This advantage is not secured if a dash-pot, or other like form of device for retarding the operation, is employed, but it will be appreciated that a dash-pot or other similar device may be employed in place of the above described mechanism without departing from the scope of the present invention.

To the right of the ratchet wheel g^3 is arranged the selector mechanism by means of which the movement obtained by the depression of the keys is translated so as to give the desired impulses. Such mechanism comprises a ring or other suitable member j secured between the front and back plates b and c, this member being provided with a number of pins j^1 (104 in the embodiment illustrated in the drawings). This member j will hereinafter be referred to as the pin disc for the sake of brevity and differentiation. The pins j^1 are held friction-tight in holes in the pin disc j and, in order to secure the desired amount of friction, the edge of the pin disc j is grooved (see Figures 10 and 11), the groove being of such depth as to expose the face of the pins located in the holes. A number of turns of thread or the like j^2 are then wound in the groove over the surfaces of the pins, and then a ring of spiral steel spring wire j^3 is sprung into the groove, thus pressing the thread against the pins. This gives sufficient friction on the pins and enables the same at the same time to be moved easily in the holes.

These pins j^1 are used to control the number of impulses that are sent out by the machine when any particular key is depressed, in a manner hereinafter described. Normally the pins j^1 project to the left of the pin disc j, but depression of a key is adapted to cause one of the pins (which is selected in a manner hereinafter described) to be pushed to the right so that it projects on the right of the pin disc j.

Describing now the impulse sending portion of the device, this comprises a sleeve k (see Figure 1) which is freely journalled on the spindle h. The sleeve k terminates in a cup-shaped member k^1 which is located inside the pin disc. To this cup-shaped member k^1 is secured one end of a coil spring k^2 (see Figure 15), the other end of which is connected to a sleeve k^3 secured to the ratchet wheel g^3. Rotation of the ratchet causes the sleeve to be turned in an anticlockwise direction and so winds up the spring. On the other hand, during operation, the sleeve k and the cup-shaped member k^1 will follow the sleeve and will rotate in an anticlockwise direction and unwind the spring. The angular movement of the sleeve k^3 and the cup-shaped member are, however, equal and so the parts referred to above comprise a self winding mechanism and consequently there is always spring pressure tending to rotate the sleeve k.

The sleeve k is provided with a plate k^4 (Figures 1 and 3) on which are mounted a pinion (not shown) engaging with the toothed inner periphery j^5 of the pin disc j (Figure 3). This pinion drives the usual type of spring mounted ball governor, part of which can be seen at k^5 and also an interrupter wheel k^6 which is provided around its periphery with projections, as shown in Figures 12 and 13. The plate k^4 also carries the set of interrupter contacts k^7 so arranged that as the interrupter wheel k^6 rotates under the same they are closed and opened once for each projection on the periphery of the interrupter wheel. Figure 12 shows the interrupter contacts k^7 closed (not, however,

due to engagement with the projections on the interrupter wheel k^6,) and Figure 13 shows the interrupter contacts open, being free of the projections on the interrupter wheel. The interrupter contacts k^7 are connected by lengths of wire k^8 to a pair of slip rings k^9 carried by the sleeve k, these slip rings being connected to the connection leads by a pair of wire brushes k^{10} sliding on the slip rings k^9.

Also pivoted on the plate k^4 and on an axis which is parallel to the axis of the spindle h is a rocking lever, the one arm of which k^{11} is turned so as to lie under the interrupter contacts k^7 (see Figures 12 to 14), and the other arm k^{12} of which is curved so as to conform to the curvature of the pin circle in the pin disc j. This rocking lever k^{11}, k^{12} is spring-controlled by reason of the springiness of the interrupter contacts k^7 so as normally to raise the arm k^{12} into the pin circle (see Figure 13). The plate k^4 is arranged in close proximity to the right hand face of the pin disc j and, as explained above, the pins j^1 do not normally project beyond the right hand face. When, however, a pin does project beyond the right hand face, the arm k^{12} is depressed in passing under the same, and this causes the arm k^{11} to be raised to close the interrupter contacts. The interrupter contacts k^7 remain closed for such time as it takes for the arcuate surface k^{13} of the arm k^{12} to pass under the pin that projects. The length of the curved surface k^{12} is adjusted to correspond to the predetermined fixed space (the spacing impulse) and then when the heel of the surface k^{13} has passed under the pin j^1, the arm k^{12} is raised by the interrupter contacts k^7, as above described, and the interrupter wheel k^6 is free to perform its normal function of making and breaking the interrupter contacts k^7.

A side-way extension k^{14} of the plate k^4 also carries a curved wiper arm k^{15} which is disposed opposite the pin circle in the pin disc j and which is arranged at its free end in close proximity to the face of the pin disc. The arm k^{15} thus presents an inclined plane which, when it reaches any pins that may project on the right hand side of the pin disc, wipes over the same and returns the pin j^1 to its normal position in which it projects on the left hand side of the pin disc j ready for further operation when required. The direction of movement of the plate k^4 and its associated parts is always in the direction of the arrows shown in Figures 12, 13 and 14, and so it will be appreciated that any pin that is displaced from its normal position serves its function of operating the rocking lever k^{11}, k^{12} before it is wiped back into position by the wiper arm k^{15}.

Describing now the method of selection of the pins to be depressed, this is obtained by means of a striker arm which is carried by the ratchet wheel in such a manner that, while it is capable of transverse movement relative to the ratchet wheel, it cannot move in the direction of rotation with respect to the same. In the accompanying drawings l is the striker arm (see Figures 2, 5, 6 and 8). This striker arm is slotted, as at l^1, and in the slot are disposed two pins l^2 carried by the ratchet wheel g^3, these pins accurately locating the striker arm l. The arm l is expanded into a disc l^3 which takes about the sleeve k^3 and is extended on the further side of the sleeve, as at l^4, being connected to the ratchet wheel g^3 by a blade spring l^5. The arm l is thus free to move transversely with respect to the ratchet wheel g^3 and is returned to its normal position by means of the spring l^5. The striker arm is located close to the pin disc on the left hand side (see Figure 1) and is so arranged that, in its normal position, it is clear of all the pins j^1 which project on the left hand side while, when it is moved transversely on its spring, it engages with one pin and pushes the same until it projects on the right hand side of the pin disc j to operate the arm k^{12}, as above described.

The striker arm l is adapted to be moved transversely so as to move a pin near the end of the return of the ratchet g^1 engaging the ratchet wheel g^3, and the means for accomplishing this comprise a plate m which passes about the spindle h, see Figure 7, and which is connected to the front plate or to the member f^5 thereon through a small blade spring m^1 so that the plate is free to oscillate backwards and forwards on the spindle h, it being always returned after operation to the position shown in full lines in Figure 7 by the spring m^1. The forward end of the plate m, which is disposed on the further side of the spindle h to the member f^5, is bevelled off as at m^2. Secured to the sleeve k^3 carrying the ratchet wheel g^3 is an arm n, the outer end of which is turned back so as to provide a tongue n^1 which in the normal position in which the mechanism is at rest is disposed above the bevelled end m^2 of the arm m. When, however, a key is operated to rotate the ratchet wheel, the arm n is caused to rotate in an anticlockwise direction and so engages the bevelled end m^2. The tongue n^1 is so arranged that as it moves it presses the arm n backwardly against the action of the spring m^1 towards the stretcher bar f^2. The arm is held out while the ratchet wheel g^3 rotates, but on the return stroke the bevelled end m^2 slips over the tongue n^1 to assume the position shown in dotted lines in Figure 7. This movement takes place with a sharp snap since the spring m^1 has been flexed. After moving out to the position shown in dotted lines in Figure 7, the arm m returns to its normal position under the influence of the spring m^1 so as to be ready to operate again when a further key is actuated to cause rotation of the

ratchet wheel g^3. This transverse movement of the arm m is used to give a transverse movement of the striker arm l in the following manner; the striker arm l is provided with a pair of pins l^6 arranged on opposite sides of the spindle h, and projecting through the ratchet wheel g^3 so as to lie in contact with or in close proximity to the arm m in the normal position (see the full line position of Figure 7). When the arm m is moved away from the striker bar f^2, as above described, it engages the pins l^6 and moves the same, thus moving the striker arm transversely and causing it to strike are pins j' (see the broken line position of Figure 7). The particular pin j^1, opposite which the striker arm l was disposed, is thus pressed through the pin disc j and caused to project on the right hand side of the same.

The mechanism is so arranged that the plate k^4 and the impulse sending mechanism does not commence to move until the selected pin has been moved to project on the right hand side of the pin disc j. The means of securing this holding up of the movement comprises a ratchet arm o which is journalled freely about the spindle h and connected through a tension spring o^1 to the ratchet wheel g^3, this spring being connected to a projection o^2 on the arm o (see Figure 8). Also, pivoted on the ratchet wheel g^3, as at o^3, is a stop member o^4, the movement of which is limited in both directions by means of a pin o^5 on the ratchet wheel g^3. The stop member is also spring-controlled by means of a tension spring o^6 and is provided with a turned up arm o^7 disposed in the path of the ratchet arm o. The ratchet arm o engages with the internally ratchet toothed periphery of a ring p which is mounted in ball bearings (not shown) in the pin disc j. The ratchet ring p is held against any appreciable amount of rotation by means of a slot p^1 therein within which is disposed one end of a spring p^2 which projects through the pin disc (see Figure 11) and is provided outside the same with a button p^3 engaging with spring contacts p^4 (see Figures 11 and 1) which are wired in circuit so as to cut out the transmitter and receiver. The springiness of the contacts exerts a constant pressure on the ring p, tending to revolve the same in a clockwise direction.

The plate k^4 is provided with a pin o^7 (see Figure 8) which abuts against the ratchet arm o so that the plate k^4 and its associated parts are thereby held stationary, the ratchet arm engaging with the ratchet teeth on the ring p. The ratchet teeth on the ring p are, however, tapered (see Figures 9 and 10) so that a transverse movement of the ratchet arm o will operate to free the same from the ratchet teeth. The arm o, as shown in Figures 9 and 10, lies in close proximity to the striker arm l so that when the striker arm is moved transversely, the arm o is likewise moved and freed from the ratchet teeth. It will be appreciated, however, that before the striker arm is moved transversely, the ratchet wheel g^1 has been rotated and hence the stop member o^4 has been withdrawn from the forward edge of the ratchet arm o. Hence, when the striker arm is moved to cause movement of a pin j^1, the ratchet arm o is also freed from the ratchet teeth in the ring p and since the tension spring o^1 has been stretched by the previous rotation of the ratchet wheel g^3, the arm o will, as soon as it is released from the ratchet teeth in the ring p, fly round until it encounters the stop member o^4 which arrests its movement. The ratchet teeth are so arranged that the arm o is released before the pin j has been fully depressed. Hence, the arm has sufficient time to fly round to its normal position before the striker arm returns to its normal position. A blade spring or the like o^8 is provided (see Figures 9 and 10) bearing on the arm o to return the same to its normal position in engagement with the ratchet teeth, when the striker arm has moved back. When the ratchet arm o has reached to its new position, it forms a new stop for the pin o^7 on the plate k^4 and hence, since the removal of the arm o frees the pin o^7, the plate k^4 and its associated impulse mechanism are free to rotate under the action of the spring k^2.

The pull of the spring o^6, plus the pressure exerted on the ring p by the blade spring p^2, are sufficient to overpower the pull of the spring o^1 on the arm o and hence, when the arm o flies round, it does not at once assume its final position, it merely abuts against the stop member o^4 which remains in a position with its outer arm in contact with the pin o^5. When the plate k^4, however, has nearly completed its movement, the pin o^7 thereon abuts against the arm o and adds an additional force, tending to overpower the pull of the spring o^6. The pressure of the spring k^2 transmitted through the pin o^7 to the arm o, plus the pull of the spring o^1, is sufficient to overcome the combined action of the springs o^6 and p^2 so that the ring p is moved around slightly (a distance equal to one tooth). The stop member o^4 thereupon swings until its inner arm abuts against the pin o^5 which thus forms a positive stop. The movement of the ring p, however, pushes the spring p^2 out and causes operation of the contacts p^4. Thus when the impulse sender comes to rest, the transmitter and receiver are immediately brought into circuit, but when the impulse sender is moving to send out the impulses, the transmitter and receiver are cut out of circuit, in the usual manner.

Describing now the operation of the device, it will be appreciated that in all automatic telephone installations it is necessary to space the sets of signalling impulses by means of a spacing impulse in order to sep-

arate the digits or letters. This spacing impulse should be of a duration equal to, at least, five signalling impulses in the systems at present in use, in order that the slow acting relays employed may be allowed to operate. Accordingly, in order that time may be saved, the mechanism according to the present invention is so arranged that a spacing impulse equal in duration to five signalling impulses is given out between each set of signal impulses. In order to accomplish this, the key operating mechanism is so proportioned that depression of any one key causes the ratchet wheel to be rotated by an amount equal to the number of the key depressed, plus the spacing. Thus, given that the spacing impulse shall be equal in duration to five signal impulses (it may be longer or shorter as required), the key, corresponding to the number 1, would cause the ratchet wheel to be rotated six steps (say teeth), the key corresponding to the numeral 2 would cause the ratchet wheel g^3 to be rotated seven teeth and so on.

Rotation of the ratchet wheel results in a similar angular movement of the striker arm l and hence depression of the key corresponding to the numeral 1 would cause the striker arm to be advanced six pins (and to actuate the sixth pin to cause the same to project on the right hand side of the pin disc j), depression of the key corresponding to the numeral 2 would cause actuation of the seventh pin and so on.

As above explained, operation of the striker arm allows the plate k^4 and its associated impulse sending mechanism to operate, and this impulse sending mechanism is so arranged that one impulse is sent out when the plate k^4 rotates through an angle corresponding to the distance between two pins. Accordingly six impulses are given by depression of the key 1 and seven impulses are given by depression of the key 2 and so on. These sets of impulses are, however, split up into the spacing impulse (5) and the number of individual impulses (which will, of course, correspond to the number of the key) by means of the arm k^{11}, k^{12} which cuts out the impulse sending contacts over the spacing interval.

It is immaterial at what point the mechanism starts, but it is so arranged that when the pin o^7 abuts against the arm o (the position of rest), a pin is in contact with the surface k^{13}. Thus, movement of six spaces may be split up in to say three parts of a spacing impulse, one signalling impulse and two parts of a spacing impulse. It is not necessary to start with a spacing impulse, and hence it does not matter whether one key is depressed before the movement caused by another key has been completed, for in all cases the sets of signalling impulses will be spaced by a spacing impulse, due to the surface k^{13} riding under the pin which has been caused to project on the right hand side of the pin disc. This, it will be appreciated, will result in a material saving of time, since the required sequence of numbers may be tapped out on the keys as fast as the operator can do so. The correct sets of signalling impulses will then be sent out, due to movement of the plate k^4 which is controlled by the governor. In all cases, however, before the mechanism can reach the space between two pins caused by subsequent operation of other keys, the surface k^{13} must pass under the previously displaced pin to give the spacing impulse.

The mechanism according to the present invention is, therefore, practically fool proof and will enable a great saving of time to be obtained particularly on private branch exchanges and the like where a large number of calls are sent out.

Many modifications and alterations in the above described mechanism may be carried out without departing from the spirit of this invention. Thus, in place of the pins j^1, above referred to, I may employ balls.

The keys and stop are so arranged that the movement of the impulse wheel is the correct amount for the depressed key; thus a movement of six pins for the digit 1, seven pins for the digit 2 and so on.

Many further modifications may be made in the above described constructional form without departing from the spirit of this invention. Thus, for example, by a suitable arrangement of the ratchet wheel and spacing arm (or of the disposition of the key levers and stops in the pin operated arrangement), the spacing impulse may be lengthened or shortened as desired.

I claim:—

1. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys each corresponding to a number, a set of interrupter contacts to transmit the impulses over the line, means for causing operation of said contacts, setting mechanism controlled by said depressible keys to set said contact operating means so that for any key depressed said contact operating means will cause said contacts to be interrupted a number of times equal to the number corresponding to the key depressed, plus a fixed number, and means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number.

2. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys each corresponding to a number, a set of interrupter contacts to transmit the impulses over the line, means for causing operation of said contacts, setting mechanism controlled by said depressible keys to set said contact operating means so that for any key depressed said

contact operating means will cause said contacts to be interrupted a number of times equal to the number corresponding to the key depressed, plus a fixed number, means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number and means for holding up said contact operating mechanism until after the first depressed key of any sequence has been released.

3. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys, a set of contacts adapted to transmit impulses over the line, an interrupter wheel to operate said contacts, means for driving said interrupter wheel, means controlled by said depressible keys for limiting the operation of said means for driving said interrupter wheel so that for depression of any one key the contacts are operated a number of times equal to the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, and means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number.

4. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

5. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key levers attached to said keys, a pivoted member operatively connected to said ratchet wheel and adapted to be moved by said key levers to cause operation of said ratchet wheel through an arc, the magnitude of which varies in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

6. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key levers attached to said keys, a pivoted member operatively connected to said ratchet wheel and adapted to be moved by said key levers to cause operation of said ratchet wheel through an arc, the magnitude of which varies in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, and means adapted to return each key to its raised position independent of the other keys.

7. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, a check-pawl co-operating with said ratchet wheel to prevent rotation of the same in a reverse direction, means for raising said check-pawl from said ratchet operatively connected with said key setting mechanism so that when any key is depressed said check-pawl is raised clear of said ratchet wheel, and means for returning said check-pawl into engagement with the ratchet wheel as soon as said depressed key is released.

8. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, a check-pawl co-operating with said ratchet wheel to prevent rotation of the same in a reverse direction, means for raising said check-pawl from said ratchet operatively connected with said key setting mechanism so that when any key is depressed said check-pawl is raised clear of said ratchet wheel, means for returning said check-pawl into engagement with the ratchet wheel as soon as said depressed key is released and means adapted to return each key to its raised position independent of the other keys.

9. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the

number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, an arm, the movement of which is limited to the movement of said ratchet wheel, a ratchet ring engaged by said arm, means for freeing said arm from said ratchet ring to allow the same to move, an abutment on said impulse sending means to engage with said arm and assist the movement of said impulse sending means, and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

10. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, means for freeing said arm from said ratchet ring after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

11. A impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, means, operated after the ratchet wheel has been set to correspond to the key depressed, for moving said arm transversely with respect to said ratchet ring in order to free said arm from the teeth thereof and allow the same to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

12. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by a said arm, cut away teeth to said ratchet ring adapted to hold said arm until the same is moved transversely with respect thereto, means, operated after the ratchet wheel has been set to correspond to the key depressed, for moving said arm transversely with respect to said ratchet ring in order to free said arm from the teeth thereof and allow the same to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

13. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

14. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, means for freeing said arm from

said ratchet ring after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

15. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, means, operated after the ratchet wheel has been set to correspond to the key depressed, for moving said arm transversely with respect to said ratchet ring in order to free said arm from the teeth thereof, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

16. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

17. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a spring controlled stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, means for freeing said arm from said ratchet ring after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said spring controlled stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

18. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a spring controlled stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said spring controlled stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

19. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accord-

ance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a spring controlled stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said spring controlled stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

20. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring mounted so as to be capable of a small rotary movement and engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and move the same and hence the ratchet ring with which the same is engaged forward a step against the action of the spring controlled stop and finally arrest the movement of said impulse sending means, and means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses.

21. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring mounted so as to be capable of a small rotary movement and engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and move the same and hence the ratchet ring with which the same is engaged forward a step against the action of the spring controlled stop and finally arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses and a set of contacts operatively connected to said ratchet ring adapted to cut the transmitter and receiver out of circuit until such time as the impulse sending means come to rest.

22. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of

said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

23. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key levers attached to said keys, a pivoted member operatively connected to said ratchet wheel and adapted to be moved by said key levers to cause operation of said ratchet wheel through an arc, the magnitude of which varies in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

24. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, an arm, the movement of which is limited to the movement of said ratchet wheel, a ratchet ring engaged by said arm, means for freeing said arm from said ratchet ring to allow the same to move, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

25. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said ram, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

26. An impulse sender for use in the automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said trans-

verse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved traversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

27. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means, and means for returning the displaced pin after it has operated the rocking arm.

28. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means and means for returning the displaced pin after it has operated the rocking arm.

29. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period

corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means and means for returning the displaced pin after it has operated the rocking arm.

30. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means, and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases.

31. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means, and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases and means for returning the displaced pin after it has operated the rocking arm.

32. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface

of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases.

33. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases and means for returning the displaced pin after it has operated the rocking arm.

34. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means, and a wiper arm carried by said impulse sending means and disposed behind the rocking arm in the direction of movement of the impulse sending means, said wiper arm being adapted to engage the displaced pin and return the same to its normal position.

35. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means, having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases, and a wiper arm carried by said impulse sending means and disposed behind the rocking arm in the direction of movement of the impulse sending means, said wiper arm being adapted to engage the displaced

pin and return the same to its normal position.

36. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases, means for returning the displaced pin after it has operated the rocking arm and a wiper arm carried by said impulse sending means and disposed behind the rocking arm in the direction of movement of the impulse sending means, said wiper arm being adapted to engage the displaced pin and return the same to its normal position.

37. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm carried by said ratchet wheel in such a manner as to be incapable of rotary movement on the same, but free to move transversely with respect to the same, said striker arm being connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

38. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transferred to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed, a tension spring connected between said ratchet wheel and said arm to cause said arm to move and again engage with said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and arrest the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a striker arm carried by said ratchet wheel in such a manner as to

be incapable of rotary movement on the same, but free to move transversely with respect to the same, said striker arm being connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases.

39. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys each corresponding to a number, a set of interrupter contacts to transmit the impulses over the line, means for causing operation of said contacts, setting mechanism controlled by said depressible keys to set said contact operating means so that for any key depressed said contact operating means will cause said contacts to be interrupted a number of times equal to the number corresponding to the key depressed, plus a fixed number, means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number, said means including a setting member, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

40. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys each corresponding to a number, a set of interrupter contacts to transmit the impulses over the line, means for causing operation of said contacts, setting mechanism controlled by said depressible keys to set said contact operating means so that for any key depressed said contact operating means will cause said contacts to be interrupted a number of times equal to the number corresponding to the key depressed, plus a fixed number, means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number, means for holding up said contact operating mechanism until after the first depressed key of any sequence has been released, said means including a setting member, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

41. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys, a set of contacts adapted to transmit impulses over the line, an interrupter wheel to operate said contacts, means for driving said interrupter wheel, means controlled by said depressible keys for limiting the operation of said means for driving said interrupter wheel so that for depression of any one key the contacts are operated a number of times equal to the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number, said means including a setting member, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

42. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said means including a setting member, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

43. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, a check-pawl co-operating with said ratchet wheel to prevent rotation of the same in a reverse direction, means

for raising said check-pawl from said ratchet operatively connected with said key setting mechanism so that when any key is depressed said check-pawl is raised clear of said ratchet wheel, means for returning said check-pawl into engagement with the ratchet wheel as soon as said depressed key is released, said means including a setting member, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

44. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said means including a transversely movable striker arm adapted to be operated from said ratchet wheel, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

45. An impulse sender for use in automatic telephone system and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, a check-pawl co-operating with said ratchet wheel to prevent rotation of the same in a reverse direction, means for raising said check-pawl from said ratchet operatively connected with said key setting mechanism so that when any key is depressed said check-pawl is raised clear of said ratchet wheel, means for returning said check-pawl into engagement with the ratchet wheel as soon as said depressed key is released, said means including a transversely movable striker arm adapted to be operated from said ratchet wheel, abutments, one of which is adapted to be selectively displaced by said setting member when operated by the depression of a key, and a rocking arm carried by said impulse sending means to suspend the effective operation of said contact operating means.

46. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins held friction tight in said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

47. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, a pivoted arm, a stop on said ratchet wheel to limit the movement of said arm, a ratchet ring engaged by said arm, an arm connected to and moving with the ratchet wheel operating mechanism, an inturned tongue to said arm, a further arm engaged by said inturned tongue and held so that as said inturned tongue moves with the ratchet wheel it imparts to said further arm a sharp transverse movement during its return movement, means for causing said transverse movement of said further arm to be transfered to said arm engaging with said ratchet ring to free the same from the teeth thereof after the ratchet wheel has been set in accordance with the key depressed so as to allow said arm to move and again engage said stop on said ratchet wheel, an abutment on said impulse sending means to engage with said arm and assist the movement of said impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins held friction tight in said pin disc, a striker arm connected to said further arm engaged by said inturned tongue and adapted to be moved transversely thereby

in order to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

48. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins held friction tight in said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means, and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rocking arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases.

49. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins held friction tight in said pin disc, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means, and a wiper arm carried by said impulse sending means and disposed behind the rocking arm in the direction of movement of the impulse sending means, said wiper arm being adapted to engage the displaced pin and return the same to its normal position.

50. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins carried by said pin disc, a plurality of turns of textile material around said pins, a spring to hold said textile material in good frictional contact with said pins, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means and adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means.

51. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins in said pin disc, a plurality of turns of textile material around said pins, a spring to hold said textile material in good frictional contact with said pins, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means, and having a surface adapted to engage said displaced pin to cause said rocking arm to rock and so close said contacts and suspend the effective operation of the contact interrupting means, the length of said surface of the rock-

ing arm adapted to engage said pin being such that the effective operation of the contact interrupting means is suspended over a period corresponding to a number of interruptions equal to the predetermined fixed number which is added in all cases.

52. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses, said last mentioned means including a pin disc, a plurality of pins in said pin disc, a plurality of turns of textile material around said pins, a spring to hold said textile material in good frictional contact with said pins, a striker arm operated from said ratchet wheel at the end of its movement to displace one of said pins, contacts carried by said impulse sending means, means for interrupting said contacts and a rocking arm also carried by said impulse sending means adapted to be engaged by the displaced pin to close the said contacts and suspend thereby the effective operation of the contact interrupting means, and a wiper arm carried by said impulse sending means and disposed behind the rocking arm in the direction of movement of the impulse sending means, said wiper arm being adapted to engage the displaced pin and return the same to its normal position.

53. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key setting mechanism adapted to operate said ratchet wheel in accordance with the number corresponding to the key depressed plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, means for suspending operation of said impulse sending means over a period corresponding to the predetermined fixed number of impulses and a driving spring wound by the movement of said ratchet wheel and unwinding to drive said impulse sending means.

54. An impulse sender for use in automatic telephone systems and the like, comprising a plurality of depressible keys each corresponding to a number, a set of interrupter contacts to transmit the impulses over the line, means for causing operation of said contacts, setting mechanism controlled by said depressible keys to set said contact operating means so that for any key depressed said contact operating means will cause said contacts to be interrupted a number of times equal to the number corresponding to the key depressed, plus a fixed number, means for suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number, and a governor to control the speed of said impulse sending means.

55. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key levers attached to said keys, a pivoted plate having an inclined edge with which said key levers engage so that contact is made at different distances from the fulcrum whereby equal depression of the keys causes different amounts of depression of the plate, means operatively connecting said plate to the ratchet wheel in order to cause said ratchet wheel to move by an amount corresponding to the number of the key depressed, plus, in all cases, a predetermined fixed number, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, and means suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number.

56. An impulse sender for use in automatic telephone systems and the like comprising a plurality of depressible keys, a ratchet wheel, key levers attached to said keys, a pivoted plate having an inclined edge with which said key levers engage so that contact is made at different distances from the fulcrum whereby equal depression of the keys causes different amounts of depression of the plate, means operatively connecting said plate to the ratchet wheel in order to cause said ratchet wheel to move by an amount corresponding to the number of the key depressed, plus, in all cases, a predetermined fixed number, means for raising said plate after depression, and a stop to limit the upward movement of the same, impulse sending means, means operatively connected with said ratchet wheel to control the movement of the impulse sending means, and means suspending the action of said impulse sending contacts over a period corresponding to the predetermined fixed number.

In testimony whereof I have signed my name to this specification.

DONALD MACADIE.