J. G. BLESSING.

AUTOMATIC TELEPHONE CALLING DEVICE.

APPLICATION FILED FEB. 2, 1912.

1,277,840.

Patented Sept. 3, 1918.

3 SHEETS—SHEET 1.

FIG. 1.

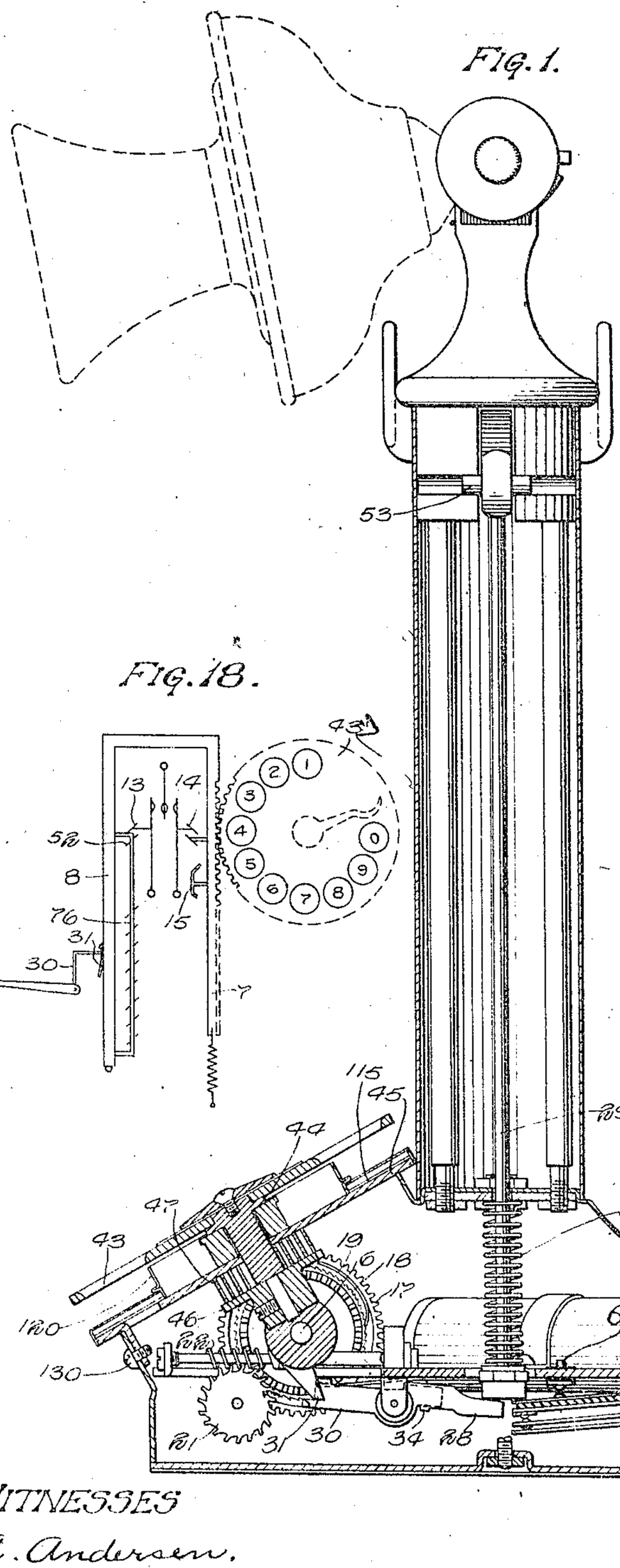


FIG. 3.

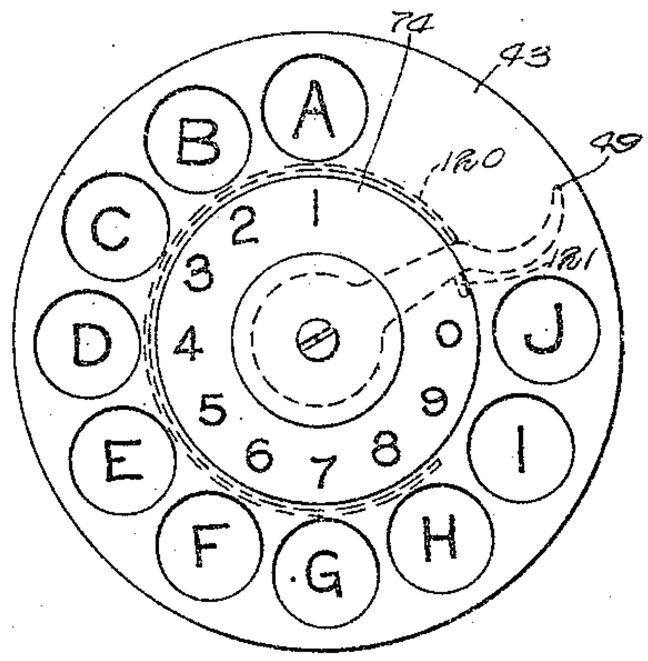
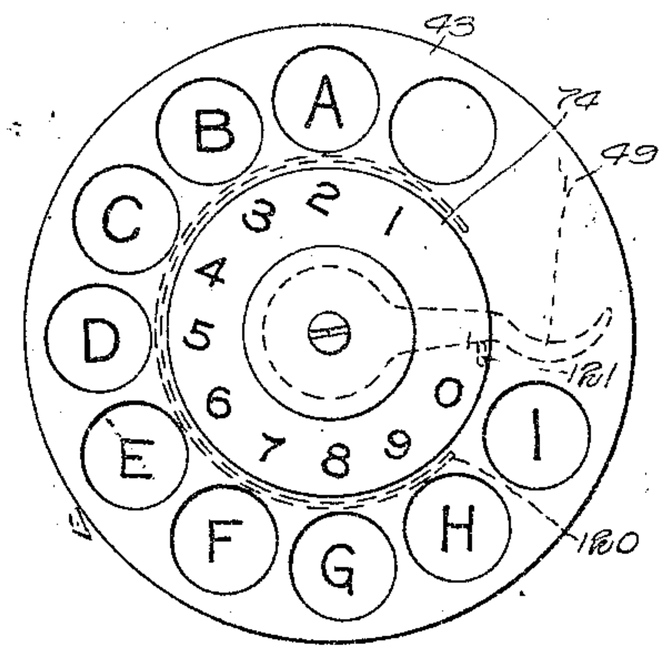


FIG. 18.

FIG. 4.



WITNESSES

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3 SHEETS—SHEET 2.

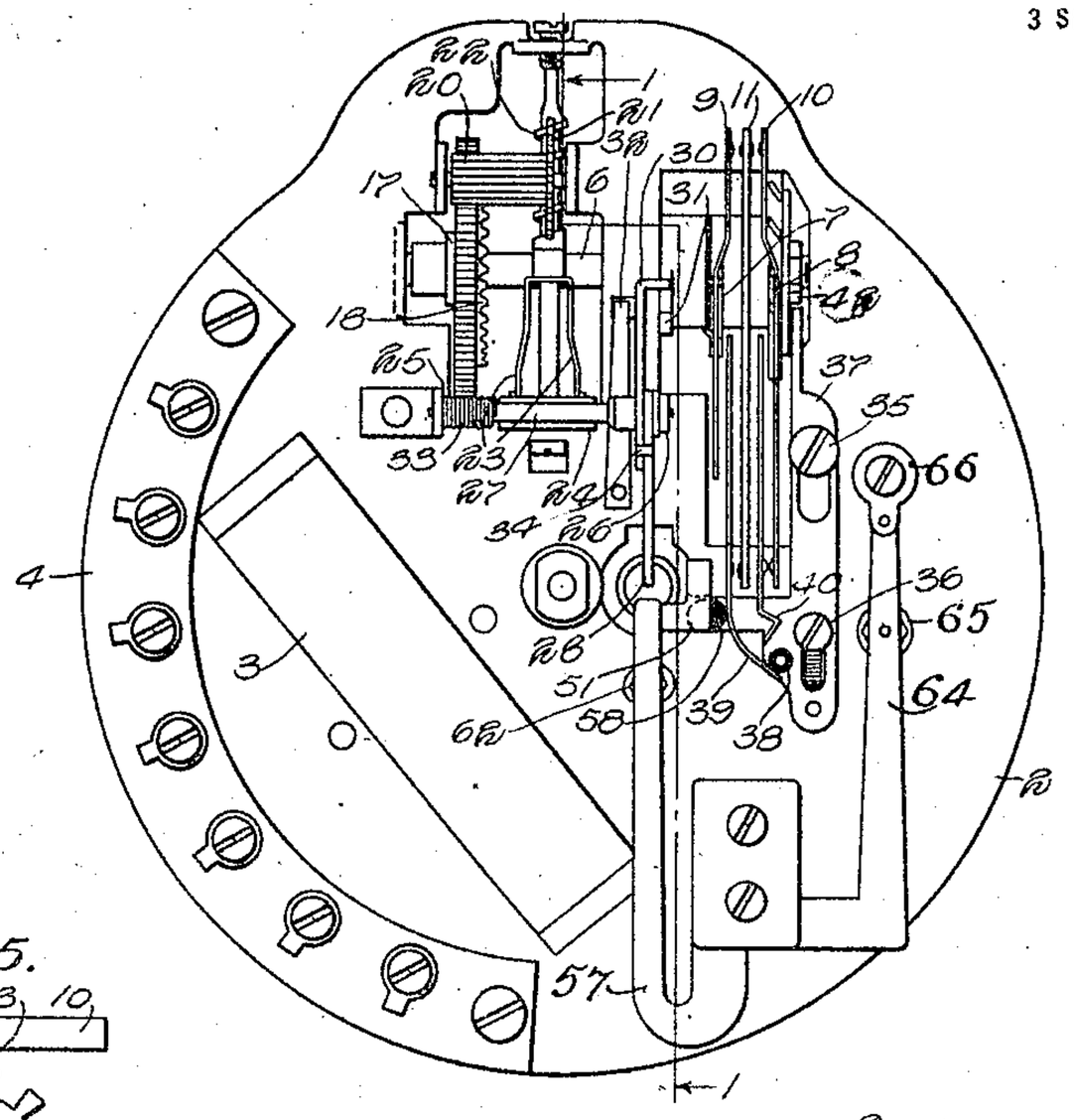
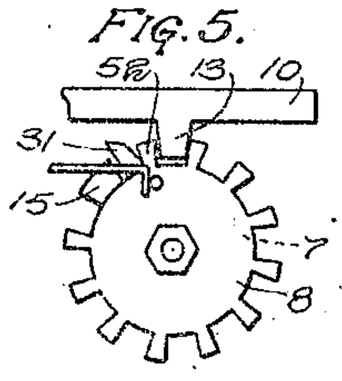


FIG. 2.

FIG. 5.



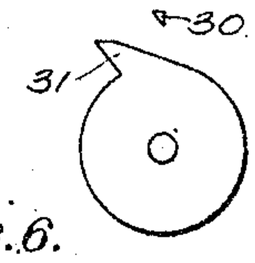


FIG. 6.

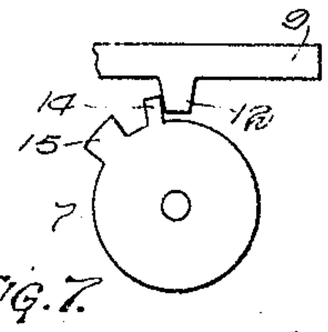


FIG. 7.

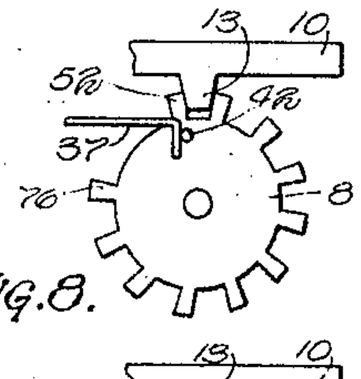


FIG. 8.

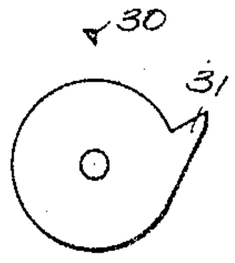


FIG. 9.

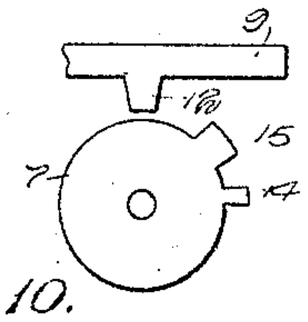


FIG. 10.

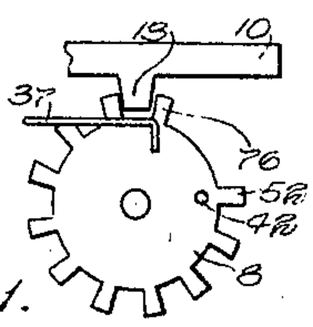


FIG. 11.

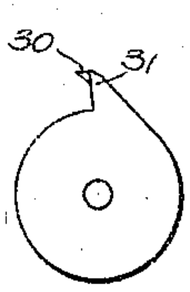


FIG. 12.

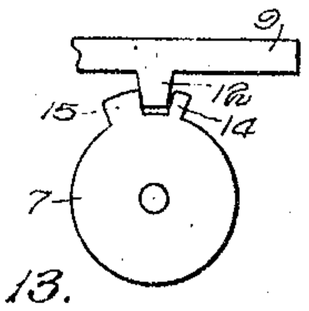


FIG. 13.

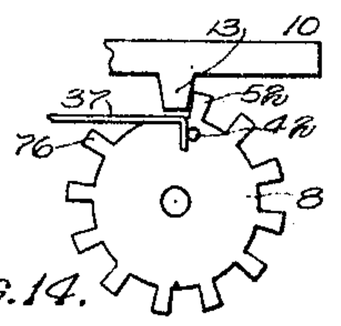


FIG. 14.

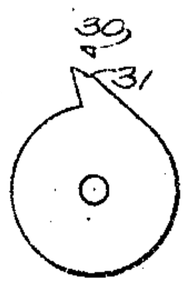


FIG. 15.

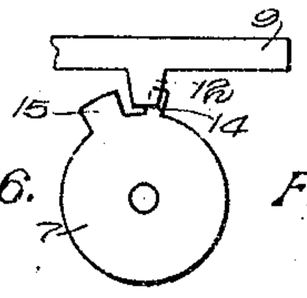


FIG. 16.

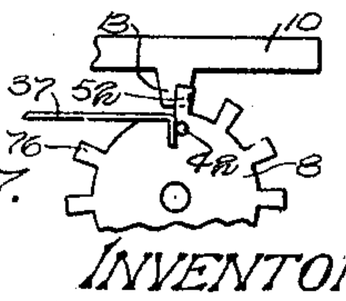


FIG. 17.

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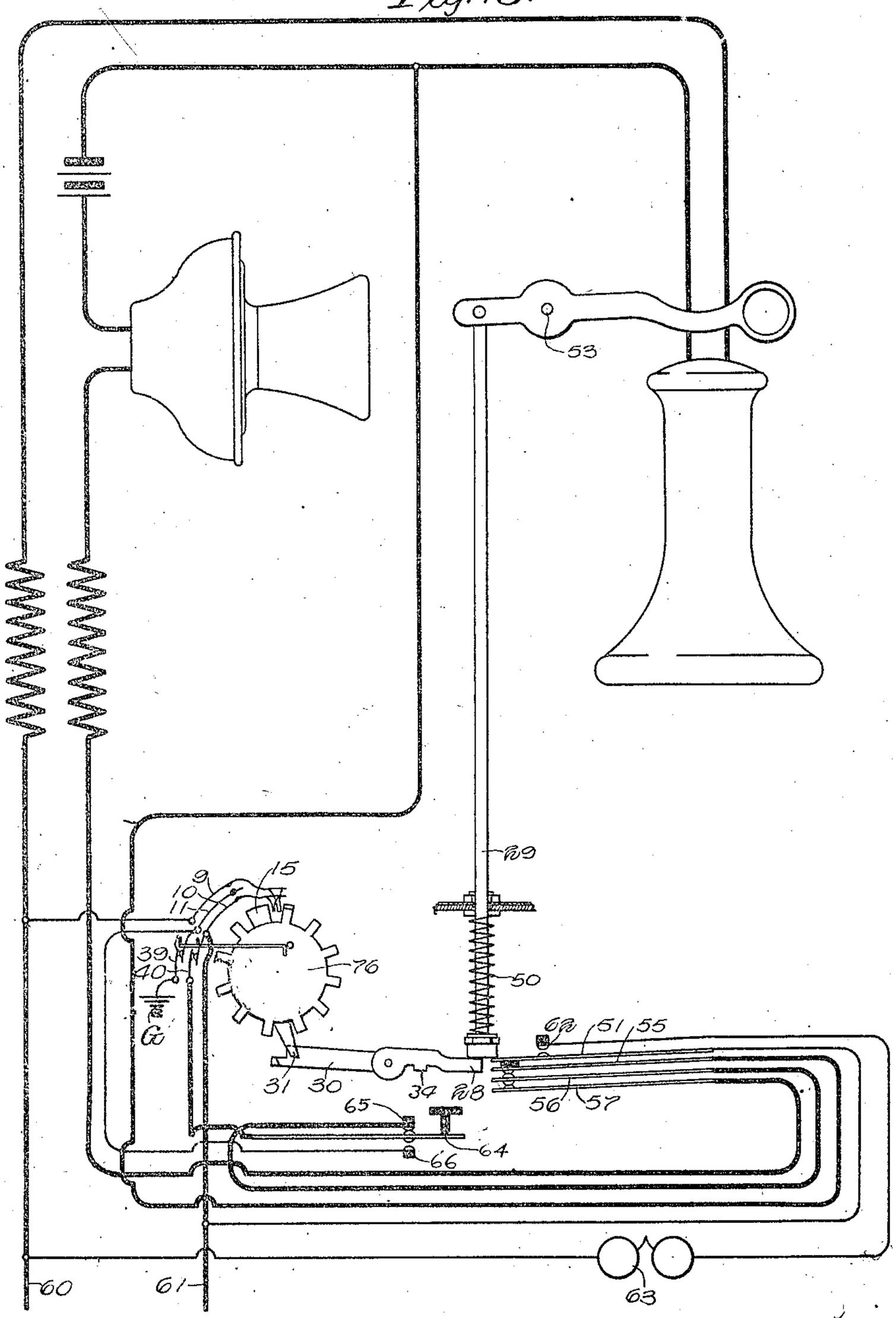
3 SHEETS—SHEET 3.

Fig. 19.



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AUTOMATIC TELEPHONE CALLING DEVICE.

1,277,840. Specification of Letters Patent. Patented Sept. 3, 1918.

Application filed February 2, 1912. Serial No. 675,049.

To all whom it may concern:

Be it known that I, JOHN G. BLESSING, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Automatic Telephone Calling Devices, of which the following is a specification.

My invention relates to an impulse-transmitting device, and more particularly to an impulse-transmitting device for use in connection with automatic telephone systems.

Broadly, the objects of my invention are to simplify and improve the construction of such impulse-transmitting devices.

My invention is particularly adapted for use in connection with an automatic telephone system of the "three-wire" type—that is, a system in which the impulses for operating the switches are transmitted first over one side of the line circuit and then over the other side of the line. In systems of this character it is customary to transmit one or more impulses over one side of the line, then to transmit a series of impulses over the other side of the line, the number of impulses in this series depending upon the digit of the called number, and then to follow each series of impulses by one or more impulses over the first side of the line. This operation is repeated for each digit of the called number. It is also customary to transmit an impulse over the two sides of the line simultaneously upon the hanging up of the receiver for the purpose of releasing the central office apparatus. This release impulse is some times produced by causing the dial of the calling device to move from a subnormal to a normal position upon the hanging up of the receiver. In constructing impulse-transmitting devices for such systems it has been found difficult to construct a transmitter of small dimensions which would provide for this extra movement of the dial upon the hanging up of the receiver and which would also provide a prolonged impulse over the first side of the line, which prolonged impulse is employed for causing the switches of the automatic system to perform certain operations. In order to provide a sufficiently long impulse it was found necessary to give the dial a greater angle of movement. If the finger holes on the dial were kept of a given size, it was impossible to have the dial accomplish all that is required, with an angle of movement equal to or less than three hundred and sixty degrees. One of the features of my invention is the overcoming of this objection by providing a dial which is capable of rotating through an angle of more than three hundred and sixty degrees; while the impulse wheel which is controlled by this dial still operates through an angle of less than three hundred and sixty degrees. This increased angle of movement of the dial is made possible by means of an improved movable finger stop.

A further important feature of my invention is the arrangement of the dial and dial shaft separate and distinct from the rest of the mechanism, whereby this mechanism can be readily detached from the dial.

A further feature is the provision of a dial having a stationary series of characters or numbers to represent the first series of impulses to be transmitted in calling a desired subscriber, in combination with a movable series of characters or letters to represent the remaining or subsequent series of impulses.

These and other objects of my invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical section of a desk telephone embodying the principles of my invention, the section through the base being taken on the line 1—1 in Fig. 2.

Fig. 2 is a bottom view of the mounting plate in the base of the telephone.

Fig. 3 is a top view of the dial in normal position.

Fig. 4 is a top view of the dial after it has been operated once.

Fig. 5 is a view showing the normal relation of the impulse wheels and springs.

Figs. 6 to 17, inclusive, are diagrams showing the relative positions of certain parts of the apparatus in various positions.

Fig. 18 is a graphic representation of the calling device.

Fig. 19 is a diagram of the substation circuits.

As shown in Fig. 1, the general appearance of the telephone as a whole is very much the same as that of an ordinary manual telephone, with the addition of the auto-

matic calling device in the base of the instrument. The usual switch hook is shown pivoted at the point 53 in the upper part of the telephone, and it controls the usual hook switch springs 51, 55, 56 and 57 through the medium of the rod 29. The rod 29 is secured to the rear portion of the switch hook, behind the pivot point, so that the rod moves in the opposite direction to that of the switch hook—that is, when the switch hook moves upward, the rod moves downward, and vice versa. The hook switch springs 51, 55, 56 and 57 are secured to the under side of the usual mounting plate 2 in the base of the telephone. The mounting plate 2 also forms a base for the mounting of the various parts of the automatic calling device, as well as for the induction coil 3 and the terminal block 4.

Referring especially to Figs. 1 and 2, the automatic calling device is constructed as follows: Mounted in bearings on the upper side of the plate 2 there is a rotary shaft 6 upon which, near one end, there are secured two toothed impulse wheels 7 and 8. Beneath these impulse wheels there is a pair of flexible impulse springs 9 and 10, between which there is a stationary ground post 11. The wheels 7 and 8 and portions of the springs 9 and 10 are shown in elevation in Figs. 7, 8, 10, 11, 13, 14, 16 and 17 in the various positions which they assume in the operation of the device. These figures are shown upside down so as to correspond with Fig. 2. Upon the upper side of the springs 9 and 10 there are a couple of projections or lugs 12 and 13 which extend into the path of rotation of the teeth on the impulse wheels 7 and 8, respectively. These impulse teeth are inclined to the planes of the wheels, as are also the lugs 12 and 13 on the impulse springs. There are eleven teeth on the wheel 8 and they are so inclined that as the wheel is rotated in a clockwise direction, as viewed in Fig. 8, or from the right, as shown in Fig. 2, each of the teeth on the wheel, as it passes the lug 13 on the spring 10, forces said spring outward away from the ground post 11. As the wheel is rotated in the opposite direction, however, each of the teeth, as it passes the projection 13, momentarily forces the spring 10 into contact with the ground post 11. There are only two teeth 14 and 15 on the wheel 7. The tooth 14 is so inclined that it forces the spring 9 into engagement with the ground post only when it passes the projection 12 in a counter-clockwise direction. The two edges of the tooth 15 are inclined in opposite directions, so as to force the spring 9 into engagement with the ground post 11 when it passes the projection 12 in either direction. Loosely mounted upon the opposite end of the shaft 6 there is a gear wheel 17. This gear wheel is hollowed out to form a shallow cup and fits over a second gear wheel 18 which is firmly secured to the shaft. The wheel 18 is provided with both spur and crown teeth. Secured to the inside of the wheel 17 there is a spring pawl 19 which coöperates with the spur teeth on the wheel 18. The wheel 17 meshes with a pinion 20 which is secured to a worm wheel 21, which latter in turn meshes with a worm 22 of a small governor comprising a pair of weighted springs 23 and a stationary cup 24. When the wheel 17 is rotated, the springs 23 revolve and fly out and rub on the inner surface of the cup 24, thereby producing a braking action to control the speed of operation of the device. Journaled in the bearings 25 and 26 on the under side of the plate 2 is a shaft 27 to which there is secured a lever 28 which extends back under the switch hook rod 29. Loosely mounted upon the shaft 27, alongside the lever 28, there is a second lever 30, the forward end of which is bent over into the plane of a locking member 31 on the main shaft 6. A small flat spring 32 tends to turn the lever 30 on the shaft 27 in a clockwise direction, the position of the lever 30 being limited by a small lug 34 on the lower side of the lever 28, which lug extends across and beneath the rear end of the lever 30. A coiled spring 33 on the shaft 27 serves to raise the lever 28 when the rod 29 is lifted by the depression of the switch hook. When the receiver is on the switch hook, the lever 28 is permitted to rise and tip the forward end of the lever 30 down, out of the path of the locking member 31. When the switch hook rises upon the removal of the receiver, the lever 28 is forced down, thereby permitting the lever 30 to rise into the path of the member 31. The locking member 31 is beveled on one side so that when the shaft 6 is rotated forward, with the lever 30 in its upper position, the member 31 may tip the end of the lever 30 down and pass it, but will be arrested by said lever on the return motion of the shaft. Slidably mounted upon the under side of the plate 2 by means of the screws 35 and 36 there is a bar 37. This bar controls, through the medium of the insulating bushing 38, a couple of movable springs 39 and 40. The bar 37 is normally held in the position shown in Fig. 2, against the tension of a small spring on its upper side, by a hook on the upper side of the end of the hook switch spring 51 which normally engages the insulating bushing 58, and by a pin 42 in the impulse wheel 8. If the impulse wheel is rotated while the receiver is off the hook, the bar 37 slides forward. Upon the initial movement of the bar 37 the spring 39 is permitted to come into contact with the ground post 11, and in the most advanced position of the bar the spring 40 is forced out of contact with the spring 10.

The subscriber controls the operations of the calling device through the medium of a dial 43 which is provided with finger holes, and is secured to a shaft 44 which is rotatably mounted in a plate 45, which latter is secured over the top of an opening in the base of the telephone. Upon the lower end of the shaft 44 there is a gear wheel 46 which meshes with the crown teeth of the wheel 18 on the shaft 6. Around the shaft 44, between the plate 45 and the gear wheel 46, there is a clock spring 47, one end of which is secured to the shaft and the other to the plate. Secured to the top of the dial there is a number plate 74 bearing a number for each of the finger holes. Immediately beneath the dial there is a finger stop 49. This finger stop is loosely mounted upon the shaft 44 and projects out through an opening in the side of the casing 120. Upon the under side of the dial there is a lug 121 which, as the dial is rotated backward toward normal position by the spring 47, engages the finger stop 49, and after it has forced the stop back against the upper edge of the notch in the casing brings the dial to rest, as shown in Fig. 3.

The only connection between the dial and the remainder of the mechanism of the calling device is that obtained through the medium of the gear wheels 46 and 18. It will thus be seen that by simply removing the screw 130 which holds the plate 45 in place, said plate and the dial may be entirely removed so as to render the remainder of the mechanism accessible for inspection and repair.

The general mode of operation of the calling device is as follows: Before making a call the subscriber first removes the receiver from the switch hook, whereupon the rod 29 is pulled down by the spring 50, depressing the spring 51 to unlock the sliding bar 37 and depressing the lever 28 to permit the end of the lever 30 to rise into the path of the locking member 31. The subscriber now inserts his finger into a finger hole of the dial corresponding to the first digit of the number to be called, and rotates the dial until the finger is brought to rest by the finger stop 49. During this rotation of the dial the spring 47 is wound up and the shaft 6 is rotated forward by reason of the engagement of the gear wheels 46 and 18. During this forward rotation of the shaft the pawl 19 slips over the top of the spur teeth of the wheel 18, thereby permitting the wheel 17 and governor to remain stationary. The normal relation of the impulse wheels 7 and 8 and the springs 9 and 10 is that shown in Figs. 7 and 8. The normal relation of the member 31 and the lever 30 after the switch hook is removed is as shown in Fig. 6. Upon the initial movement of the shaft 6 the pin 42 in the wheel 8 permits the bar 37 to slide forward sufficiently to permit the spring 39 to drop onto the post 11. The impulse teeth 14 and 52 then pass the projections 12 and 13 simultaneously, forcing the springs 9 and 10 outward and the bar 37 continues to move forward to its extreme position to separate the springs 40 and 10. As the shaft 6 continues its forward motion the locking member 31 slips past the lever 30, and the tooth 15 on the impulse wheel 7 momentarily forces the spring 9 into contact with the ground post 11. The teeth on the impulse wheel 8 next begin to pass the projection 13 on the spring 10, forcing it outward, and when the dial finally comes to rest, a number of the teeth corresponding to the finger hole in which the finger was inserted will be carried past the projection. Figs. 9, 10 and 11 represent the positions of the apparatus after the dial has been rotated forward for the digit 1. The finger is now removed from the dial and it, together with the shaft 6, begins to be returned back toward normal position by the spring 47. During this backward rotation the pawl 19 engages the spur teeth of the wheel 18, so as to bring the governor into play to control the speed. During the return movement of the shaft 6 the impulse teeth pass the impulse springs in the reverse order to that described above. Each tooth of the wheel 8, as it passes the projection 13, forces the spring 10 into momentary contact with the post 11. After the tooth 76 on the wheel 8 passes the projection 10, the tooth 15 again passes the projection 12 and momentarily forces the spring 9 onto the ground post. The shaft 6 and impulse wheels do not return entirely to their normal positions, but are brought to rest by the engagement of the member 31 and the lever 30 before the teeth 14 and 52 engage the projections 12 and 13. This position of the apparatus is represented in Figs. 12, 13 and 14. In this position of the apparatus the pin 42 forces the bar 37 back far enough to permit the springs 40 and 10 to come into engagement, but this does not occur until after the impulse tooth 15 has permitted the spring 9 to break contact with the post 11, nor is the bar forced back far enough to separate the springs 39 and 11.

From the foregoing it will be seen that the complete operation of the dial for the digit first causes the contact 39—11 to be closed, then the spring 9 is momentarily forced into contact with the ground post 11, after which the spring 10 is forced into contact with the ground post a number of times corresponding to the digit called, and then the spring 9 is forced into contact with the post 11, the springs 40 and 10 being separated during the entire time the impulse springs are being operated. The operations

of the calling device for each of the digits after the first one is the same as has just been described, with the exception, of course, that the springs 39 and 11 are already in contact upon the beginning of the operation for each digit.

As has been explained, the impulse wheels 7 and 8 do not return entirely to normal position after each operation of the dial, but come to rest in the position shown in Figs. 13 and 14. When the receiver is restored to the switch hook, the lever 28 is permitted to rise and tip the forward end of the lever 30 down to release the member 31, thereby unlocking the impulse wheels and allowing them to make the short step from the position shown in Figs. 13 and 14 to normal, during which movement the teeth 14 and 52 simultaneously force the springs 9 and 10 into contact with the ground post 11. This final movement of the impulse wheels forces the bar 37 back to normal position to cause the springs 39 and 11 to be separated. Figs. 15, 16 and 17 show the relative positions of various parts of the apparatus just after it has started toward normal from the position represented in Figs. 12, 13 and 14.

In order to aid in the understanding of the operation of the device, I have shown diagrammatically in Fig. 18 the essential features of the calling device. In this figure the impulse wheels 7 and 8 are shown developed into the form of horizontal bars which may be moved longitudinally through the medium of gear teeth on the periphery of the dial when said dial is rotated.

As has been explained, when the calling device is operated, the bar 37 cannot move forward to permit the spring 39 to come into engagement with the ground post 11 unless the receiver has first been removed from the switch hook, and it will thus be seen that it will be impossible to send in a call without first removing the receiver. In large exchanges in which the numbers of the subscribers' lines comprise several digits, it is sometimes desirable to substitute a letter for the first digit of each of the numbers, so that they may be more easily remembered. Since the letters are to be used for only the first digit, it is not necessary that they be secured to the dials of the calling devices, but they may be placed on a stationary plate 115 beneath the dial in such a position that they will be beneath the proper finger holes when the dial is in its normal position. Of course, since the dial is not returned to normal position after being once operated, these letters will appear to be shifted, as shown in Fig. 4, after the first operation of the dial, but this will produce no confusion, because the letters are not used after the first digit is called.

The advantage of the movable form of finger stop, as disclosed herein. over the usual stationary finger stop is that it permits the dial to be rotated through more than a complete revolution, and therefore allows the dial to be made smaller, since the space between the first and last finger holes in the dial may be made smaller than would otherwise be the case. As shown herein, the space between the No. 1 and the No. 0 finger holes is equal to the space occupied by two holes. It has been found desirable in telephone systems that the rotary impulses be longer than the vertical impulses. The rotary impulse tooth 15 is long enough to produce an impulse approximately twice as long as the vertical impulses. This requires that the distance between the teeth 52 and 76 on the vertical impulse wheel 8 be three times the pitch of the vertical impulse teeth, whence, in order to rotate the first vertical impulse tooth 76 past its spring 9, the impulse wheels must be rotated through a distance equal to four times the angular pitch of the impulse teeth. Since a movement of the dial through a distance equal to the pitch of the finger holes therein must rotate the impulse wheels through a distance equal to the pitch of the vertical impulse teeth, it will be seen that the finger stop must be so arranged as to bring the finger to rest after it has rotated past the normal position of the No. 1 finger hole, a distance equal to four times the pitch of the finger holes, or, in other words, with the dial shown herein, the hole in which the finger is inserted must be brought to rest in what is the normal position of the No. 9 hole. This means that if the finger stop were stationary it would have to be in front of the No. 9 hole and would thus prevent the use of the last two holes in the dial. In order that the stationary stop would not interfere with the use of the last finger holes, the dial would have to be enlarged, so that the space between the first and last holes could be made four times the pitch of the holes, so that the finger stop could be placed behind the last hole. With the stop movable, as shown herein, it always remains behind the last hole, yet allows the finger to move past the normal position of the last hole before being brought to rest by it. Although, as shown, the space between the No. 1 and the No. 0 finger holes is equal to the space occupied by two holes, this space has been chosen arbitrarily, as it may be decreased indefinitely, as long as the proper movement of the finger stop is chosen, and the ratio between the gears 46 and 18 is maintained such that a rotation of the dial equal to the pitch of the finger holes moves the impulse wheels through a distance equal to the pitch of the vertical impulse teeth.

In Fig. 19 there are shown the circuit connections of a local battery telephone equipped with the calling device disclosed

herein. The line conductors 60 and 61 are directly connected to the impulse springs 9 and 10. The spring 39 is connected to ground, so that when the contact between said spring and the rear portion of the spring 11 is closed the latter spring is grounded. Thus each time the springs 9 and 10 are forced into contact with the spring 11 during the operation of the calling device, the respective line conductors 60 and 61 are grounded. The separation of the spring 40 from the rear portion of the spring 10 while the calling device is operating serves to open the talking bridge across the line conductors 60 and 61 while the impulses are being transmitted. This is to prevent the impulses transmitted to one line conductor from passing to the other. The usual hook switch comprising the springs 57, 56, 55 and 51 and the contact point 62 is controlled by the switch hook through the medium of the rod 29. At 64 there is shown the usual ringing push button through the medium of which the called subscriber is signaled after the connection is completed. By the depression of this button its spring is disengaged from the contact point 65 and engaged with the contact point 66, whereby the bridge across the line is opened and the line conductor 61 is grounded.

While I have illustrated one particular form of my invention, it is to be understood that I do not wish to limit myself to the exact construction shown and described, as many changes and modifications will readily suggest themselves to those skilled in the art.

What I claim as my invention is:—

1. In a calling device, an impulse transmitter, a rotary dial controlling said transmitter, means whereby said transmitting device transmits a single impulse during the forward rotation of the dial and a series of impulses during the backward rotation of the dial, and a stop movable each time the dial approaches the end of its stroke for limiting the movement of said dial.

2. In a calling device, an impulse transmitter, a dial for controlling said transmitter, two conductors, means operating on the forward rotation of said dial to cause said transmitter to transmit one or more impulses over one of said conductors, means operated upon the return of said dial to transmit a series of impulses over the other of said conductors, and a stop movable each time the dial approaches the end of its stroke for limiting the forward movement of said dial.

3. In a telephone, an impulse transmitter, a dial for controlling said transmitter, means for moving said dial forward to cause said transmitter to transmit a single impulse, means for returning said dial to a sub-normal position in advance of its normal position to cause said transmitter to transmit a series of impulses, a switch hook associated with said transmitter, and means controlled by said switch hook for returning said dial to its normal position.

4. In a telephone, an impulse transmitter, a dial for controlling said transmitter, means for moving said dial forward to cause said transmitter to transmit a single impulse, means for returning said dial to a sub-normal position in advance of its normal position to cause said transmitter to transmit a series of impulses, a switch hook associated with said transmitter, means controlled by said switch hook for returning said dial to its normal position, and means for transmitting one or more impulses when said transmitter passes from sub-normal to normal stopping point.

5. In a calling device, an impulse transmitter, a dial for controlling the operation of said transmitter in accordance with a series of characters, stationary characters representing the first character of said series, and movable characters representing successively the remaining characters of said series.

6. In a calling device, an impulse transmitter, a rotary dial having a series of finger holes, said dial adapted to be operated a plurality of times in order to transmit a plurality of series of impulses, a stationary series of characters representing the first series of impulses transmitted, and a movable series of characters for representing the remaining series of impulses.

7. In a calling device, an impulse transmitter, a rotary dial having a series of finger holes for controlling said device, said dial adapted to be operated a plurality of times in order to transmit a plurality of series of impulses, a stationary series of characters arranged below said dial representing the first of said series of impulses, and a second series of characters located on said dial and movable therewith for representing the remaining series of impulses.

8. In a calling device, an impulse transmitter, a dial for controlling said transmitter, and a movable stop for the dial, said dial being adapted to revolve through an angle of more than three hundred and sixty degrees.

9. In a calling device, an impulse transmitter, a dial for controlling said transmitter, a shaft on which said dial is mounted, and a movable stop for the dial pivoted on said shaft, said dial being adapted to revolve through an angle of more than three hundred and sixty degrees.

10. In a calling device, an impulse transmitter, a movable dial having a series of finger holes for controlling said transmitter, and a movable stop for the dial, said dial being adapted to revolve through an angle of over three hundred and sixty degrees, the

said stop operable in the same direction with the dial by the finger of the operator and by the dial.

11. In a calling device, an impulse transmitter, a dial having a series of finger holes for controlling said transmitter, and a movable stop for the dial, said dial being adapted to revolve through an angle of over three hundred and sixty degrees, the said dial having a reciprocating motion, the said stop operable in one direction by the finger of the operator and in the other direction by the dial, but in the same direction with the dial in each case.

12. In a calling device, a reciprocating impulse transmitter having a normal and a sub-normal stopping point, and having a series of circuit closers, two conductors associated therewith, the circuit closers being so arranged that when the transmitter is moved forward from the normal stopping point an impulse is sent over one of the conductors, and when the transmitter is moved back a series of impulses is sent over the other conductor and a single impulse over the first conductor, a latch for preventing the transmitter from returning to normal starting point, said transmitter having the impulse closers so arranged with respect to the said conductors that after being latched the circuit closers can engage the conductors to send one or more impulses on the second conductor and only one impulse over the first conductor in each cycle of operation, being operable when the receiver is placed upon the switch hook to release the latch and restore the transmitter to normal, some of the circuit closers operable upon such return to engage both the first and second conductors.

13. In a subscriber's automatic telephone, a base, a dial mounted on the base, and impulse-sending mechanism mounted in the base separable from the dial and the base.

14. In a calling device, a rotary dial, a shaft upon which said dial is mounted, and impulse-transmitting mechanism controlled by said dial, said mechanism being separate and distinct from said dial and shaft, whereby it can be readily detached therefrom.

15. In an automatic telephone, a base, an impulse transmitter in said base, a dial for controlling said transmitter mounted on said base, a movable stop for the dial for limiting the stroke of the latter, said stop movable in the same direction with the dial, and means for removing the impulse transmitter from the base and disconnecting it from the dial.

Signed by me at Chicago, Cook county, Illinois, this 29th day of January, 1912.

JOHN G. BLESSING.

Witnesses:
ARTHUR J. RAY,
ALBERT ANDERSEN.