This invention relates to signal-transmitting methods and devices for use in connection with automatic telephone systems, and particularly to methods of transmitting signals, and transmitters, of the character used in automatic telephone systems wherein the selective switches for establishing connections are operated in response to current impulses induced by such transmitters. This invention has for its object improvements upon the automatic telephone signal-transmitting method and device set forth in U. S. Patent No. 1,671,633, issued to me on December 20, 1932. A particular object of this invention is to provide a positive or direct current make-and-break device in conjunction with the general method and apparatus disclosed in said patent, in order to overcome the disadvantages inherent in the sliding or commutator type of circuit breaking device shown in said patent, wherein a contact pin traverses a series of plates having grooves therein, making and breaking the circuit each time the pin strikes a ridge and passes over a groove.

With this principal object in view, and such other objects as will appear from the specification, my invention consists in the method, construction, combination and arrangement of parts herein described and claimed in the accompanying drawings. In these drawings the same reference characters have been used to designate the various parts as in the drawings of the said patent, in so far as the same parts are utilized in carrying out the present invention, and in this specification only so much of the apparatus is described as is necessary for an understanding of this invention, it being understood that reference may be made to the said patent for more detailed description if desired. The general external appearance of the device is the same as shown in Figs. 1 and 2 of my said Patent No. 1,671,633. Furthermore, the operation of the device by the person using the telephone is exactly the same as set forth in said patent. Referring to the accompanying drawings.

Figure 1 is a sectional view taken approximately on the line 1—1 of Fig. 5, looking in the direction of the arrows, showing the parts in normal position, and corresponding in general with Fig. 9 of said patent;

Fig. 2 is a corresponding sectional view showing the operating parts in position to commence the automatic transmission of a signal, this figure corresponding in general with Fig. 10 of said patent;

Fig. 3 is a transverse vertical section taken approximately on the line 3—3 of Fig. 1, looking in the direction of the arrows, and corresponds with Fig. 4 of said patent;

Fig. 4 is a view looking from beneath upward at the cam plates shown in Fig. 3, and corresponds with Fig. 5 of said patent;

Fig. 5 is a longitudinal vertical section taken approximately on the longitudinal centre line of the device, and corresponds in general with Fig. 6 of said patent;

Fig. 6 is a detail of the make-and-break impulse producing mechanism; and

Fig. 7 is a diagrammatic view showing the electrical connections, which differ somewhat from those shown in Fig. 13 of said patent.

As a matter of convenience, the reference characters applied to the parts in the said Patent No. 1,671,633 are applied to the same parts in the drawings accompanying this specification, as mentioned above, and numbers commencing with 200 are applied to the new parts herein.

The type of signal transmitting device to which this invention particularly refers as shown in the drawings heretofore, and as more fully described in my said patent, is one in which the person desiring to make a telephone call first sets a series of plates 31–37 each in position corresponding to the elements of the signal to be transmitted, and then turns the knob 25 to the left as far as it will go, about half a turn, thus swinging a forked arm 60 to the left, and causing a pin 50 actuated by the fork to travel to the left to the initial position for the transmission of the signal, whereupon the fork is released from the knob and the transmission of the signal is effected automatically. The automatic transmission of the signal is accomplished by the sending out of signal impulses upon the line as the pin 50 traverses the plates 31–37, the number of impulses sent out as the pin passes over each plate, being determined by the positions in which the plates were set. The pin 50 is caused to traverse the plates by the spring 66 acting on the fork 60, and the speed of travel is controlled by a governor 108 driven from the shaft 82 upon which the forked arm 60 is mounted through a gear train including the gear wheel 105, to which further reference will be made.

As shown in the drawings there is provided a casing 20 mounted upon a suitable base plate 21 which casing and base plate together enclose all of the operative parts of the mechanism except those to which access is necessary for the selecting or setting up of the signal to be transmitted, 55.
and for the setting of the apparatus to effect the automatic transmission of the signal. The base plate 21 is capable of being connected with a telephone instrument in substantially the same manner as the dial transmitters now in use. Immediately under the top face of the casing 20 are located a plurality of cam plates 31, 32, 33, 34, 35, 36, 37, one for each element of the signal to be transmitted, as shown in Figs. 3 and 4. These cam plates are slidably mounted upon a plate 40, in the same manner as the corresponding contacts plates of said patent, and are operated in the same manner. However, these cam plates do not themselves have anything to do with the production or electrical transmission of the signal impulse as did the contact plates of said patent, but they serve the purpose of determining the number of impulses to be sent out on the line corresponding with each element of the signal to be transmitted, as will hereinafter be set forth more fully.

The production of the signaling impulses is effected by the make-and-break device 201, 202 shown particularly in Figs. 1 and 2, in which the 25 is a stationary contact member 201 and a movable contact member 202 suitably carried by an insulated mounting 203 attached to the casing base plate 21. The normal position of the member 202 is against the stop 204, in which position the circuit is open. The contact member 202 is provided with a stud 206, and the circuit is closed by means of the toothed or notched wheel 205 acting upon the stud 206 to force the member 202 against the member 201, each time a tooth of the wheel 205 passes under the stud 205.

The wheel 205 is preferably driven by the gear wheel 105 through the mechanism shown more clearly in the detail view Fig. 6. The wheel 205 is keyed at 210 to a sleeve 211 having as an integral part thereof a ratchet wheel 212, said sleeve being mounted upon a pin 213 fixed to the casing base plate 21. Rotatably mounted upon the sleeve 211 is a gear wheel 215 which meshes with the gear wheel 105. The gear wheel 215 carries a pawl 216 which engages the ratchet wheel 212, so that when the wheel 105 during the transmission of a single revolution of the rotating the gear 215, the ratchet wheel 212 and sleeve 211 are rotated through the pawl 216, and thus the wheel 205 is driven to operate the make-and-break device 201, 202, but when the gear wheel 165 turns in the opposite direction, during the setting of the device preliminary to the automatic transmission of a signal, the pawl 216 rides over the teeth of the ratchet wheel 212, so that the sleeve 211 and the wheel 205 remain motionless.

The gear wheel 105 is part of the train which drives the governor 100, and it makes a definite number of revolutions from the beginning to the end of the transmission of a complete telephone signal or number. Thus the gears 216 and 105, and the number of teeth on the wheel 205, may be so related that the circuit will be made and broken a definite number of times by the circuit breaker 201, 202 during the transmission of each complete telephone signal. Inasmuch as the complete telephone signal consists usually of seven elements having a maximum of ten impulses each, the gear ratios may be set so that the circuit breaker 201, 202 will make and break the circuit 70 times during the transmission of a complete telephone signal.

This device operates in exactly the same manner and produces the full seventy impulses, each time a signal is transmitted, irrespective of the elements comprising the telephone signal being transmitted; and the control device including the cam plates 31 to 37 then determines the number of those impulses to be sent out on the line, and also the grouping of them with respect to the telephone plates 31 to 37.

As in the case of my said Patent No. 1,891,633, the transmission of the signal is controlled by the pin 50 traversing the plates 31 to 37; but instead of the pin 50 and the plates forming part of the electrical circuit, as in said patent, the plates 31 to 37 are now merely cam plates having raised portions 200 which depress the pin 50 as it passes over them, thus closing at such time a switch 221, 222 carried by the roller 51 in which the pin 50 is mounted, causing the movable contact member 222 to make contact with the other member 221 closing a circuit.

The cam plates 31 to 37 correspond with the contact plates of my said patent save that the grooves of each plate are replaced by a raised cam surface 208 extending over the same stepped arrangement shaped as the grooves. The pin 50 passes across the raised cam portions 200, and is held depressed a period of time dependent upon the particular step set in line of travel, which thus determines how long the switch 221, 222 remains closed, and how many impulses are produced by the circuit breaker 201, 202 are sent out on the line.

As will be seen from the wiring diagram Fig. 7, when the circuit is closed by the depression of the pin 50, the signal impulses produced by the make-and-break device 201, 202 are permitted to go out over the line, but when the pin 50 is traveling over a portion of the plates 31 to 37 where it is not depressed by the cam portion 200 thereof, the switch 221, 222 being open, the signal impulses being continuously produced by the make-and-break device 201, 202, do not get to the line and are not transmitted as a part of the telephone signal.

For example, during the time that the pin 50 passes over each of the plates 31 to 37, ten impulses are produced by the circuit breaker 201, 202; but if the signal being transmitted is, for instance, M13—3541, the letter M comprising the first element of the signal being in the sixth row, at this point the stepped cam 200 is of a width sufficient to hold the pin 50 depressed only during the period that six of the ten impulses are produced; thus but six impulses will be transmitted as a signal upon the line. The letter L being in the fourth row, the stepped cam is set in a position such that but four of the ten impulses being transmitted while the pin 50 passes across the second plate 32 will be transmitted on the line; and so on.

Apart from these variations, the electrical wiring and the construction and operation of the device is the same as described in my Patent No. 1,891,633 aforesaid.

Having described my invention, I claim:

1. In an automatic telephone signaling apparatus for transmitting electric impulses produced by a single contacting member to form the predetermined signal characters desired, the combination comprising an electric telephone circuit, means for repeatedly opening and closing said circuit by positive contact at uniform time intervals and in a predetermined exact time to produce an invariable number of signal impulses, and a switch carried by said single contacting member for selecting the number and grouping
of such impulses to be transmitted to form the signal characters predetermined.

2. In an automatic telephone signalling device, the combination comprising an electric telephone circuit, a time governed circuit breaker for producing signal impulses at uniform time intervals, direct contact means for closing and opening the circuit to permit only certain of such impulses to be transmitted over said circuit, a movable arm carrying the circuit closing means and a series of adjustable cams arranged to actuate said circuit closing means at predetermined intervals to effect the transmission of the predetermined characters of the signal required.

3. In a telephone signal transmitting apparatus the combination with the telephone circuit of means for producing a number of signal impulses corresponding with the maximum number required for the transmission of a complete signal, a series of flat selective cams, one for each signal element to be transmitted, means for sliding the cams into position for the transmission of a predetermined signal, a direct contact switch for closing the circuit to permit the transmission of signal impulses, and a cam traversing member actuated in accurately timed relation to the speed of production of said signal impulses and arranged to open and close said switch as determined by the setting of said cams, the said switch being carried by the traversing member and being caused to traverse all said cams successively.

4. The method of transmitting telephone signals which consists in producing at uniform intervals a fixed number of signal impulses corresponding to the maximum number required for the transmission of a complete signal, traversing a control switch successively over a plurality of variable signal elements and thereby selecting groups of such signal impulses according to the elements of a signal to be transmitted and transmitting only the impulses so selected.

5. The method of transmitting signals over a telephone circuit which consists in producing an invariable number of signal impulses at uniform intervals throughout and corresponding in number to the maximum number required for any complete signal, and traversing a control switch successively over a plurality of variable signal elements and thereby selectively opening and closing the circuit to permit of the transmission of only those signal impulses selected.

6. A method of transmitting telephone signals which comprises producing an invariable number of signal impulses at uniform time intervals and corresponding to the maximum number required for the transmission of a signal, separating the impulses into groups, and traversing a control switch over variable signal elements and thus selecting and transmitting to the line only the impulses so selected for each group.

7. A method of transmitting telephone signals which comprises producing an invariable number of signal impulses at uniform time intervals and corresponding to the maximum number required for any complete signal, separating the impulses into groups and selectively opening and closing a switch in the line by traversing said switch over independently variable control elements to permit the transmission of only those signal impulses selected to give the desired signal.

8. In a telephone signal transmitting apparatus the combination comprising, relatively movable selective members for setting the apparatus to transmit a predetermined signal, an invariable circuit make-and-break device, means for actuating said device uniformly for the transmission of all signals, a traversing member, a contact switch carried by said member and actuated by said selective members, and means for causing the said switch to traverse all said selective members for a predetermined signal corresponding to the elements of the make-and-break device to transmit the signal by selecting and controlling the transmission of impulses by the said make-and-break device.

9. In a telephone signal transmitting apparatus a group of smooth selective members each of varying width for setting the apparatus to transmit a predetermined signal, a uniformly actuated make-and-break device, a traversing member, a direct contact switch carried thereby, and means for causing the traversing member to traverse the width of all said selective members successively to actuate the said switch and so control the transmission of grouped and selected impulses by said make-and-break device.

10. In a telephone signal transmitting apparatus, the combination comprising means for producing an invariable number of signal impulses at uniform time intervals and corresponding with the maximum number required for the transmission of a complete signal, a series of relatively movable selective elements, one for each signal element to be transmitted, means for setting the said selective elements individually in position for the transmission of a predetermined signal, a direct contact switch between the signal producing means and the line, and a traversing member carrying said switch and adapted to traverse all said selective elements successively and to close said switch as determined by said selective elements and thus separate said impulses into groups corresponding to the elements of the signal to be transmitted.

CHARLES S. BATDORF.