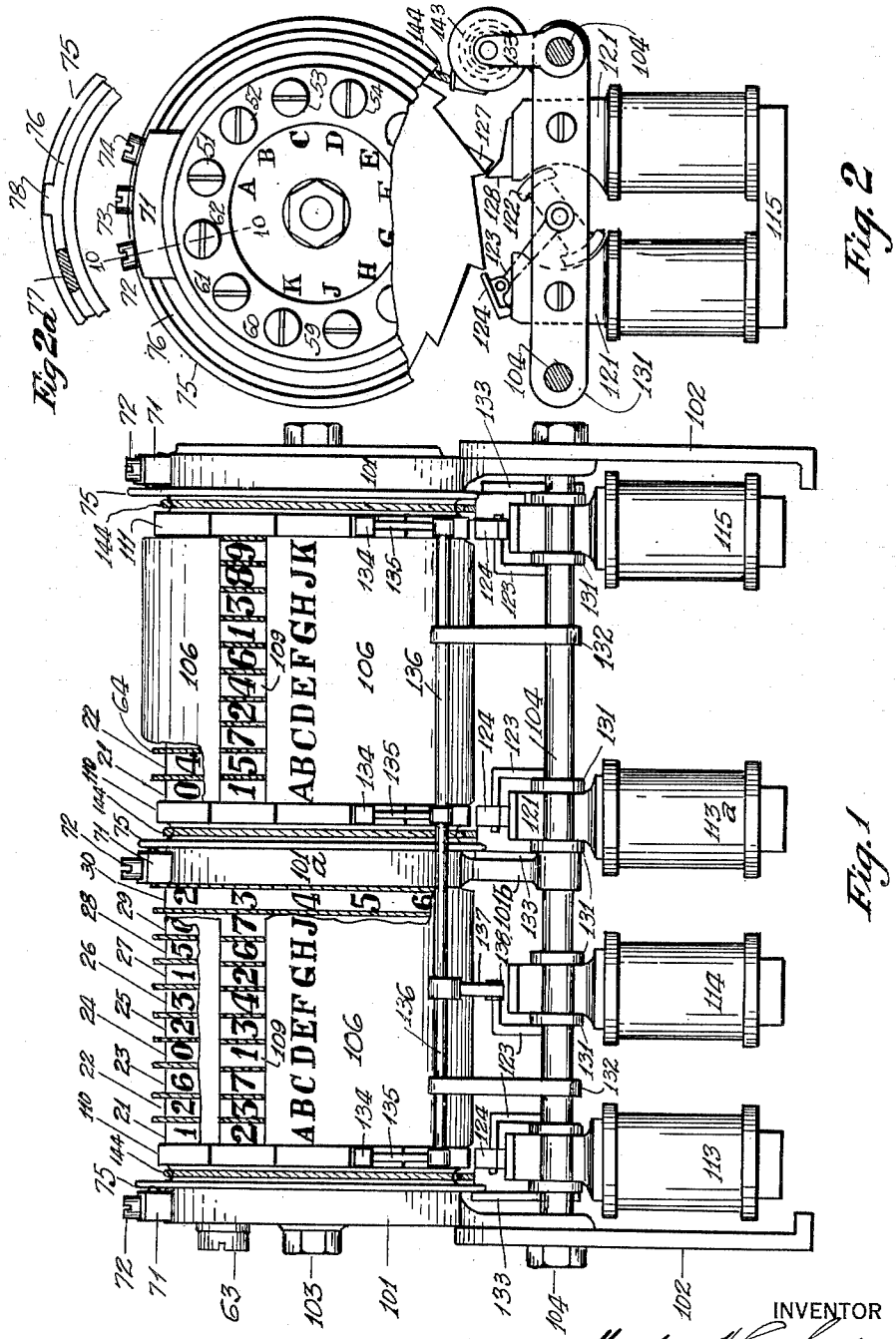
Aug. 13, 1929. M. H. LOUGHRIDGE 1,724,210

SELECTIVE APPARATUS

Filed June 16, 1921 3 Sheets-Sheet 1



INVENTOR

Matthew H. Loughridge

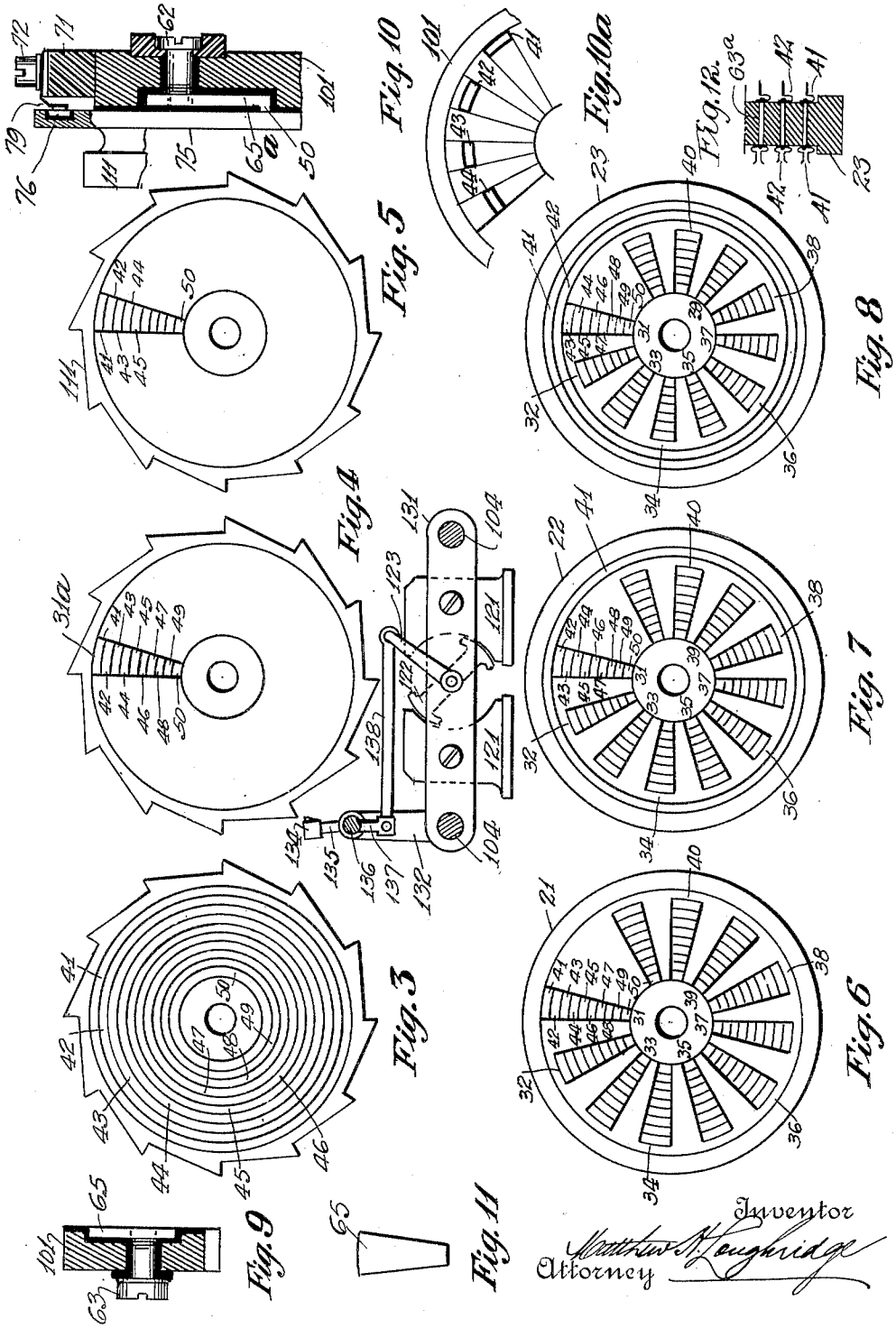
BY

ATTORNEY

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SELECTIVE APPARATUS

Filed June 16, 1921 3 Sheets-Sheet 2



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SELECTIVE APPARATUS

Filed June 16, 1921 3 Sheets-Sheet 3

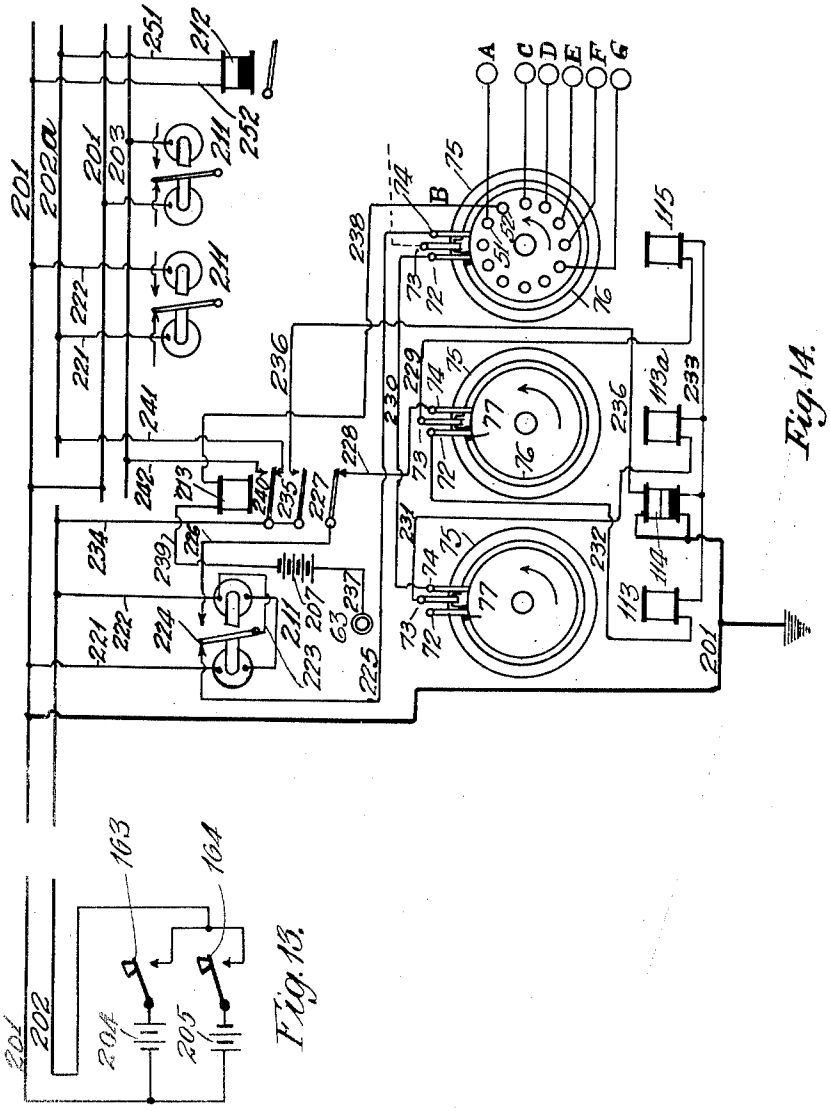


Fig. 14.

Fig. 13.

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UNITED STATES PATENT OFFICE.

MATTHEW H. LOUGHRIDGE, OF BOGOTA, NEW JERSEY.

SELECTIVE APPARATUS.

Application filed June 16, 1921. Serial No. 477,879.

This invention relates to selectors of the electro-mechanical type which may be operated by remotely located apparatus and responds, selectively, to certain predetermined signals or impulses for the purposes desired. Selectors of this type usually respond to prearranged combinations of impulses to control a circuit or otherwise perform their function and as each selector may be adjusted to respond to a combination different from other selectors operated by the same apparatus only one selector of a number will function for any predetermined combination of impulses.

One of the objects of the present invention is to provide a selector having a plurality of prearranged combinations, each of which may be independently established. Another object is to provide a selector in which any or all of the combinations can be conveniently adjusted or changed as desired and a further object of the invention is the construction of a selector in multiple units which is capable of being enlarged or reduced in capacity as desired. Other objects of the invention residing in the details of construction and operation of the selector will be more particularly understood from the following specification and the appended claims. The invention is described in connection with the accompanying drawings, in which the mechanical construction of the selector is shown in Figs. 1 to 12 inclusive; Fig. 1 being a side elevation of one form of a selector embodying my invention with the cover partially removed, Fig. 2 is an end elevation corresponding to Fig. 1 with part of the outer frame removed to show the mechanism, Fig. 2^a is a detail associated with Fig. 2, Figs. 3, 4 and 5 show the details of the stepping discs, Figs. 6, 7 and 8 show the details of the adjusting discs, Figs. 9 and 10 show in section the details of the end frames, Fig. 10^a is a fragmentary view showing the arrangement of contacts in the right end frame, Fig. 11 is a front view of a part used in Fig. 9 and Fig. 12 is a sectional drawing showing the construction of the combination discs in Figs. 6, 7, and 8. The operating circuits for the selector are shown in Fig. 14 and one form of transmitting apparatus is shown in Fig. 13.

The operation of a system using this selector is based upon electrical impulses transmitted over a wire according to prearranged combinations; these signals being used to operate certain moving elements of the selector which, under certain conditions, establish a circuit for any useful purpose. This selector is also operated on the group-combination principle. That is to say, the signals are transmitted in groups of a definite number of steps and each group is characterized from the preceding group of signals. The selector has an independent moving member responsive progressively to the steps of each group of signals. In this arrangement it is possible to obtain a large variety of combinations from comparatively few impulses. This arrangement in selectors is well known in the art.

In the form of the present invention shown, the selector comprises a cylindrical shaped body made up of a plurality of discs rotatably mounted on a common shaft. Each disc has a plurality of transverse conductors parallel with its axis and arranged to align with corresponding conductors in the adjacent discs so that when assembled, the cylinder of the selector has a plurality of conductors parallel with its longitudinal centre, these conductors being controlled by the discs making up the cylinder. The conductors in the discs are arranged radially in segments and the arrangement is such that a specific conductor is controlled by each disc so that as these discs are positioned by hand the combination to which the selector will respond is correspondingly adjusted. At the end of the cylinder a stepping wheel is provided which selectively determines the longitudinal conductor and thus the particular discs to which the selector will respond. Thus the combination to which the selector will respond can be quickly set up or changed and the code for calling any station can easily be kept secret by frequent changes.

The selector is preferably made with a plurality of cylinders, each containing the same number of adjusting discs all of which may be mounted on the same shaft. A stepping wheel is provided for each cylinder or bank of discs which responds to a particular group of signals and a selective stepping wheel is provided to select the particular circuit desired through the selector.

The general arrangement of the selector will be understood from Figs. 1 and 2, in which 101—101 are the end frames of the

mechanism and 101[a] is an intermediate frame in the centre; 102—102 are the legs supporting the mechanism and 103 is a shaft through the axis of the cylinder forming a bearing for the discs. The pair of bolts 104—104 support the stepping magnets and the under part of the frame and also the intermediate or centre frame 101[a] by arms 101[b]. The stepping magnets 113, 113[a] and 115 operate the stepping discs 110—110 and 111 respectively, and magnet 114 operates a holding mechanism for holding the stepping discs in the position to which they have been stepped or moved during the operation of the selector. These magnets are provided with pole pieces 121—121 and are supported by non-metallic cleats 131—131 on the bolts 104—104 as shown. The magnets are provided with a shuttle type armature 122 to the pivot of which an arm 123 is connected. This arm, in the case of the stepping magnets, operates the stepping pawl 124 which engages the teeth of the stepping wheel as indicated in Fig. 2 moving the wheel around one tooth for each impulse the magnet receives. The shuttle armature 122 may be restored to the starting position by the gravity of the moving parts or by a coil spring, (not shown). The stepping wheels have a starting position determined by the stop 128 secured to the magnet pole piece and engaging the stop member 127, and from this as a starting point the wheels are stepped around progressively for each impulse sent out by the transmitter. The stepping wheels are biased towards the starting position by a coil spring shown in dotted outline in drum 143 which is supported by arm 133 from the bolt 104. This spring winds up a flexible cable 144 passing around a groove in each stepping disc as shown so that when the holding mechanism releases the stepping wheels they are restored to the starting position.

The stepping wheels are retained in the position to which they have been moved by the holding magnet 114 operating a mechanism as shown in Fig. 4. The arm 123 on the shaft of armature 122, by connection 138 and arm 137 rotates shaft 136 which is supported from bolt 104 by arms 132—132. This moves the arm 135 towards the teeth of the stepping wheel thereby bringing the pawl 134 under a wheel tooth and holding it in position during the time magnet 114 is energized. Pawl 134 has a ratchet motion so that the stepping wheel may be moved while the pawl is in the engaging position without moving shaft 136. Shaft 136, as will be noted from Fig. 1 extends throughout the length of the selector and is provided with a pawl 134 to engage each of the stepping wheels 110—110 and 111.

The selector functions by establishing a circuit between terminal 63 and any one of the terminals 51 to 60 inclusive on the opposite end of the selector which terminals are also indicated by the letters A, B, C, D, E, F, G, H, J and K. Each circuit so established may be arranged to perform any desired function. The cylindrical body of the selector between these terminals comprises a number of discs with conductors arranged in circular layers and divided into segments within the cylinder, each of said discs having means for interrupting or controlling at least one of these longitudinal conductors as it is rotated on shaft 63.

Fig. 3 shows the side of stepping disc 110 which is placed adjacent the end frame 101 and Fig. 4 shows the opposite side of this disc against which the adjusting discs are placed as indicated in Fig. 1. The transverse conductors of the stepping disc are numbered 41 to 50 inclusive and are insulated from each other. The side shown in Fig. 3 engages the insulated segmental contact plate 65, Figs. 9 and 11 to which the binding post or terminal 63 connects. As the conductors 41 to 50 inclusive are continuous rings on this side, this plate makes connection with all of these conductors in any position. The transverse conductors in the adjusting discs, Figs. 6, 7 and 8 are indicated by the numerals 41 to 50 inclusive, and are divided into segments 31 to 40 inclusive, the space between the segments being about equal to the segments themselves. When these discs are assembled in the cylinder of the selector the transverse conductors correspondingly numbered engage with each other thereby forming longitudinal conductors through the cylinder of the selector. Both sides of each of the combination or adjusting discs, Figs. 6, 7 and 8 are alike. The circuit of each conductor is carried through the insulation of the disc as indicated at 63[a], Fig. 12. This sectional drawing indicates that the contacting members are constructed in the form of knife switches. It should be noted from Fig. 4 that the side of the stepping wheel adjacent the combination discs is provided with the single segment 31[a] having the insulated conductors 41 to 50 therein connected with the corresponding ring conductors on the opposite side. The conductors in segment 31[a] match with the corresponding conductors in the segments of the combination discs.

By referring to Fig. 6 showing disc 21, it will be noted that conductor 41 appears in segment 31 only; this disc, therefore, controls conductor 41. Also, in disc 22, Fig. 7 conductor 42 appears in segment 31 only; this conductor is thus controlled by the position of this disc. Again in disc 23, Fig. 8, conductor 43 appears in segment 31 only and consequently is controlled by the position of this disc. Corresponding conditions are maintained for the remaining discs up to 30,

each one in turn controlling a different conductor of the segment 31.

The continuity of all of the longitudinal conductors in the cylinder of the selector is preserved through the transverse conductors of the discs in any position to which they may be adjusted, except the particular conductor which each disc controls; for this reason all of the conductors appear in each segment of the discs except one. It is necessary to preserve the individuality of each step of the stepping wheel and apply it individually to each of the combination discs. This object is secured by dividing the transverse conductors of the discs into segments to match with the segment 31ª of the stepping wheel.

When segment 31ª Fig. 4 of disc 110 is placed against segment 31 of disc 21, it is apparent, since the conductors pass through the disc that the continuity of all the conductors is carried over to the adjacent disc 22, or is in fact, the equivalent of placing segment 31ª against disc 22; and if, on disc 22, it engages segment 31 again it will be the equivalent of placing disc 110 against disc 23, and so on with relation to the remaining discs which are assembled consecutively.

Now suppose that the combination discs are adjusted for a combination so that when the stepping disc is on zero or at the starting position, segment 31 does not align with segment 31ª. Suppose segment 31 on disc 21 is moved forward two steps or segments—the segments or steps corresponding to the teeth of the stepping disc—and, similarly, disc 22 is moved forward three steps and disc 23 is moved forward seven steps; then it is apparent since conductor 41 of disc 21 occurs in segment 31 only, that the main circuit through the selector from terminal 63 will be interrupted on conductor 41 except for the interval in which disc 110 rests on the second step. Similarly, the circuit will be interrupted on conductor 42 except when disc 110 rests on the third step; and it will be interrupted on disc 23 except when the stepping disc rests on the seventh step, and so on throughout the selector.

The segments, as stated, preserve the individuality of the steps of the stepping disc. It is not necessary, however, to maintain this individuality beyond the disc where a conductor is controlled. For instance, conductor 41 is controlled by disc 21; in the next disc 22, conductor 41 appears as a continuous ring; likewise in disc 23, conductors 41 and 42 are rings; these conductors being controlled in previous discs there is no further need to maintain their individuality.

The selector as shown in Fig. 1 comprises two banks of combination discs similarly numbered, the one being arranged to operate in series with the other. The frame 101ª is placed between the banks and is provided with ring conductors passing from one side to the other, similar to Fig. 3. These conductors carry the combination effects from one bank over to the next bank. The face, Fig. 3 of the middle stepping disc 110 takes up all of the circuits established in the first bank in all positions of the combination discs from terminal 63 to segment 31ª on the opposite side of this disc which is in position to co-operate with the combinations in the adjoining bank of discs in the manner already explained.

From this it will be apparent that discs 21 in both banks of the selector control conductor 41; discs 22 control conductor 42, discs 23 control conductor 43, and so on for the remaining discs. Thus it is possible to obtain combinations in both banks of the selector, each responding to a different group of impulses which co-operatively cause the selector to function in response to the predetermined groups of impulses. It will be noted that the circuit through the selector is established only when the stepping discs of both banks have completed the required number of steps to answer the combination set up, and it will not be established if a greater number of steps than is called for by the combination is made by either disc.

The combination discs can be adjusted by the knurled rings 64 secured to the discs, to the combination desired. This is conveniently shown by the series of numerals placed on the outside of each disc as indicated in Fig. 1. The particular combination set up may be read through an aperture 109 cut in the cover 106. The capital letters in each bank indicate the various combinations which will establish a circuit through the selector. Thus, over letter "A" in both banks appear the numerals 2—1 and over letter "B" appear the numerals 3—5 and so on. Hence, when the first stepping disc 110 makes two steps and the next stepping disc makes one step, a continuous conductor will be established through both banks of the selector on conductor 41 only. In the same way, conductor 42 will be continuous in both banks when the first wheel has made three steps and the second wheel has made five steps but no other conductor will be continuous through the selector under these conditions.

Ten or more segments are provided on each disc. This means ten active positions of the stepping wheel and hence, with two banks of combination discs it is possible to obtain ninety-nine different combinations which may be answered with comparatively few steps of the stepping discs.

Attention is here called to the fact that the selector is built on the multiple unit principle and is capable of being expanded indefinitely by the addition of similar parts. For instance, to add another bank of combi-

nation discs to the selector it is simply necessary to increase the length of the rods 103 and 104 and insert another stepping wheel 110 with the combination discs between the end plates, and extend shaft 136 with another holding pawl for the new stepping wheel. A three bank selector with ten active positions of the stepping wheel would have a total of nine hundred and ninety-nine possible combinations.

In the apparatus described ten longitudinal conductors extend through the selector each of which is controlled by a different combination disc and any of these conductors may establish a circuit through the selector. Usually only one of these conductors is required to be effective at a time so that the selector may respond to a definite combination and with this end in view an additional stepping wheel is provided adjacent the last bank of the selector which selectively determines the particular conductor that shall be effective.

Stepping wheel 111 for selecting the longitudinal conductors is placed at the end of the selector adjacent the end plate 101 and, as shown in Fig. 5, has one segment with all of the conductors from 41 to 50 inclusive passing through the disc which is the same on both faces. The right end plate, Fig. 2, is provided with a row of terminal screws 51 to 62 inclusive, also indicated by the capital letters A to K inclusive. These terminal screws connect with segmental contacts 65^a arranged as shown in Figs. 10 and 10^a. Each segmental contact is insulated and has a raised section corresponding in size and position to the transverse conductors in the discs, Figs. 6, 7 and 8 and also to the segment in Fig. 5. These raised or projecting portions make contact with the conductors of the segment of the stepping wheel 111 and thus continues the longitudinal conductors through to the end terminals as indicated; each raised section in Fig. 10^a being numbered to correspond with the longitudinal conductor of which it forms a part.

The raised conductor on each terminal plate 65^a is positioned to correspond with the termination of the different longitudinal conductors in the segment of the stepping wheel 111, appearing in the form of a spiral around the end plate. When the stepping wheel 111 is placed adjacent the end plate the circuit of only one conductor to the end terminals can be established at one time and the particular conductor is determined by the number of steps which wheel 111 makes from the starting position. For instance, if this wheel makes three steps so as to establish the circuit on conductor 43, then all the other longitudinal conductors in the selector are disconnected and the circuit on conductor 43 is the only circuit that can be established. This circuit will be established as the stepping wheels 110—110 have been moved around to synchronize with the combination called for to establish conductor 43 through both banks of the selector.

For convenience, in adjusting the selector and installing the same, the end terminals are designated by letters corresponding to the letters on the side of the selector for designating each group of adjustable discs. For instance, letter A in both banks of the selector controls conductor 41 and conductor 41 is established to terminal 51 when stepping wheel 111 has made one step. This terminal, therefore, is designated A and the circuit leading therefrom is called circuit A. In the same way, the adjusting discs on the side of the selector designated B control conductor 42 and this conductor, through stepping wheel 111, is established to terminal 52 designated by the letter B and known as circuit B. The same conditions prevail relating to the remaining designations of the selector as shown.

In practice, disc 111 is stepped around until the proper circuit is selected by the first group of signals sent out by the transmitter, then the characteristic of the signals is changed and the middle disc 110 is stepped around according to the next group of signals sent out by the transmitter. In order to establish a circuit, therefore, the particular circuit must first be selected, then the stepping wheel for one bank of the selector must be moved around to synchronize with the adjustable disc controlling the particular circuit selected, and then the next stepping wheel or disc controlling the other bank of the selector must also be stepped around to correspond with the adjustable disc in that bank controlling the same conductor. These conditions will establish a circuit through the selector for any purpose desired, but any other condition will not establish a circuit in that particular selector.

Each of the stepping wheels or discs 110—110 and 111 are provided with an insulated flange 75 having a ring conductor 76 embedded therein. This conductor has an insulated section at 77 and an extended section 78, Fig. 2^a. On each of the end plates 101—101, and 101^a an insulated block 71 is provided having terminal screws 72, 73 and 74 arranged as shown in Fig. 2. These terminal screws carry contact members 79, Fig. 14 engaging with the ring 76. The contact member, however, connected to 73, falls in the plane of the extension 78 so that when this extension is moved from under the contact member, it is thereby cut out of circuit. This arrangement is used to progressively operate the stepping wheels in connection with the operating circuits described hereafter.

This selector is operated by a transmitter of which there are a number of varieties ar-

ranged to send positive and negative impulses over the line usually by a mechanism which operates automatically. In Fig. 13 I have shown diagramatically a manually operated transmitter in connection with which the operating circuits of the selector are described. The line circuit of the selector includes the wires 201 and 202. By operating key 163 the circuit of battery 204 is completed which sends out positive impulses on wire 201, and by operating key 164 the circuit of battery 205 is completed, sending out negative impulses on wire 201. Thus, a group of signals of one characteristic is sent out by operating key 163 and another group with a different characteristic is sent out by operating key 164.

The operating circuits of the selector are shown in Fig. 14. A polarized relay is connected to the line circuit and responds to the characteristic of the current impulses from the transmitter. This relay, when in one position co-operates with one of the stepping discs of the selector to set up a circuit for one of the stepping magnets of another disc and interrupts the circuit of the stepping magnet of a third disc. Thus, when one stepping disc has made one step, the circuit of the previously operated disc is interrupted and the circuit of the next succeeding disc is established to be operated when the polarized relay changes its position by a change in the characteristic of the impulses. A slow acting magnet is included in the system for operating the holding mechanism of the selector, preventing it from releasing in the interval between each impulse sent out by the transmitter.

The line circuit is represented by wires 201 and 202 to which the polarized relay 211 is connected by wires 221 and 222. This relay has an armature 224 responding to the polarity of the signals in the line circuit and when moved to a position by a given polarity remains in this position until the polarity is changed. The armature of this relay connects to wire 222 by wire 223, and when the polarity in the line is such as to change the position of this armature, a circuit is established to wire 226, contact 227 of relay 213 deenergized, wire 228, finger 74 of the middle disc 75, finger 73, wire 229 to magnet 115; thereby operating the right hand stepping wheel 111 of the selector to the position desired. When the characteristic of the signals on the line is changed, moving armature 224 into contact with wire 225, a circuit is established from finger 74 to finger 72, through insulated ring 76 of the right hand disc and through wire 230, fingers 74 and 73 of the left hand disc and wire 231 to magnet 113a operating the middle stepping wheel 110. When the characteristic of the current in the line is again changed, armature 224 is moved into contact with wire 226, establishing a circuit through wire 228, fingers 74 and 72 of the middle disc and wire 232 to magnet 113 of the left hand disc, thereby stepping this disc around to the position desired.

In this way each of the three discs of the selector is progressively moved into position in response to the signals sent out progressively in each group. The circuit from magnets 113, 113a and 115 is connected by wire 233 to magnet 114 and to the common wire 201, so that when either of these magnets is energized, magnet 114 is energized and this magnet is slow acting so that it remains energized during the interval of the impulses on the line.

It will be observed that in the operation of the polarized relay, if the impulses first sent on the line move the armature 224 into contact with wire 225, no operating circuit would be established as this circuit ends on finger 74 of the right hand disc, and finger 72 on this disc is resting upon insulation. However, another set of selectors on the same line might be started from finger 73 on this polarity and thus operate quite independently of the selectors shown, each set being arranged to function according to the polarity of the first group of signals sent out while the other set of selectors would only be partially operated by the same set of signals. As soon as the right hand disc has made one step a circuit is established between the fingers 72 and 74 through ring 76, but this circuit cannot be established until the polarized armature 224 changes its position, which can only happen when a new group of signals is sent out. Also, it will be noted that when the middle disc makes one step the circuit between fingers 73 and 74 is interrupted. This disconnects magnet 115 which cannot again be operated until the mechanism is restored to the normal position and also establishes a circuit between fingers 72 and 74, placing magnet 113 in position to respond to the polarized armature when it changes its position for the next group of signals, and it will be noted that on the left hand disc when one step is made, the circuit between fingers 73 and 74 is interrupted, thereby interrupting the circuit of magnet 113a which cannot again be operated until the apparatus is restored to the normal position. This principle, it is apparent, can be applied to any succeeding number of discs and so arranged that the operation of one disc prevents further operation of the last succeeding disc and sets up conditions for the operation of the next disc ahead.

The right hand disc, Fig. 14, also indicates the end frame of the selector with the terminals 51, 52, etc., thereon and a wire leading from each terminal indicated by the letters A, B, C, etc. These may be used to

operate any circuits desired. Circuit B in this case is shown as operating relay 213 through wire 238 and wire 239 connecting to battery 207, the other side of which connects by wire 237 to terminal 63. When circuit B therefore is established, relay 213 is energized. This relay is arranged to establish a circuit on another line, indicated by wires 201 and 203, to which a new group of signals may be transmitted to operate selective devices as desired.

When the relay 213 is energized, the circuit from wires 202, 234, contact finger 240 of relay 213 deenergized and wire 241 to line wire 202^a is interrupted and a circuit from wire 202 to 203 is established through contact finger 240 with relay 213 energized and wire 242 to wire 203. This directly connects the line from the transmitting instrument on wire 202 to the line wire 203. Also, it will be noted that another circuit is established from wire 234 through contact finger 235 and wire 236 to a holding coil of magnet 114, thus holding this magnet energized in multiple circuit with the impulses that may be sent out on the line to operate instruments on line 203, and the circuit from the polarized relay through wire 226 and contact 227 to wire 228 is interrupted and, as the circuit from the opposite contact of the polarized relay 211 is also interrupted, further impulses sent out on the line 202 do not influence the selector, but merely hold it in the position to which it has been moved, while these impulses are transmitted into a new line and may operate another selector connected to this line as indicated at 211, to the right. Since line 202^a is disconnected from line 202 by relay 213, this line may be operated as an independent line having a selector as indicated at 211 and transmitting apparatus at some remote point. When the impulses cease on line 202, the holding magnet 114 is released and the selector is restored to the starting position by mechanical means provided for that purpose.

Where these selectors are used on a call system with one selector at a station controlling a number of lines as A, B, C, D, etc., Fig. 14, a separate combination is used for each individual line instead of a single combination for the station. The transmitting station thus calls each line by its own code and this code can be quickly changed from one line to another or a secret combination can be instantly established for calling any line without affecting the other lines.

The operation of the selector may be briefly described as follows: Suppose it is desired to call line C in station 77. The first three impulses sent on the line energizes magnet 115 to move disc 111 around three steps to position C. Next a group of seven signals is sent out differing in characteristic from the first signals which energize magnet 113^a to move disc 110 around seven steps and then another group of seven signals of the same characteristic as the first group is sent out to energize magnet 113 causing it to move disc 110 seven steps. Any selector having the discs 23 adjusted as shown in Fig. 1, to the position 7 over letter C in both banks of the selector will establish a circuit on conductor 43 and thus line C is selected for operation. A selector with any other combination in either bank will not establish circuit C. This circuit is maintained through the selector as long as current is maintained on the line.

When it is desired to select a line at a station and to impress upon that line a group of signals to operate other selectors; the first set of signals transmitted answer the combination which energizes relay 213, this relay is held energized by the selector and connects the second line to the first when a new set of signals are transmitted to operate the desired combination on the new line.

A selector constructed on the lines of the present invention and applied to the automatic operation of railway switches is shown and described in U. S. Patent 1,381,317, issued June 14, 1921.

Having thus described my invention, I claim:

1. A selector as described comprising a plurality of adjustably positioned discs forming the body of the selector, means associated with each disc controlling by its position one of a plurality of operating circuits which may be established by the separate adjustment of each disc according to a prearranged combination for each circuit and an electrically operated disc movable to correspond with the different positions of the first mentioned discs for controlling said circuits.

2. A selector as described comprising a plurality of adjustably positioned discs forming the body of the selector, means associated with each disc controlling by its position one of a plurality of operating circuits which may be established by the separate adjustment of each disc according to a prearranged combination for each circuit and a plurality of electrically operated discs movable to correspond with the different positions of the first mentioned discs for controlling said circuits.

3. A selector as described comprising a plurality of adjustably positioned discs in separate groups forming the body of the selector, means associated with each disc controlling by its position one of a plurality of operating circuits which may be established by the separate adjustment of each disc according to a prearranged combination for each circuit and an electrically operated disc movable to correspond with the different positions of the first mentioned

discs for each of said groups controlling said circuits.

4. A selector as described comprising a plurality of adjustably positioned discs forming the body of the selector, means associated with each disc controlling by its position one of a plurality of operating circuits which may be established by the separate adjustment of each disc according to a prearranged combination for each circuit, an electrically operated disc movable to correspond with the different positions of the first mentioned discs for controlling said circuits and a second electrically operated disc selectively making one of said circuits effective at a time.

5. A selector of the class described having a plurality of adjusting discs arranged in groups, means associated with each disc controlling one of a plurality of conductors, by the position of the discs, a stepping wheel for selecting any particular conductor at a time and a stepping wheel for each of said groups controlling said conductors, means whereby said stepping wheels are progressively operated and means for retaining said wheels in position during the operation of the selector.

6. A selector of the class described having a plurality of combination discs arranged in groups, means for manually adjusting said discs, means associated with said discs whereby each disc controls a circuit, means remotely located for selecting any particular circuit and an electrically operated stepping disc for synchronizing the selector with the prearranged adjustment.

7. A selector of the class described having a plurality of conductors connected to a terminal at one end of the selector and each of said conductors connecting to a separate terminal at the other end of the selector, a plurality of discs adjustably positioned, means associated with said discs controlling said conductors according to prearranged combinations, means for selecting any particular conductor and an electrically operated stepping disc movable to correspond with the different positions of the plurality of adjusting discs controlling said conductors.

8. A selector of the class described having a plurality of conductors connected to a terminal at one end of the selector and each of said conductors connecting to a separate terminal at the other end of the selector, a plurality of discs adjustably positioned, means associated with said discs controlling said conductors by the position of the discs, and a plurality of electrically operated stepping discs movable to correspond with the different positions of the plurality of adjusting discs controlling said conductors.

9. A selector of the class described comprising a plurality of discs adjustable relative to each other to set up predetermined combinations of the selector, a plurality of independent conductors controlled by each disc, a plurality of electrically operated discs controlling said conductors to synchronize the selector to the predetermined combinations and a conductor carried by one of said electrically operated discs controlling the operation of another electrically operated disc.

10. A selector of the class described comprising a plurality of discs adjustable relative to each other to set up predetermined combinations of the selector, a plurality of independent conductors controlled by each disc, a plurality of stepping discs electrically operated controling said conductors to synchronize the selector to the predetermined combinations, a polarized relay associated with the operation of said stepping discs and means whereby the initial movement of one of said stepping discs co-operates with said polarized relay to prevent the movement of a previously moved disc.

11. A selector of the class described comprising a plurality of discs adjustable relative to each other to set up predetermined combinations of the selector, a plurality of independent conductors controlled by each disc, a plurality of stepping discs electrically operated controling said conductors to synchronize the selector to the predetermined combinations, and means whereby said stepping discs are progressively operated and the initial movement of one stepping disc establishing conditions for the movement of a succeeding stepping disc in any position after its initial movement.

12. A selector as described comprising a conductor having its circuit controlled by an electrically operated disc, an annular contacting ring on said disc, a finger making electrical contact with said ring, means associated with said ring for interrupting the electrical connection between said ring and said finger at predetermined positions of said ring and a circuit controlled by said finger affecting the operation of said selector.

13. A selector of the class described comprising a conductor having its circuit controlled by a plurality of stepping discs electrically operated, means whereby one of said discs, on its initial movement, establishes the circuit for the operation of another disc and interrupts the operating circuit of a third disc.

14. A selector as described comprising a conductor having its circuit controlled by an electrically operated disc which is moved to a position to establish the circuit of said conductor, a slow releasing magnet for holding said disc in the position to which it has been moved and a plurality of independent windings for energizing said magnet.

15. A selector of the class described comprising a plurality of members for setting up predetermined combinations arranged in groups, a circuit controlled by said members, a stepping wheel for each of said groups arranged to synchronize said selector by controlling said circuit, means for operating each of said stepping wheels by impulses in groups having characteristics particular to each group and a polarized relay for selectively controlling said impulses between said groups in the operation of said stepping wheels.

Signed at New York city, in the county of New York and State of New York, this 10th day of May, A. D. 1921.

MATTHEW H. LOUGHRIDGE.