

May 28, 1929.

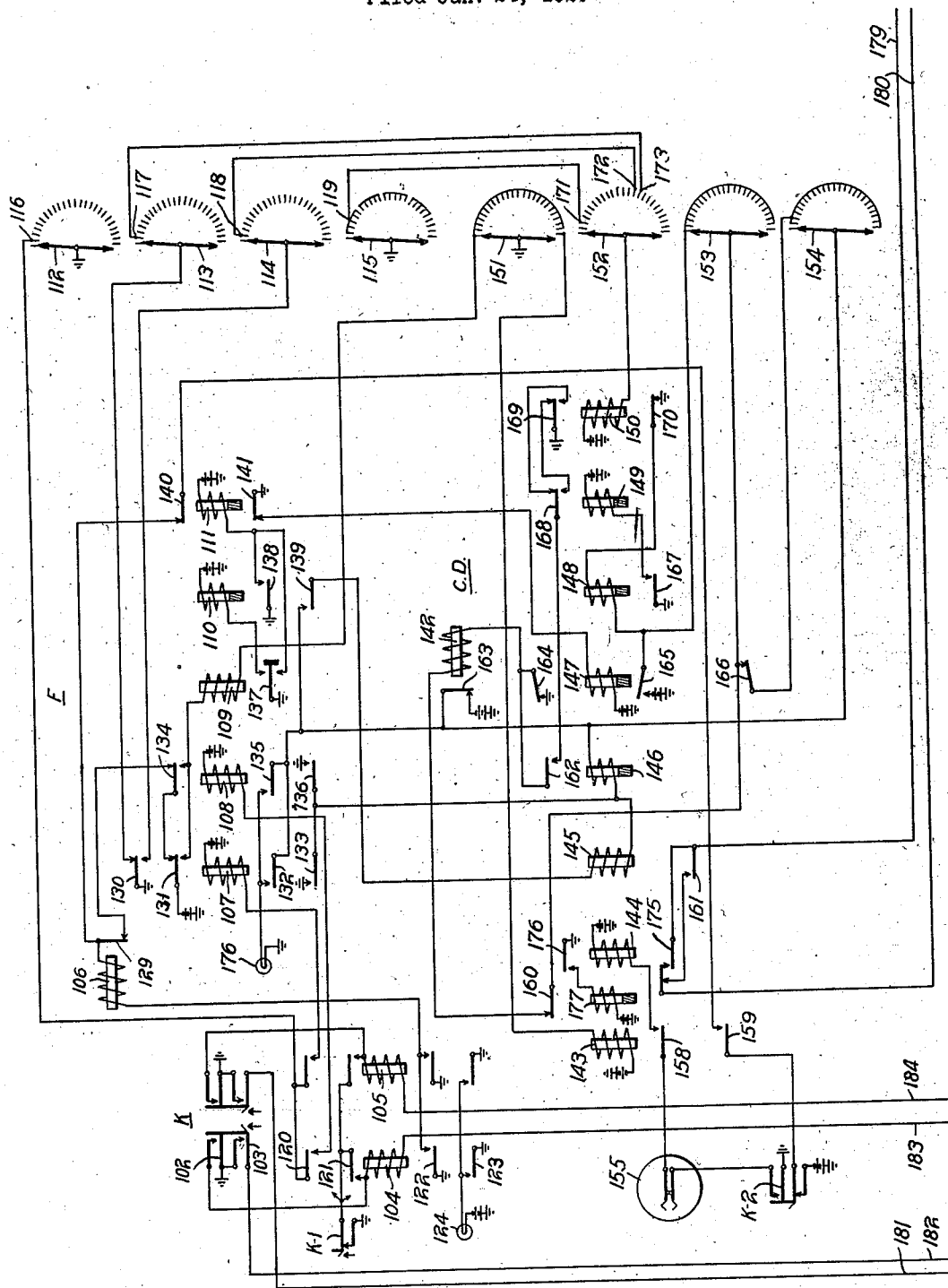
T. U. WHITE

1,714,973

SIGNALING SYSTEM

Filed Jan. 24, 1925

6 Sheets-Sheet 1



WITNESSES:

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Fig. 1.

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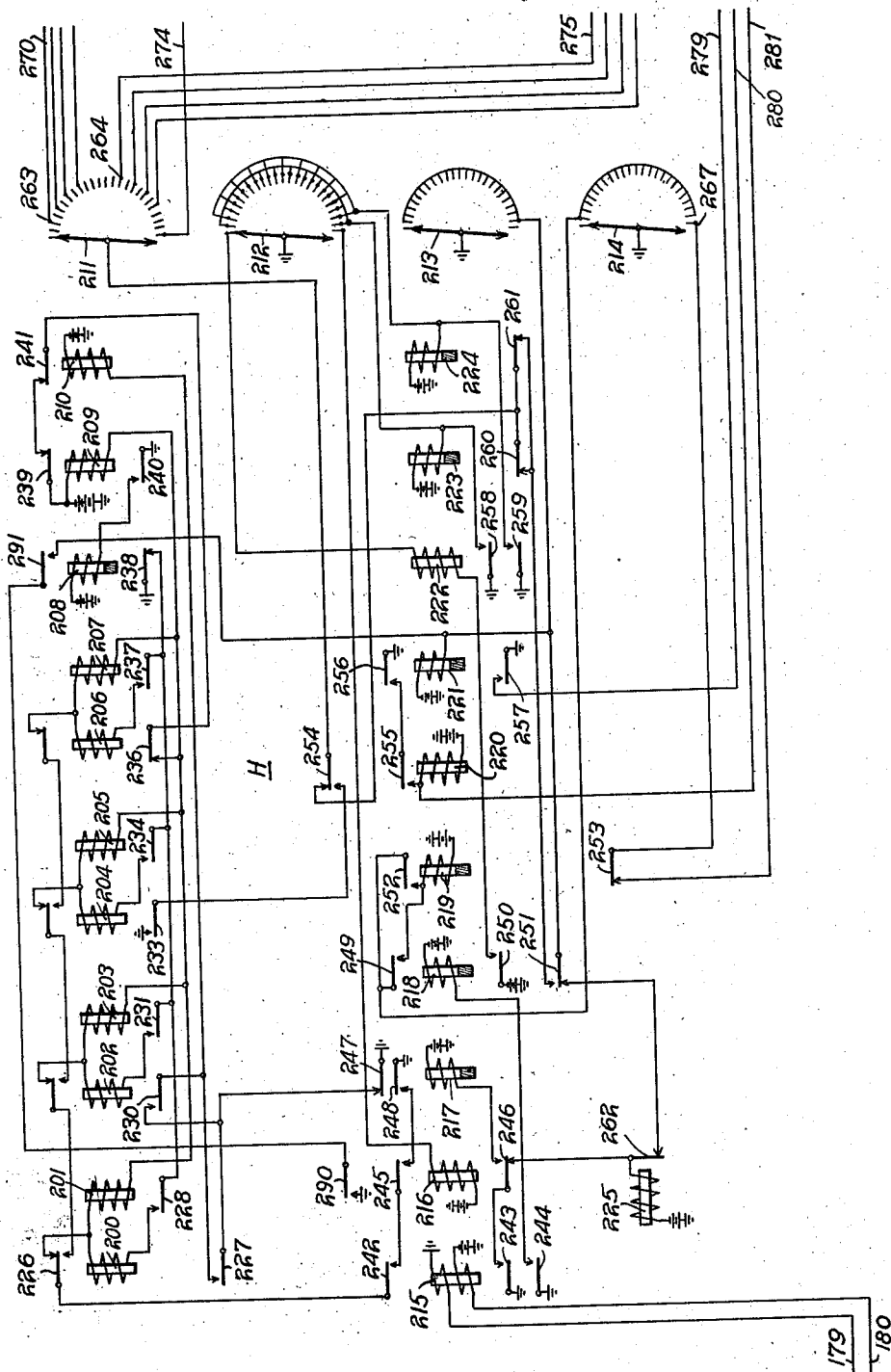
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T. U. WHITE
SIGNALING SYSTEM

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6 Sheets-Sheet 2



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Fig. 2.

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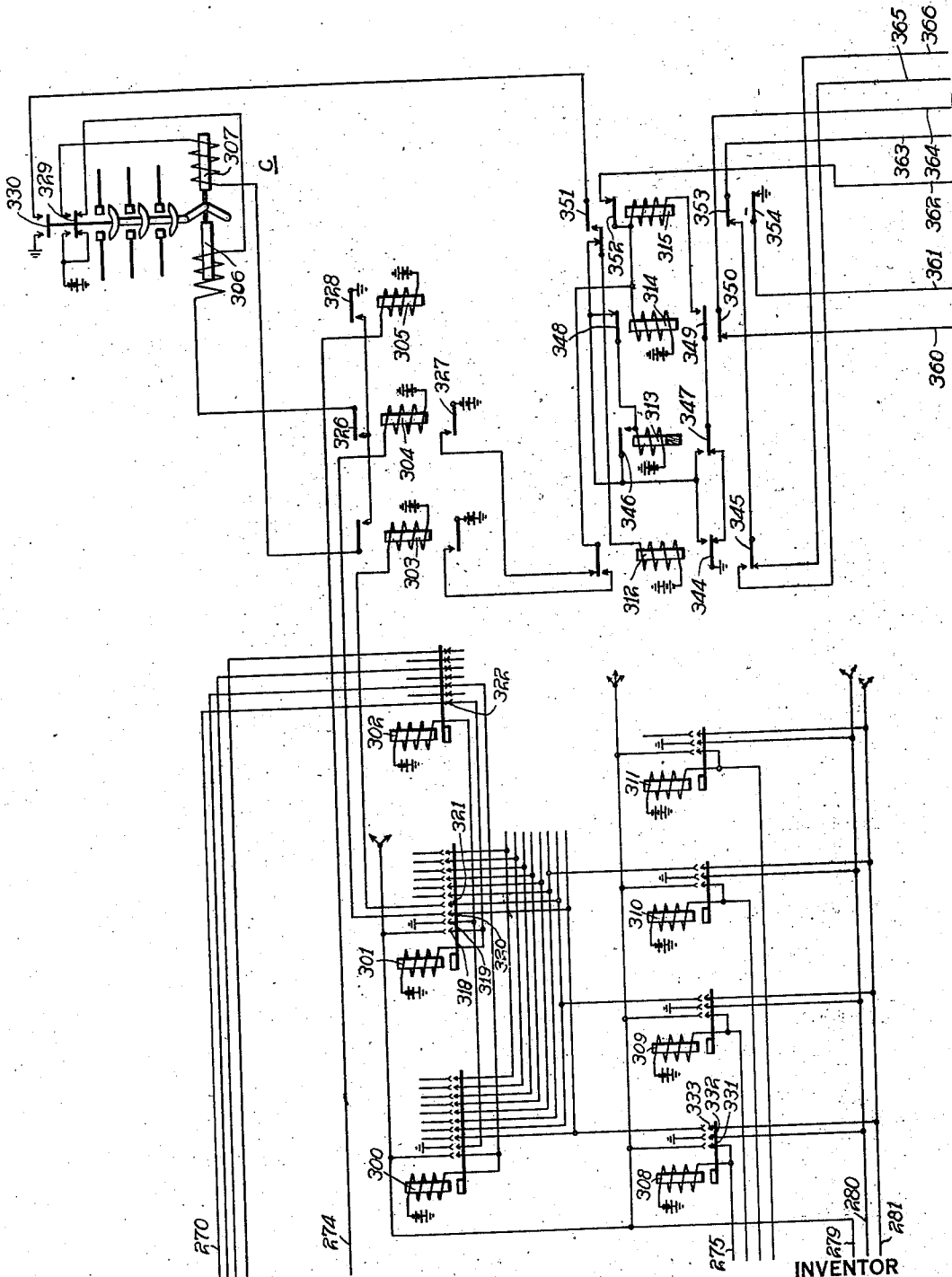
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SIGNALING SYSTEM

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Fig. 3

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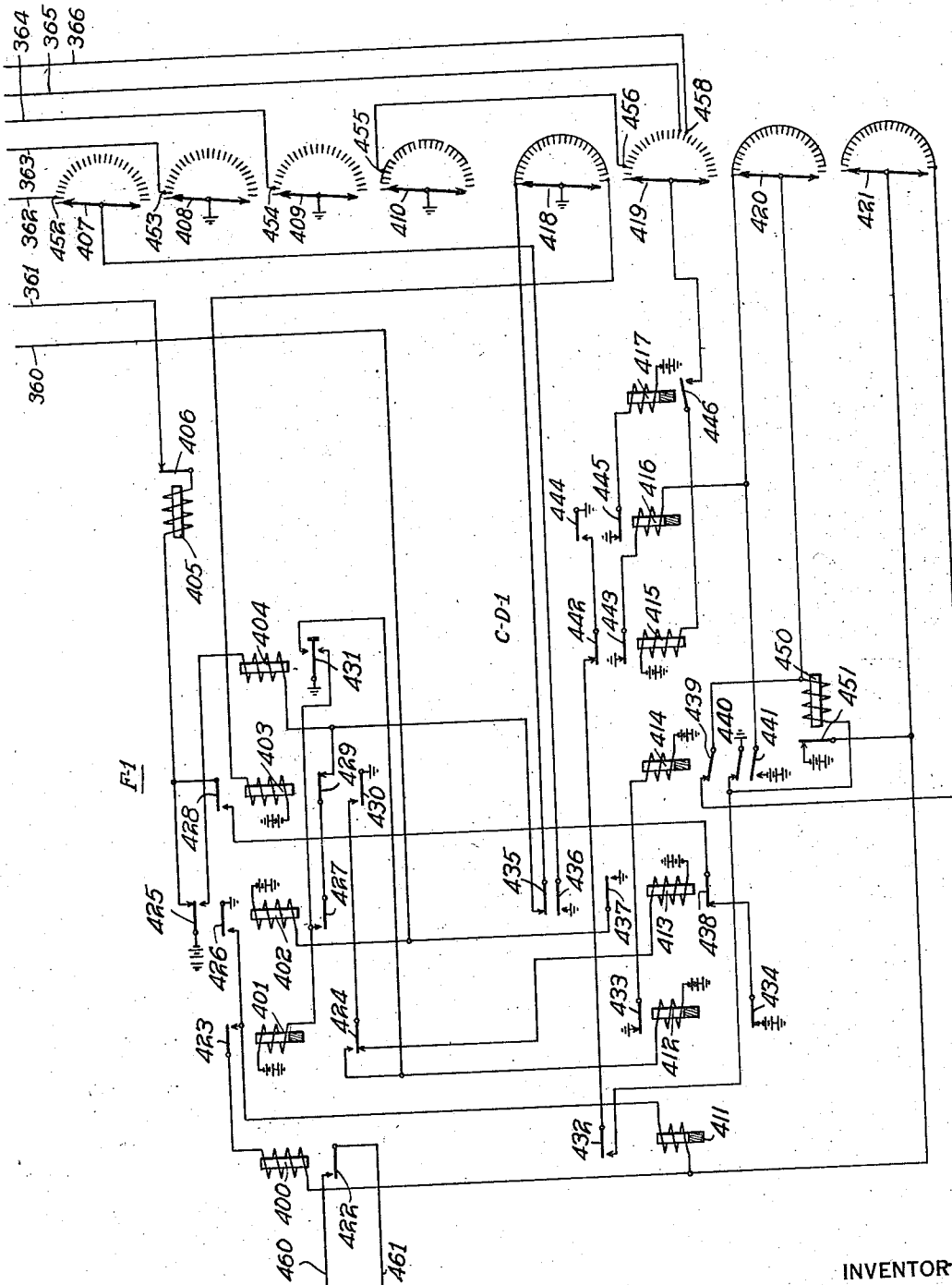
T. U. WHITE

1,714,973

SIGNALING SYSTEM

Filed Jan. 24, 1925

6 Sheets-Sheet 4



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FIG. 4

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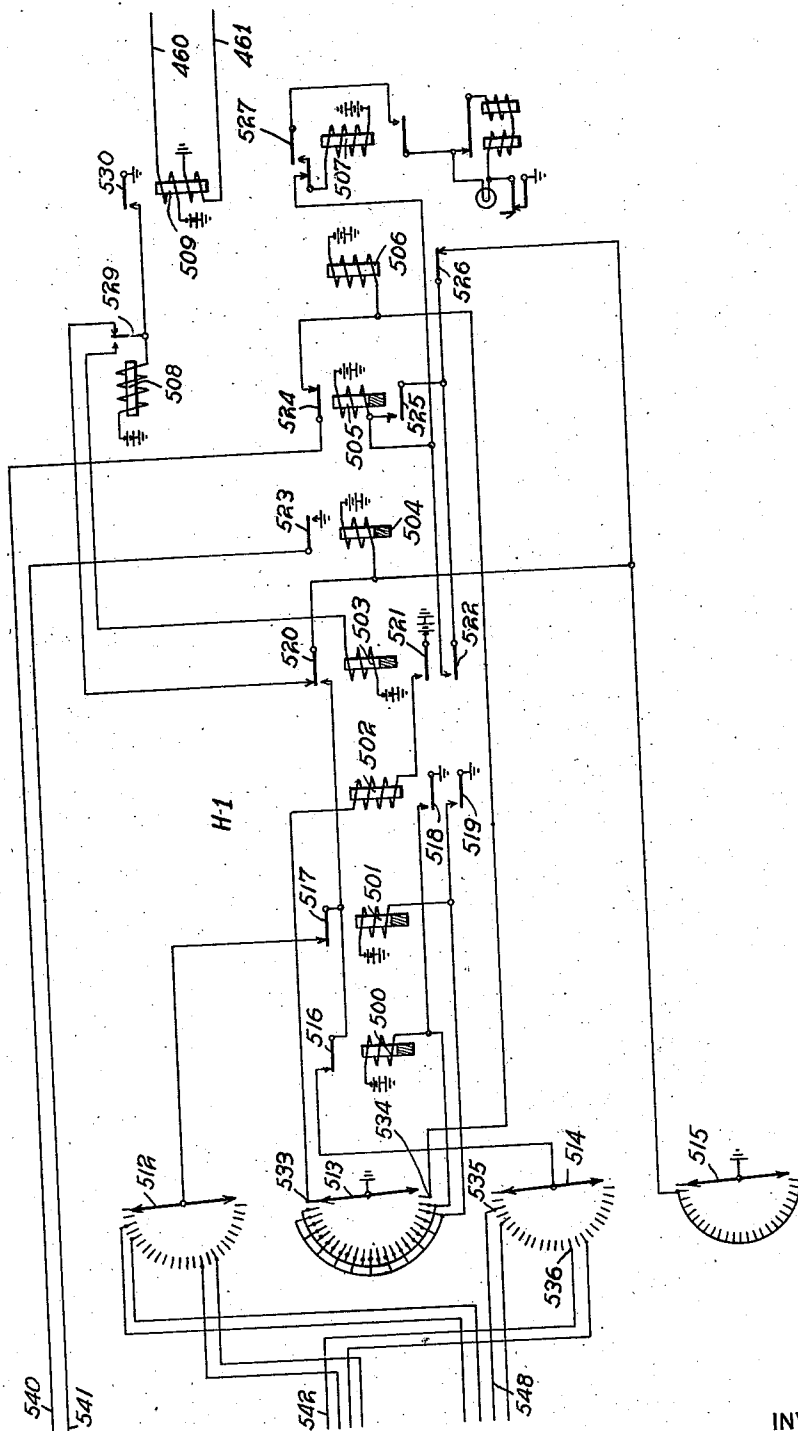
T. U. WHITE

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SIGNALING SYSTEM

Filed Jan. 24, 1925

6 Sheets-Sheet 5



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Fig. 5.

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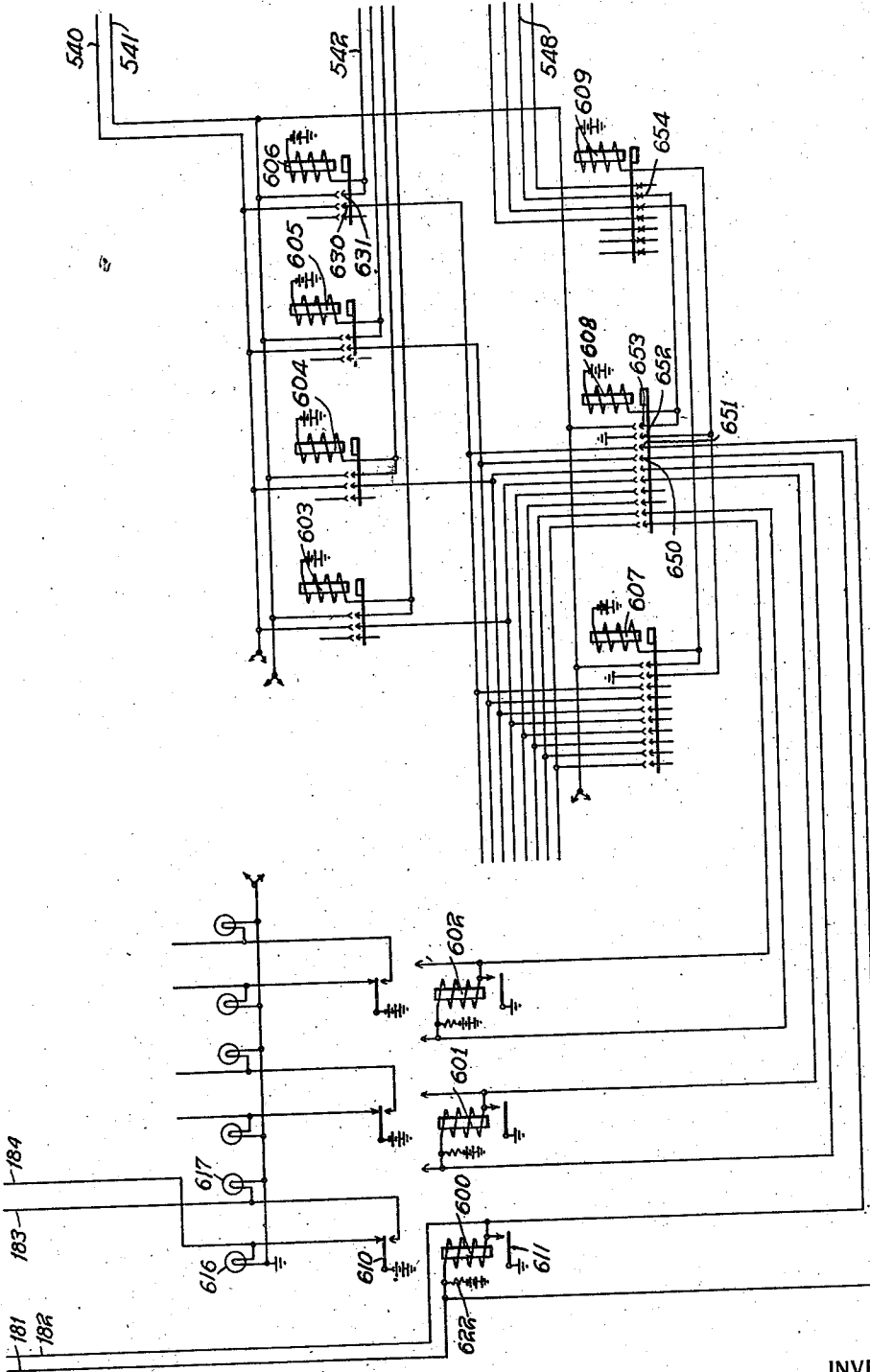
T. U. WHITE

1,714,973

SIGNALING SYSTEM

Filed Jan. 24, 1925

6 Sheets-Sheet 6



WITNESSES:

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FIG. 6

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Patented May 28, 1929.

1,714,973

UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

Application filed January 24, 1925. Serial No. 4,533.

My invention relates, in general, to signaling and control systems and particularly to systems for supervising and controlling, from a central point, remotely-disposed electrical apparatus.

One object of my invention is to provide improved selecting apparatus and circuits whereby the dispatcher at the central station may select an apparatus unit at one of the remotely-disposed stations.

Another object of my invention is to provide an improved code-sending device at the dispatcher's office for controlling the operation of the selecting device at the station.

Another object of my invention is to provide an improved selecting device at the station for selecting predetermined apparatus units therein.

Another object of my invention is to provide a code-sending device at the dispatcher's office and a selecting device at the receiving station that will be operative to select a predetermined apparatus unit without operating it if the dispatcher so desires.

Another object of my invention is to provide an improved control device for bringing about the operation of the selected unit.

Another object of my invention is to provide means for indicating to the dispatcher the apparatus unit selected after such selection has taken place and before such unit is operated.

A still further object of my invention is to provide a code-receiving device at the station that may be controlled from the dispatcher's office to operate the desired unit after it has been selected by the operation of the selecting device at the station.

There are other objects of the invention which, together with the foregoing, will be described more fully in the detailed specification that is to follow.

Referring now to the drawings, comprising Figures 1 to 6, inclusive, sufficient apparatus and circuits have been shown, by means of the usual conventional diagrams, to enable my invention to be readily explained and understood.

The apparatus and circuits shown in Figs. 1, 5 and 6 are those located at the dispatcher's office, while the apparatus and circuits shown in Figs. 2, 3 and 4 are those located at the station.

In practicing my invention, I provide a

plurality of keys at the dispatcher's office, one for each apparatus unit that it is desired to select. A finder switch and a code-sending switch, as well as a code-receiving or selecting switch, are provided at the office. There are two signaling devices for each apparatus unit that it is desired to control. In addition, a control device is provided at the dispatcher's office.

At the station or substation, a code-receiving or selecting switch is provided, as well as a finder switch and a code-sending switch. A group of relays is also provided at the substation for controlling the operation of the selected unit. Certain relays are also provided at the substation for controlling the operation of the desired apparatus units and for initiating the operation of the finder and code-sending switches.

Briefly, the operation of my invention proceeds as follows: When the dispatcher desires to operate an apparatus unit at the station, he will operate the key associated with this unit in the proper direction. As a result of this operation, the finder switch is operated to find the position of the desired key. The signaling lamps associated with this key are so operated as to give an indication opposite from the one shown when the key is in normal position.

Upon the completion of the operation of the finder switch, the code-sending switch begins to operate and a code of impulses is sent to the substation to control the selecting or code-receiving switch thereat. The impulse code for controlling the code-receiving switch consists of twenty-five impulses. The selecting operations are determined by pauses in this code of twenty-five impulses. The position of these pauses is, in turn, controlled by the position of the finder switch. As a result of the operations of the code-receiving switch, certain relays at the substation are operated to select the desired apparatus unit.

When the complete code of twenty-five impulses has been sent out, a circuit is completed for initiating the operation of the finder switch at the station, and this finder switch is operated to connect with the apparatus unit that has been selected by the operation of the selecting relays. The code-sending switch at the station is then operated to control the operation of the code-receiving switch at the dispatcher's office in substan-

tially the same manner as the code-sending switch at the office controls the code-receiving switch at the station. By the operation of the code-receiving switch at the office, certain signaling devices are selected, corresponding to the apparatus unit that has been connected at the station.

When the code-sending switch at the station and the code-receiving switch at the dispatcher's office are stopped in their twenty-fifth position, a circuit is completed for operating the signaling devices that have been selected. The operation of these signaling devices apprises the dispatcher that the proper unit has been selected; that is, the signaling devices whose indication was reversed by the operation of the key are restored to the same condition as before the key was thrown. This indicates to the dispatcher the absolute accuracy of the selecting operations.

The dispatcher will now operate the control device to bring about the desired operation of the selected unit at the station. The operation of this control device sets up certain indications upon the chain of counting relays at the station, whereupon the desired apparatus unit is operated. As a result of the operation of the apparatus unit at the station, the finder switch and code-sending switch thereat are operated to control the code-sending switch at the office to bring about a change in operation of the signaling devices. This change indicates to the dispatcher the completed operation of the selected apparatus unit. The apparatus is restored to normal under the control of the dispatcher.

Referring now more particularly to Fig. 1, there is shown in the upper left-hand corner a key K. This key is one of a plurality of keys that is operated to control the selection of the desired apparatus unit at the station. The key K is an ordinary double-throw key of the usual type. Associated with each key, such as key K, are two relays 104 and 105 for controlling the operation of the finder switch F. A monitor lamp 124 is also associated with each key. A common release key K-1 is provided for controlling certain releasing operations. This key is of the usual single-throw, non-locking type.

The control device, shown at 155, comprises an ordinary two-wire calling device well known in the automatic telephone art. This calling device is adapted to produce certain interruptions in the control circuit, as will appear.

The finder switch F is of the usual type of rotary switch having four wipers 112 to 115, inclusive, each of which is adapted to engage a contact bank set comprising twenty-five bank contacts. These wipers are moved in a forward direction only upon the operation of a motor magnet 106. The me-

chanical construction of the switch is shown in the patent to Clement No. 1,107,153.

A code-sending switch CD is associated with the finder switch F. This code-sending switch is of the same mechanical construction as the finder switch F, having four wipers 151 to 154, inclusive, which are adapted to be advanced by the operation of a motor magnet 142. The wipers of the finder switch F have no normal position, while the wipers of the code-sending switch CD have a normal position. Relays 107 to 111, inclusive, are associated with the finder switch F, while relays 143 to 150, inclusive, and relay 177 are associated with the code-sending switch CD. These relays control the operations of these switches in a manner that will be described.

A key K-2 is placed in circuit with the control device 155. This key is of the usual single-throw, non-locking type.

In Fig. 2, a connector switch H is of the same mechanical construction as the finder switch F. Relays 208 to 210, inclusive, and relays 215 to 224, inclusive, are associated with the selecting switch H and control these operations. Relays 200 to 207, inclusive, comprise the group of counting relays at the station.

In Fig. 3, three multi-contact relays 300 to 302, inclusive, are shown. The relays 300 and 301 are a portion of the primary group of selecting relays and are of the usual multi-contact type. Relays 308 to 311, inclusive, are a portion of the secondary group of selecting relays. A set of relays, such as 303 to 305, inclusive, and relays 312 to 315, inclusive, are associated with each circuit breaker, such as the circuit breaker C which is one of the apparatus units at the substation and may perform any desired function thereat.

In Fig. 4 is shown a finder switch F-1 and a code-sending switch CD-1. These switches are similar to the finder switch F and the code-sending switch CD, previously described. Relays 400 to 404, inclusive, and relays 411 to 417, inclusive, control the operation of the finder switch and the code-sending switch.

In Fig. 5 is shown a connector or code-receiving switch H-1. This switch is similar to the connector switch H and has associated relays 500 to 510, inclusive, for controlling its operation.

Relays 603 to 606, inclusive, of Fig. 6, comprise a portion of the secondary selecting relay group at the dispatcher's office while the relays 607 to 609, inclusive, comprise a portion of the primary selecting relay group at the dispatcher's office. Relays 600 to 602, inclusive, control the operation of signaling devices 616 to 621, inclusive.

Having briefly described the apparatus shown in the drawings, I will now explain

its detailed operation. For this purpose, it will be assumed that the dispatcher desires to close the circuit interrupter C at the station. In order to bring about the functioning of the selecting apparatus, the dispatcher will operate the key K associated with this unit in such direction as to cause the springs 102 and 103 to engage their working contacts. By the operation of the spring 103 into engagement with its working contact, a circuit is completed that extends from ground by way of the working contact of said spring and said spring, conductor 182, relay 600, and resistor 622 to battery.

The relay 600 is energized over this circuit and operates to establish a locking circuit for itself at armature 611, to open the circuit of the signaling lamp 616 at armature 610 and to complete the circuit of the signaling lamp 617 at the front contact of this armature. This change in supervisory signals informs the dispatcher that the apparatus is functioning to select the desired apparatus unit.

Another circuit is completed by the operation of the armature 610 into engagement with its front contact over a path that extends from battery by way of said armature and its front contact, conductor 183, relay 104, and working contact of spring 102 of key K and said spring to ground. The relay 104 is energized over this circuit and operates to establish a locking circuit for itself at armature 121, over the above-traced circuit including armature 610, conductor 183, relay 104, front contact and armature 121 and key K—1 to ground, and to complete a circuit for the monitoring lamp 124 at armature 123.

When the key K is released, the original circuit of the relay 600 is opened, as well as the original circuit of the relay 104. These relays are not, however, deenergized by reason of their locking circuits. Other results of the operation of the relay 104 are that at armature 120 a circuit is prepared for the relay 108, and at armature 122 a circuit is completed which may be traced from ground by way of said armature and its front contact, stepping magnet 106 of finder switch F, armature 129 and its back contact, back contact and armature 134, and back contact and armature 131 to battery.

The stepping magnet 106 operates as a buzzer to advance the switch wipers 112 to 115, inclusive, into engagement with the bank contact set which comprises the bank contacts 116 to 119, inclusive. It will be noted that each contact set is individual to a key such as key K. Thus the group of bank contacts 116-119 is individual to key K and upon operation of key K, the switches are stepped to and brought to a stop at the contact set individual thereto. In the present instance when the switches reach the first

contact, a circuit is completed extending from ground by way of wiper 112, bank contact 116, armature 120 and its front contact and relay 108 to battery.

The relay 108 is operated to open the circuit of the stepping magnet 106 at armature 134, to complete a circuit for the relay 109 at the front contact of this armature, to complete a circuit for the monitoring lamp 176 at armature 135, from ground through battery, back contact and armature 163, armature 135 and its front contact, lamp 176 and ground, and to complete a circuit for the slow-releasing relay 146 over a path that extends from ground by way of front contact and armature 136, relay 146, and armature 163 and its back contact to battery.

The circuit of the relay 109 extends from battery by way of armature 131 and its back contact, armature 134 and its front contact, relay 109, bank contact with which the wiper 151 is in engagement and said wiper to ground. The relay 109 is energized to complete a circuit for the slow-releasing relay 110 at armature 137. The relay 146 is operated to prepare a circuit for the stepping magnet 142 at armature 162.

The relay 110 is energized to complete a circuit for the slow-releasing relay 111 at armature 138, and to complete a circuit at armature 139 over a path which extends from battery by way of back contact and armature 163, front contact and armature 139, impulsing relay 145, and armature 136 and its front contact to ground.

The relay 145 is energized to complete an impulsing circuit at armature 161. This impulsing circuit may be traced from ground through the upper winding of the line relay 215 at the substation (Fig. 2), conductor 179, armature 161 and its front contact, normally closed springs controlled by armature 175', conductor 180, and lower winding of line relay 215 to battery.

The slow-releasing relay 111 is energized to open the circuit of the slow-releasing relay 147 at armature 141. The slow-releasing relay 147 is deenergized to complete a circuit at armature 165 which extends from battery by way of back contact and said armature, slow-releasing relay 148, and armature 170 and its back contact to ground.

The slow-releasing relay 148 is energized to complete a circuit for the slow-releasing relay 149 at armature 167. The slow-releasing relay 149 is energized to complete a circuit for the stepping magnet 142 at armature 168 over a path extending from ground by way of armature 169 and its back contact, front contact and armature 168, front contact and armature 162, stepping magnet 142, armature 160 and its back contact, wiper 153, bank contact with which said wiper is in engagement, and armature 165 and its back contact to battery.

The stepping magnet 142 is energized over the above circuit and operates to open the circuit of the slow-releasing relay 146 and the impulsing relay 145 at armature 163. The slow-releasing relay 146 is deenergized, after a short interval of time, to open the circuit of the stepping magnet 142. The stepping magnet is thereupon deenergized to complete the circuit of the slow-releasing relay 146 and the circuit of the impulsing relay 145.

By the energization and deenergization of the stepping magnet, the wipers 151 to 154, inclusive, of the code-sending switch CD are advanced one step into engagement with their second set of bank contacts. The stepping magnet 142 and the relays 146 and 145 are now alternately operated until the wipers 151 to 154, inclusive, of the code-sending switch are brought into engagement with the bank contact set which includes the bank contact 171.

As a result of this operation, a circuit is completed which extends from ground by way of wiper 115 of finder switch F, bank contact 119, bank contact 171, wiper 152, and relay 150 to battery. The relay 150 is operated to open the circuit of the stepping magnet 142 at armature 169, and to open the circuit of the slow-releasing relay 148 at armature 170. The operation of the stepping magnet 142 is thus interrupted.

The slow-releasing relay 148 is deenergized after a short interval of time to open the circuit of the slow-releasing relay 149. After another short interval of time, the slow-releasing relay 149 is deenergized to complete the circuit of the stepping magnet 142 over a path that extends from ground by way of armature 169 and its front contact, back contact and armature 168, front contact and armature 162, stepping magnet 142, armature 160 and its back contact, wiper 153, bank contact with which said wiper is in engagement, and armature 165 and its back contact to battery.

The stepping magnet 142 is energized to open the circuit of the relays 145 and 146. The relay 146 is deenergized to open the circuit of the stepping magnet 142. By the operation of the stepping magnet 142, the wipers 151 to 154, inclusive, are brought into engagement with the next set of bank contacts. By this operation, the circuit of the relay 150 is opened, and this relay is deenergized to complete the circuit of the relay 148 at armature 170 and to open the circuit of the stepping magnet 142 at armature 169. The relay 148 is operated to complete the circuit for the relay 149. The relay 149 is energized to reestablish the original operating circuit of the stepping magnet 142. The stepping magnet 142 and the relays 145 and 146 are now alternately operated until the wipers 151 to 154, inclusive, are brought in-

to engagement with the set of bank contacts which includes the bank contact 173.

Another circuit for the relay 150 is now completed extending from the ground by way of armature 130 and its back contact, wiper 113, bank contact 117, bank contact 173, wiper 152, and relay 150 to battery. The relay 150 and the slow-releasing relays 148 and 149 operate in the same manner as before to bring about a pause in the operation of the stepping magnet 142, during which interval of time the relay 145 is maintained energized. After the relays 147 and 148 have operated, the original circuit for the stepping magnet 142 is completed by the energization of the slow-releasing relay 149 and the deenergization of the relay 150.

The alternate operation of the relays 145 and 146 of the stepping magnet 142 now continues until the switch wipers 151 to 154, inclusive, are brought into engagement with their twenty-fifth set of bank contacts. By the operation of the wiper 153, the circuit of the stepping magnet 142 is opened and this magnet ceases to operate. By the operation of the wiper 151, the circuit of the relay 109 is opened and a circuit is completed for the relay 143.

The relay 109 is deenergized. As a result of this operation, the armature 137 is started into vibration and alternately sends impulses to the slow-releasing relays 110 and 111.

The relay 143 is energized to complete a circuit for the relay 144 by reason of the fact that, as the dispatcher desires to control the operation of the circuit interrupter C at the station, the key K—2 will be in an operated position. The relay 144 is operated to complete a circuit for the slow-releasing relay 177 at armature 176, to open the impulsing circuit comprising the armature 161 and its front contact at armature 175, and to complete a new holding circuit for the line relay 215 of the connector H at the front contact of this armature. The slow-releasing relay 177 is energized to open another point in the circuit of the stepping magnet 142.

The circuit of the relay 110 is opened by the operation of the armature 137 and, after a short interval of time, this relay is deenergized to open the circuit of the impulsing relay 145 at armature 139. The relay 111 is deenergized shortly to prepare a circuit for the stepping magnet 142 of the finder switch F at armature 140, and to complete the circuit of the slow-releasing relay 147 at armature 141.

The slow-releasing relay 147 is energized to open the circuit of the slow-releasing relay 148 at armature 165, to prepare one point in the circuit of the stepping magnet 142 at armature 164, and to prepare another point in the circuit of the stepping magnet

at armature 166. The relay 148 is deenergized to open the circuit of the slow-releasing relay 149. This relay is also deenergized to open another point in the circuit of the stepping magnet 142 at armature 168. The deenergization of the relay 145 is without particular function by reason of the fact that the relay 144 is energized, the key K—2 having been operated into a position opposite to that shown. The above is the manner in which the code is sent by the code-sending apparatus CD to the code-receiving apparatus comprising the connector H at the substation. The operation of this code in controlling the connector H will now be described.

When the impulsing relay 145 at the dispatcher's office is first operated, a circuit is completed for the line relay 215. The line relay 215 is operated to complete a circuit for the stepping magnet 225 at armature 243, and to complete a circuit for the slow-releasing relay 218 at armature 244. The slow-releasing relay 218 is energized to prepare a circuit for the slow-releasing relay 219 at armature 249, to complete a circuit for the relay 222 at armature 250, and to prepare a selecting circuit at armature 251. The stepping magnet 225 is energized to position its pawl so that the switch wipers 211 to 214, inclusive, will be advanced upon the deenergization of the stepping magnet 225.

The relay 222 is energized to complete a circuit for the slow-releasing relay 223 at armature 258 and to complete a circuit for the slow-releasing relay 224 at armature 259. The relay 223 is energized to open one point in the selecting circuit at armature 260. The slow-releasing relay 224 is energized to open another point in the selecting circuit at armature 261. All these operations occur in response to the energization of the line relay 215.

When the relay 145 at the dispatcher's office is deenergized, the circuit of the line relay 215 is opened and this relay is deenergized to open the circuit of the stepping magnet 225 at armature 243 and to open the circuit of the slow-releasing relay 218 at armature 244. The stepping magnet 225 is deenergized to advance the switch wipers 211 to 214, inclusive, into engagement with their second set of bank contacts.

By the operation of the wiper 212, the circuit of the relay 222 is opened and a circuit is completed for the slow-releasing relay 223. The relay 222 is deenergized to open the circuit of the slow-releasing relay 223 and also the circuit of the slow-releasing relay 224.

By the operation of the wiper 214, a circuit is completed which extends from ground by way of said wiper, bank contact with which said wiper is in engagement, armature 249 and its front contact, and slow-releasing

relay 219 to battery. The slow-releasing relay 219 is energized to open one point in the operating circuit at armature 253, and to prepare a circuit for itself at armature 252, exclusive of the armature 249 and its front contact on the relay 218.

The operation of the wiper 213 causes the completion of a circuit for the slow-releasing relay 221. The slow-releasing relay 221 is energized to prepare a locking circuit for the relay 220 at armature 256, and to place ground upon the conductor 279 at armature 257.

When the circuit of the line relay 215 is again closed by the operation of the impulsing relay at the dispatcher's office, the circuit of the stepping magnet 225 is again completed, as is the circuit of the slow-releasing relay 218. The slow-releasing relay 218 has sufficient time lag to prevent its deenergization between successive operations of the armature 244 of the line relay 215. The operation of the stepping magnet 225 now serves to again position the pawl.

The operation of the impulsing relay again opens the circuit of the line relay 215, whereupon the circuit of the stepping magnet 225 is opened to cause this magnet to advance the switch wipers 211 to 214, inclusive, into engagement with the next set of bank contacts, including the bank contact 263. The movement of the switch wiper 212 opens the circuit of the slow-releasing relay 223 and completes a circuit for the slow-releasing relay 224. So long as the switch wiper 212 is advanced without interruption, the relays 223 and 224 are maintained energized by reason of their sluggish action.

It will be remembered that, after the switch wipers of the code-sending switch CD have been advanced two steps, a time interval occurs in the operation of the impulsing relay with the consequence that the line relay 215 is maintained energized for a comparatively long interval of time. This interval is sufficient to permit the slow-releasing relay 223 to deenergize.

A selecting circuit is now completed extending from ground by way of wiper 213, bank contact with which said wiper is in engagement, armature 251 and its front contact, back contact and armature 260, back contact and armature 254, wiper 211, bank contact 263, conductor 270, resting contact of spring 322 and said spring, and primary selecting relay 301 to battery.

The primary selecting relay 301 is energized to prepare certain selecting circuits at certain of these springs, including the springs 320 and 321, and to complete a circuit which extends from ground by way of working contact of spring 319 and said spring, and relay 302 to battery.

The relay 302 is energized to open the original energizing circuit of the relay 301

and also to open points in the circuits of all the other relays of the primary selecting group. The relay 301 is not deenergized by reason of the fact that there is a locking circuit completed extending from ground through conductor 279, spring 318, working contact of said spring, and relay 301 to battery.

Shortly after this selecting operation has been completed, the circuit of the line relay 215 is again intermittently interrupted by a series of interruptions that are produced by the second advancement of the switch wipers of the code-sending switch CD. By the operation of the line relay 215 and the stepping magnet 225, the wipers 211 to 214, inclusive, are advanced into engagement with the bank contact set which includes the bank contact 264. When the wipers 211 to 214, inclusive, are brought into engagement with this set of bank contacts, interruptions in the circuit of the line relay 215 are temporarily interrupted by the operation of the code-sending apparatus at the dispatcher's office. This interval is sufficiently long to permit the relay 223 to again deenergize.

Another selecting circuit is completed which extends from ground by way of wiper 213, bank contact with which said wiper is in engagement, armature 251 and its front contact, back contact and armature 260, back contact and armature 254, wiper 211, bank contact 264, conductor 275, and selecting relay 308 to battery. The selecting relay 308 is energized to establish a locking circuit for itself at spring 331, to place ground upon the conductor 280 at spring 332, and to prepare another point in the selecting circuit at spring 333. The locking circuit of the relay 308 extends to ground upon grounded conductor 279.

By the grounding of conductor 280, a circuit is completed for the relay 220. The relay 220 is energized to open one point in the selecting circuit at armature 254, to prepare a point in the operating circuit at the front contact of this armature, and to establish a locking circuit for itself at armature 255.

After this selecting circuit is completed, another series of interruptions is produced in the circuit of the line relay 215 by the operation of the impulsing relay at the dispatcher's office. This series of interruptions causes the line relay 215 to operate the stepping magnet 225 to bring the wipers 211 to 214, inclusive, into engagement with their twenty-fifth set of bank contacts. At this point, the impulsing circuit for the line relay 215 remains permanently closed and the circuits of both the slow-releasing relays 223 and 224 are permanently opened at wiper 212.

Another result of the operation of the

wiper 212 in engagement with its twenty-fifth bank contact 266 is to complete a circuit for the relay 216. The relay 216 is energized to open one point in the circuit of the stepping magnet 225 at armature 246 and to complete a circuit for the slow-releasing relay 217 at the front contact of this armature. The circuit of the stepping magnet 225 is opened at armature 246 before the line relay 215 is energized. Consequently, the wipers 211 to 214, inclusive, remain in engagement with their twenty-fifth set of bank contacts. Another result of the operation of the relay 216 is that an impulsing circuit is prepared at armature 245. A still further result of the operation of the relay 216 is that a circuit is prepared at armature 290 for the slow-releasing relay 221.

The slow-releasing relay 217 is energized to complete a circuit at armature 248 which extends from ground by way of said armature and its front contact, front contact and armature 245, front contact and armature 242, armature 226 and its back contact, counting relay 201, back contact and armature 236, armature 241 and its back contact, and back contact and armature 239 to battery.

The counting relay 201 is energized over this circuit and operates to complete a circuit at armature 228 over a path that extends from ground by way of armature 238 and its back contact, armature 228 and its front contact, relay 200, relay 201, back contact and armature 236, armature 241 and its back contact, and back contact and armature 239 to battery. This circuit is not effective to cause the operation of the relay 200 so long as the original circuit for the relay 201 is maintained.

When the wiper 214 is brought into engagement with its twenty-fifth bank contact, the circuit of the slow-releasing relay 219 is opened. The slow-releasing relay 219 is, consequently, deenergized to complete a circuit that extends from ground by way of wiper 214, bank contact 267, armature 253 and its back contact, conductor 281, spring 333 and its working contact, spring 320 and its working contact, and relay 304 to battery. The relay 304 is energized to prepare a circuit for the closing coil of the circuit interrupter C at armature 326, and to complete a short-circuit for the relay 315 by-passing relay 314 at armature 327.

Normally, the relay 315 is in an energized condition. The circuit over which this relay is operated extends from ground by way of armature 344 and its back contact, back contact and armature 347, armature 349 and its front contact, relay 315 and relay 314 to battery. By this circuit, the relays 314 and 315 are maintained energized.

Now, when the relay 304 is operated, the relay 314 is short-circuited. The relay 314

is deenergized to open the circuit of the relay 315 at armature 349, and to prepare a circuit for the relay 313 at armature 348. The relay 315 is deenergized to complete a circuit that extends from ground by way of back contact and armature 354, conductor 361, back contact and armature 406, stepping magnet 405, and back contact and armature 425 to battery.

The stepping magnet 405 is operated as a buzzer over this circuit to advance the switch wipers 407 to 410, inclusive, until these wipers are brought into engagement with the bank contact set comprising the bank contacts 452 to 455, inclusive. When the wipers are brought into this position, a circuit is completed that extends from ground by way of wiper 409, bank contact 454, conductor 364, armature 350 and its back contact, conductor 360, and relay 402 to battery. The relay 402 is energized to open the circuit of the stepping magnet 405 at armature 425, to complete a circuit at the front contact of this armature which extends from battery by way of said armature and its front contact, relay 404, back contact and armature 435, bank contact with which wiper 418 is in engagement and said wiper to ground, to complete a circuit at armature 426 over a path which extends from ground by way of said armature and its front contact, slow-releasing relay 411 and armature 451 and its back contact to battery, and to complete a circuit at armature 427 over a path that extends from battery by way of relay 401, front contact and armature 427, armature 429 and its back contact, back contact and armature 435, bank contact with which wiper 418 is in engagement and said wiper to ground.

The relay 404 is energized to complete a circuit for the slow-releasing relay 412 at armature 431. The relay 411 is energized to prepare a circuit for the stepping magnet 451 at armature 432. The relay 401 is energized to complete a circuit for the impulsing relay 400 over a path that extends from ground by way of armature 426 and its front contact, front contact and armature 423, relay 400, and armature 451 and its back contact to battery.

The impulsing relay 400 is energized to complete a circuit for the line relay 509 of connector switch H-1 at the dispatcher's office over a path extending from battery by way of the upper winding of line relay 509, conductor 460, front contact and armature 422, conductor 461, and lower winding of line relay 509 to ground.

The relay 412 is operated to open the circuit of the slow-releasing relay 414 at armature 433, and to open one point in the circuit of the stepping magnet 405 at armature 434. The relay 414 is deenergized after a short interval of time to open two points in the

circuit of the stepping magnet 450 at armatures 439 and 440, and to complete a circuit at armature 441 for the slow-releasing relay 416. The slow-releasing relay 416 is energized to open the circuit of the slow-releasing relay 417 at armature 445, and to complete a circuit at armature 444 over a path that extends from ground by way of said armature and its front contact, armature 442 and its back contact, armature 432 and its front contact, stepping magnet 450, wiper 420, bank contact with which said wiper is in engagement, and armature 441 and its back contact to battery.

The stepping magnet 450 is energized over the above circuit and operates to open the circuits of the relays 411 and 400 at armature 451. The relay 400 is deenergized to produce an interruption in the circuit of the line relay 509 at the dispatcher's office, and the slow-releasing relay 411 is deenergized to open the circuit of the stepping magnet 450. The stepping magnet 450 is deenergized to advance the switch wipers 418 to 421, inclusive, one step and to again complete the circuit of the relays 411 and 400. The relay 400 is energized to close the circuit of the relay 509. The relay 411 operates to close the circuit of the stepping magnet 450.

The intermittent operation of the stepping magnet 450 continues on until the switch wipers 418 to 421, inclusive, are brought into engagement with the bank contact set which includes the bank contact 456. As a result of this operation, a circuit is completed extending from ground by way of switch wiper 410, bank contact 455, bank contact 456, switch wiper 418, back contact and armature 446, and relay 415 to battery. The relay 415 is energized to open the circuit of the stepping magnet 450 at armature 442, and to open the circuit of the slow-releasing relay 416 at armature 443. The rotation of the switch wipers now ceases for a short interval of time.

The slow-releasing relay 416 is deenergized to open another point in the circuit of the stepping magnet 450 at armature 444 and to complete a circuit for the slow-releasing relay 417 at armature 445. The slow-releasing relay 417 is energized to open the circuit of the relay 415. The relay 415 is deenergized to prepare one point in the circuit of the stepping magnet 450 at armature 442, and to complete a circuit for the slow-releasing relay 416. The slow-releasing relay 416 is operated to complete the circuit of the stepping magnet 450 at armature 444, and to open the circuit of the slow-releasing relay 417 at armature 445.

The stepping magnet 450 is now intermittently operated under the control of the slow-releasing relay 411 until the switch wipers 418 to 421, inclusive, are brought into engagement with the bank contact set which

includes the bank contact 458. During this interval of time, the circuit of the impulsing relay 400 is opened to produce a series of interruptions in the circuit of the line relay 509 of the connector switch H-1 at the dispatcher's office.

By the operation of the wipers of the code-sending switch CD-1 into engagement with the bank contact set which includes the bank contact 458, a circuit is completed which extends from ground by way of wiper 408, bank contact 453, conductor 363, armature 353 and its back contact, armature 345 and its back contact, conductor 366, bank contact 458, wiper 419, back contact and armature 446, and relay 415 to battery.

The relay 415 is energized to interrupt the action of the stepping magnet 450 in substantially the same manner as before. The impulsing relay 400 is thus maintained energized and the switch wipers 418 to 421, inclusive, remain in engagement with this set of bank contacts until the circuit of the relay 415 is opened by the action of the slow-releasing relay 417. The relay 415 is thus deenergized to bring about the operation of the slow-releasing relay 416 whereby the circuit of the stepping magnet 450 is again established. The rotation of the switch wipers 418 to 421, inclusive, now continues until these wipers are brought into engagement with the twenty-fifth bank contact set.

During this operation of the switch wipers, another series of interruptions is produced in the circuit of the line relay 509 at the dispatcher's office by the action of the impulsing relay 400. When the switch wipers are brought into engagement with the twenty-fifth set of bank contacts, the operation of the wiper 418 opens the circuit of the relay 404 and completes a circuit for the relay 403. The operation of the wiper 420 opens the circuit of the stepping magnet 450. The relay 404 is deenergized to release its armature 431. The armature 431 then starts to vibrate to send impulses of current to the slow-releasing relay 401 and to the slow-releasing relay 412.

The relay 403 is energized to prepare a circuit for the stepping magnet 405 of the finder switch F-1 at armature 428, to open another point in the circuit of the slow-releasing relay 401 at armature 429, and to complete a circuit for the relay 413 at armature 430. The relay 401 is finally deenergized to open the circuit of the slow-releasing relay 412 at armature 424, and to complete a circuit at the back contact of this armature for the relay 413. The relay 413 is energized to complete another circuit for the relay 402 at armature 437, to place ground upon wiper 407 at armature 436, and to open another point in the circuit of the stepping magnet 405 at armature 438. The impulsing relay 400 is deenergized to open the circuit

of the line relay 509 at the dispatcher's office.

The relay 412 is deenergized after an interval of time to complete the circuit of the slow-releasing relay 414 at armature 433. The slow-releasing relay 414 is energized to prepare a circuit for the stepping magnet 450 at armatures 439 and 440, and to open the circuit of the slow-releasing relay 416 at armature 441. The circuit of the stepping magnet may be traced from ground by way of armature 440 and its front contact, stepping magnet 450, armature 439 and its front contact, twenty-fifth bank contact with which the wiper 421 is in engagement, said wiper, and armature 451 and its back contact to battery. This circuit causes the wipers 418 to 421, inclusive, to be restored to their normal position.

By the restoration of the wipers to their normal position, the circuit of the relay 403 is opened and this relay is deenergized to open the circuit of the relay 413 at armature 430. The relay 413 is deenergized to remove ground from wiper 407 at armature 436, to open the circuit of the relay 402 at armature 437, and to prepare a circuit for the relay 404 at armature 435. The relay 402 is deenergized to restore certain circuits to normal. The relay 416 is deenergized to complete a circuit for the slow-releasing relay 417. The slow-releasing relay 417 is energized to open one point in the circuit of the relay 415 at armature 446. By the deenergization of the relay 402, the circuit of the relay 411 is opened at armature 462.

When ground is placed upon the wiper 407, by the operation of the relay 413, a circuit is completed extending from ground by way of said wiper, bank contact 452, conductor 362, back contact and armature 352, and relay 314 to battery. The relay 314 is energized to remove ground from relay 402 at armature 350, and to complete a circuit for the relay 315 extending from ground by way of armature 344 and its back contact, back contact and armature 347, armature 349 and its front contact, relay 315, and relay 314 to battery. This circuit is not effective until ground is removed from the wiper 407 by the deenergization of the relay 413. The original energizing circuit of the relay 314 is opened in this manner. The short-circuit is removed from the relay 315 and this relay is energized to open another point in the circuit of the relay 314 at armature 352, to prepare a circuit for the relay 312 at armature 351, and to remove ground from conductor 361 at armature 354.

In this manner, the code-sending switch and the associated equipment are operated in order to send back a code to the dispatcher's office, which will be effective to inform him of the completion of the proper selecting operation at the substation. The

action of this code in controlling the connector switch H—1 will now be described.

When the line relay 509 is first energized, a circuit is completed for the stepping magnet 508 at armature 530. The stepping magnet 508 is energized to position its pawl and to complete a circuit, at armature 529, over a path that extends from ground by way of armature 530 and its front contact, armature 529 and its front contact, and slow-releasing relay 503 to battery. The slow-releasing relay 503 is operated to prepare a selecting circuit at armature 520, to complete a circuit at armature 521 extending from battery by way of said armature and its front contact, relay 502, bank contact 533, and wiper 513 to ground, and to prepare a circuit at armature 522 for the relay 507. The relay 502 is energized to complete a circuit for the slow-releasing relay 500 at armature 518 and for the slow-releasing relay 501 at armature 519. The relay 500 is operated to open one point in the selecting circuit at armature 516, while the relay 501 is energized to open one point in the selecting circuit at armature 517.

When the first interruption is produced in the circuit of the line relay 509, this relay is deenergized to open the circuit of the magnet 508 and also the circuit of the slow-releasing relay 503. The magnet 508 is deenergized to advance the switch wipers 512 to 515, inclusive, one step into engagement with their second set of bank contacts.

By the operation of the wiper 513, the circuit of the relay 502 is opened, and a circuit is completed for the slow-releasing relay 500. The relay 502 is deenergized to open the circuit of the slow-releasing relay 500 and also the circuit of the slow-releasing relay 501.

The operation of the wiper 515 completes a circuit extending from ground by way of said wiper, bank contact with which said wiper is in engagement, and relay 504 to battery. The relay 504 is energized to place ground upon conductor 541 at armature 523. Another result of the operation of the wiper 515 is that a circuit is completed in multiple with that of the relay 504 that extends from ground by way of back contact and armature 526, armature 522 and its front contact, and slow-releasing relay 505 to battery. Still another circuit is completed in multiple with that of the relay 505 which extends by way of the normally closed springs controlled by armature 527 and relay 507 to battery.

The relay 507 is energized to open its original energizing circuit at armature 527, and to establish a locking circuit for itself in series with the buzzer 510 at armature 528. The buzzer 510 and the lamp 511 are operated to inform the dispatcher that the connector or code-sending switch H—1 is about to

be operated. The slow-releasing relay 505 is energized to prepare a circuit for itself, exclusive of the armature 522 and its front contact, at armature 525, and to disconnect conductor 540 from the winding of the relay 506 at armature 524.

When the circuit of the line relay 509 is again completed, the magnet 508 is energized to position its pawl and to complete a circuit for the slow-releasing relay 503. Upon the next interruption in the circuit of the relay 509, the magnet 508 is again deenergized. By this operation, the switch wipers 512 to 515, inclusive, are advanced into engagement with their third set of bank contacts.

The line relay 509 is now energized and, by reason of the fact that the impulsing relay 400 is maintained energized for a comparatively long interval of time, the slow-releasing relay 500 is permitted to deenergize. As a result of this operation, a circuit is completed extending from ground by way of wiper 515, bank contact with which said wiper is in engagement, armature 520 and its front contact, armature 516 and its back contact, wiper 514, bank contact 535, conductor 548, resting contact of spring 654 and said spring, and selecting relay 608 to battery.

The selecting relay 608 is energized to prepare selecting circuits at certain of these springs, to complete a locking circuit for itself at spring 653, and to complete a circuit for the relay 609 at spring 652. The relay 609 is energized to open the original energizing circuit of the relay 608 and, also, all the circuits by which the various relays in the primary selecting group might be operated.

The next series of interruptions produced in the circuit of the line relay 509 by the operation of the code-sending switch CD—1 bring about the advancement of the switch wipers into engagement with the bank contact set which includes the bank contact 536. After this operation, the line relay 509 is maintained energized for a comparatively long interval of time.

The relay 500 is deenergized to complete a circuit extending from ground by way of wiper 515, bank contact with which said wiper is in engagement, armature 520 and its front contact, armature 516 and its back contact, wiper 514, bank contact 536, conductor 542, and selecting relay 606 to battery. The selecting relay 606 is energized to complete a locking circuit for itself at spring 631, and to prepare a selecting circuit at spring 630.

By the next series of interruptions in the circuit of the line relay 509, the wipers 512 to 515, inclusive, of the connector switch H—1 are brought into engagement with their twenty-fifth set of bank contacts. The

line relay 509 is then maintained energized until the impulsing relay 400 is released.

By the operation of the wiper 513 into engagement with the bank contact 534, the circuits of both the slow-releasing relays 500 and 501 are opened and these relays are deenergized. By the engagement of the wiper 513 with the bank contact 534, a circuit is completed for the relay 506. The relay 506 is energized to open the circuit of the slow-releasing relay 505. The slow-releasing relay 505 is thereupon deenergized to complete a circuit extending from ground by way of wiper 513, bank contact 534, back contact and armature 524, conductor 540, working contact of spring 630 and said spring, working contact of spring 651 and said spring, and resistor 622 to battery. This circuit shunts the relay 600. The relay 600 is deenergized to remove battery from conductor 183 and to complete a circuit for the signaling device 616. By the change in signaling devices, the dispatcher knows that the proper selecting action has occurred at the substation.

When the impulsing relay 400 is finally deenergized at the station, the circuit of the relay 509 is permanently opened and this relay is deenergized to open the circuit of the stepping magnet 508. The stepping magnet 508 is deenergized to advance the switch wipers one step.

In the event that the wipers 512 to 515, inclusive, are not in their normal position, a releasing circuit is completed extending from ground by way of wiper 515, bank contact with which said wiper is in engagement, armature 520 and its back contact, back contact and armature 529, and magnet 508 to battery. The stepping magnet 508 is intermittently operated over this circuit to restore the wipers of the connector switch H—1 to their normal position.

By the removal of battery from conductor 183, the circuit of the relay 104 is opened, and this relay is deenergized to open the circuit of the relay 108 at armature 120. The relay 108 is deenergized to open the circuit of the slow-releasing relay 146 at armature 136. The relay 146 is deenergized to open another point in the circuit of the stepping magnet 142.

The dispatcher, having been informed that the desired selecting action has occurred at the substation, may now operate the control device 155, whereby three interruptions are produced in the circuit of the relay 144. The relay 144 is, consequently, deenergized three times to produce a corresponding number of interruptions in the circuit of the line relay 215 of the connector H at the substation.

Upon the first deenergization of the relay 215, the short-circuit is removed from the relay 200 and this relay is permitted to op-

erate. Upon operating, the relay 200 prepares a circuit for the relay 210 at armature 227, and at armature 226 prepares a circuit for the relay 203. When the relay 215 is energized, the circuit of the relay 203 is completed and this relay is operated to complete a circuit for the relay 202 at armature 231. The circuit for the relay 202 is effective upon the deenergization of the relay 215. The relay 202 operates to prepare another point in the circuit of the relay 210 at armature 230. When the relay 215 is energized, the circuit of the relay 205 is closed and this relay is operated to prepare a circuit for the relay 204 at armature 234. The circuit of the relay 204 is effective upon the deenergization of the relay 215. When the relay 215 is operated, a circuit is closed for the relay 207. The relay 207 is energized to complete a circuit for the relay 206 at armature 237.

By the energization of the relay 204, a circuit is completed which extends from ground by way of front contact and armature 233, front contact and armature 254, wiper 211, twenty-fifth bank contact, conductor 274 and relay 305 to battery. The relay 305 is energized to complete a circuit at armature 328 for the closing coil 306 of the circuit interrupter C. The closing coil of the circuit interrupter C brings about the closure of the unit. By the operation of the auxiliary switch 329, the circuit of the closing coil 306 is opened and the circuit interrupter is latched in closed position by the usual mechanical means.

The operation of the auxiliary switch 330 completes a circuit which extends from ground by way of said switch, armature 351 and its front contact, and relay 312 to battery. The relay 312 is energized to open the circuit of the relays 314 and 315 at armature 344, and to prepare a locking circuit for itself from ground through battery, relay 312, make contact at armature 351 and front contact and armature 344 to ground at the front contact of this armature. The relay 315 is deenergized to initiate the hunting action of the finder switch F—1 in the same manner as previously described.

The relay 314 is deenergized to prepare one point in the testing circuit at armature 350, and to complete a circuit for the slow-releasing relay 313 at armature 348. The slow-releasing relay 313 is energized to prepare a point in the circuit of the relays 314 and 315 at armature 347.

The operation of the finder switch F—1 and the code-sending switch CD—1, as well as the connector switch H—1, occurs in substantially the same manner as before described. However, inasmuch as the relay 312 is now energized, the second code point is changed from bank contact 458 to bank contact 457 so that a different code is sent

to the dispatcher's office. This difference in code brings about the energization of the selecting relays 608 and 605.

When the code-sending switch CD—1 and the connector switch H—1 are in their twenty-fifth position, a circuit is closed for operating the relay 600 and this relay is energized to bring about a change in the supervisory signals 616 and 617 to inform the dispatcher that the desired action has taken place at the substation.

At the substation, by the operation of the relay 413, ground is momentarily connected to the conductor 362. This operation brings about the energization of the relay 314 and also the operation of the relay 315. In this manner, the starting circuits of the finder switch F—1 are opened and the relay 312 is again placed in circuit with the auxiliary switch 330. The reason for again connecting the relay 312 to the auxiliary switch 330 is to secure the operation of the finder switch and the code sender in the event that the circuit interrupter is operated by apparatus at the substation.

It will be seen that, if the circuit interrupter is operated for any reason, the relay 312 will be deenergized to open the circuits of the relays 314 and 315. This action will initiate the operation of the finder and code sender switches in the same manner as before.

The dispatcher having been informed of the completion of the desired operation at the substation, he will restore the key K—2 to normal. By this operation, the circuit of the relay 144 is opened and this relay is deenergized to open the circuit of the line relay 215 of the connector H at the substation. Another result of the deenergization of the relay 144 is that the circuit of the slow-releasing relay 177 is opened at armature 176. This relay is deenergized to complete a circuit for the magnet 142 over a path that extends from ground by way of armature 164 and its front contact, magnet 142, armature 160 and its back contact, front contact and armature 166, twenty-fifth bank contact, wiper 154, and armature 163 and its back contact to battery.

The stepping magnet 142 is now operated to advance the switch wipers 151 to 154, inclusive, into their normal position. This operation causes the opening of the circuit of the stepping magnet 142, whereupon its operation ceases. By the movement of the switch wipers 151, the circuit of the relay 143 is opened and this relay is deenergized to open another point in the circuit of the relay 144. In this manner, the apparatus at the dispatcher's office is restored to normal.

By the deenergization of the line relay 215, the circuits of the slow-acting relays 217 and 218 are opened at armatures 243

and 244, while the short-circuit is removed from the relay 206 at armature 242. The relay 206 is energized to remove the short-circuit from the relay 209, thereby permitting this relay to operate in series with the counting relays that are energized. The relay 209 is energized to complete the circuit of the relay 208 at armature 240. The relay 208 is operated to open the circuit of all the counting relays and also the circuit of the relay 209 at armature 238, and to complete a circuit for the slow-releasing relay 221 at the front contact and armature 291.

The relay 217 is deenergized to restore certain circuits to normal. The relay 218 is deenergized to complete a circuit for the stepping magnet 225 over a path that extends from ground by way of armature 290 and its front contact, armature 291 and its front contact, armature 251 and its back contact, back contact and armature 262, and magnet 225 to battery. The magnet 225 is operated to rotate the wipers 211 to 214, inclusive, from their twenty-fifth position. By this operation, ground is removed from conductor 281 and the circuit of the relay 304 is opened. By the deenergization of the counting relays, certain circuits are restored to normal, among which is the circuit for the relay 305.

By the movement of the wiper 212, the circuit of the relay 216 is opened and this relay is deenergized. By the deenergization of the relay 216, the circuit of the slow-acting relay 221 and the stepping magnet 225 is opened. The switch wipers 211 to 214, inclusive, are thus brought to their normal position. The relay 221 is deenergized to restore certain circuits to normal.

It will be seen that absolute positiveness of operation is acquired by providing means for giving the dispatcher a checking signal in order to inform him that the desired selecting action has occurred at the substation. It is obvious that, in order to secure proper selection of the apparatus units at the substation, the code-sending switch CD must operate in synchronism with the connector switch H. Unless these switches are operated in synchronism, the pause in the impulsing, which occurs with the code-sending switch CD in its twenty-fifth position, will not be effective to release relay 219 to operate the selecting relays and there will be no answer-back signal returned to the dispatcher. The locking circuit for relay 219 is opened at the 25th position and unless the pause occurs at this time, relay 219 will not deenergize. The dispatcher will then release the key K—2.

By this operation, the circuit of the relay 144 is opened and this relay is energized to permit the deenergization of the relay 177. The deenergization of the relay 177 causes the wipers 151 to 154, inclusive, to rotate to

their normal position. The deenergization of the relay 144 opens the circuit of the line relay 215 at the substation. The release of the relay 215 opens the circuit of the relay 218, and also removes the short-circuit from the relay 200. The relay 200 is operated to close the circuit for the relay 210, providing the relay 216 is not energized. The relay 216 is not energized unless the switch wipers are in engagement with their twenty-fifth set of bank contacts.

In the present case, it has been assumed that the wipers of the connector switch H did not operate in synchronism with the wipers of the code-sending switch CD and that switch H will not be on the 25th position. The relay 210 will be energized to remove the short-circuit from the relay 209. By the deenergization of the relay 218, a circuit will be completed extending from ground by way of wiper 213, armature 251 and its back contact, back contact and armature 262, and magnet 225 to battery.

The magnet 225 is intermittently operated to rotate the switch wipers to their twenty-fifth position.

When the wipers are brought to their twenty-fifth position, the relay 216 is energized and is operated to complete a circuit for the stepping magnet over a path that extends from ground by way of armature 290 and its front contact, armature 291 and its front contact, armature 251 and its back contact, back contact and armature 262, and magnet 225 to battery. The magnet 225 is thus operated to restore the wipers 211 to 214, inclusive, to their normal position. The counting relays 200 to 207, inclusive, and the relays 208 to 210, inclusive, are released in an obvious manner.

The code-sending operation at the substation now reoccurs in the same manner as before described, as the relay 109 is operated, when the switch wipers are brought to their normal position to complete the circuit for the slow-releasing relay 110. The operation of the relay 110 initiates the code-sending operation in the same manner as before.

In the event that the code-sending switch CD and the connector switch H have been properly operated to bring about the desired selecting action at the substation, and the connector H—1 has not been properly operated by the code-sending switch CD—1, the dispatcher will not receive any signal indicative of the completion of the selection. This is true, because, in order to secure proper operation of the selecting apparatus, it is necessary that the wipers of the connector H—1 move in synchronism with the wipers of the code-sending switch CD—1 so as to provide a sufficient period of time to permit relay 505 to deenergize. In order to secure reoperation of the selecting apparatus the dispatcher will restore the key K—2 to

normal. The action at the dispatcher's office is the same in this case.

At the substation, the circuit of the line relay 215 is opened to remove the short-circuit from the relay 206 and this relay is operated to remove the short-circuit from the relay 209. By the operation of the relay 209, the apparatus at the substation is restored to normal in the same manner as before. The code-sending operation at the dispatcher's office will now reoccur to again initiate the operation of the code-sending switch CD—1 at the substation in substantially the same manner as before described.

It will be noted that, after the operation of one of the primary selecting relays 301, the relay 302 is operated. The operation of this relay prevents any other relays in the primary selecting group being operated. Consequently, this eliminates the possibility of false selection by defective operation of the connector switch H.

In a like manner, the operation of one of the relays in the secondary selecting group causes the operation of the relay 220, and this relay opens the selecting circuit so that no other relays in the secondary selecting group may be operated. This also prevents improper operation in the event of the completed operation of the connector switch H. The same statement is true with respect to the relay 609 associated with the connector switch H—1 in the dispatcher's office.

My invention is not limited to the particular arrangement of the apparatus described, but may be variously modified without departing from the spirit and scope thereof, as set forth in the appended claims.

I claim as my invention:

1. In a signaling system, a first station, a second station, a plurality of apparatus units at said second station, a code transmitter at said first station, means including said code transmitter for transmitting different code combinations of impulses to said second station individual to said units, a code receiver at said second station responsive to the code combinations of impulses for selecting one of said apparatus units, means for checking the transmitted codes with the received codes, means operative if said codes check for conditioning the apparatus unit corresponding to the code for operation, a normally inoperative code transmitter at said second station, means whereby it is rendered operative by said last-mentioned means for transmitting codes to said first station individual to said conditioned apparatus units, a code receiver at said first station responsive to said codes from said second station code transmitter, means controlled by said code receiver for indicating the selections conditioned at said remote station and means whereby the conditioned units may be operated from said first station.

2. In a supervisory control system, a first station, a second station, a plurality of apparatus units at said second station, a movable code transmitter at said first station, means including said code transmitter for transmitting code combinations of impulses to said second station individual to the units, a movable code receiver at said second station responsive to said codes for selecting said apparatus units for operation, means operative only at a predetermined position of said code transmitter and said code receiver if said code transmitter and said code receiver have moved in synchronism, for conditioning the apparatus unit corresponding to the transmitted code for operation, a code transmitter at said second station, responsive to said last-mentioned means, for transmitting a code to said first station individual to said selected apparatus unit, a code receiver at said first station, responsive to said second station code transmitter for indicating the apparatus unit selected for operation and means for thereafter operating the conditioned unit from the first station.
3. In a supervisory control system, a first station, a second station, a plurality of apparatus units at second station, a movable code transmitter at said first station, means including said code transmitter for transmitting code combinations of impulses to said second station individual to the units, a movable code receiver at said second station responsive to said codes for selecting said apparatus units for operation, means operative only at a predetermined position of said code transmitter and said code receiver in the event that said code transmitter and said code receiver have moved in synchronism, for conditioning a selected apparatus unit for operation, a code transmitter at said second station responsive to said last-mentioned means for transmitting a code to said first station individual to said selected apparatus unit, a code receiver at said first station responsive to said second-station code transmitter for indicating the apparatus unit selected for operation and a second code transmitter at said first station for transmitting a predetermined code to said second station for operating said selected apparatus unit.
4. In a supervisory control system, a first station, a second station, a plurality of apparatus units at said second station, a signaling device at said first station individual to each of said apparatus units, a movable code transmitter at said first station, means including said code transmitter for transmitting code combinations of impulses to said second station, a movable code receiver at said second station responsive to said code for selecting one of the said apparatus units for operation, means operative at a predetermined position of said code transmitter and said code receiver only in the event that said code transmitter and said code receiver have moved in synchronism, for conditioning the selected apparatus unit for operation; a movable code transmitter at said second station, responsive to said last-mentioned means for transmitting a code to said first station individual to said selected apparatus unit, a movable code receiver at said first station, responsive to said second station code transmitter, means operative in the event said second station code transmitter and first station code receiver are in synchronism for operating a signaling device individual to said selected apparatus unit and means whereby said selected unit may thereafter be operated from said first station.
5. In a signaling system, a first station, a second station, apparatus units at the second station, operating means individual thereto at the first station, signal devices at the first station individual to the units and controlled by the position of the units for indicating the instant position of the units, means whereby the operation of the individual operating means changes the indication of the corresponding indicating means and simultaneously causes the transmission of a code corresponding to the individual operating means, means responsive to the code for selecting the individual unit for operation, means responsive to the selection for then reoperating the indicating means to its original condition and means for thereafter operating the selected unit from the first station.
6. In a signaling system, a first station, a second station, a plurality of apparatus units at said second station, operating means individual to said units at said first station, signaling devices individual to and controlled by the position of each of said apparatus units at said first station, a code transmitter at said first station, a code receiver at said second station, means responsive to the operation of any one of said operating means for operating said code transmitter, means responsive instantaneously to the operation of said operating means for changing the indication of the individual signaling device, means responsive to the operation of said code transmitter for transmitting code combinations of impulses to said second station in accordance with the operated means, a code receiver at said second station responsive to a code for selecting one of said apparatus units and conditioning it for operation, means responsive to said selection for operating said signaling device individual to said unit at said first station to its original condition, means at said first station for operating said selected apparatus units and means at said second station responsive to the operation of said apparatus

units for again operating said signaling devices to indicate the operation of said apparatus unit.

7. In a signaling system, a first station, 5 a second station, apparatus units at the second station, operating means individual thereto at the first station, signaling devices at said first station individual to the units and controlled by the position of the units, 10 for indicating the position of the units, means whereby the operation of the individual operating means changes the indication of the corresponding indicating

means, a selecting apparatus simultaneously controlled by said means for selecting one 15 of the apparatus units individual to the operating means, means responsive to the selection for reoperating the indicating means to the original condition and means for thereafter operating the selected unit from 20 the first station.

In testimony whereof, I have hereunto subscribed my name this 22nd day of January, 1925.

THOMAS U. WHITE.