June 13, 1944. N. D. NEWBY 2,351,360

SELECTING SYSTEM

Filed Dec. 31, 1942 2 Sheets-Sheet 1

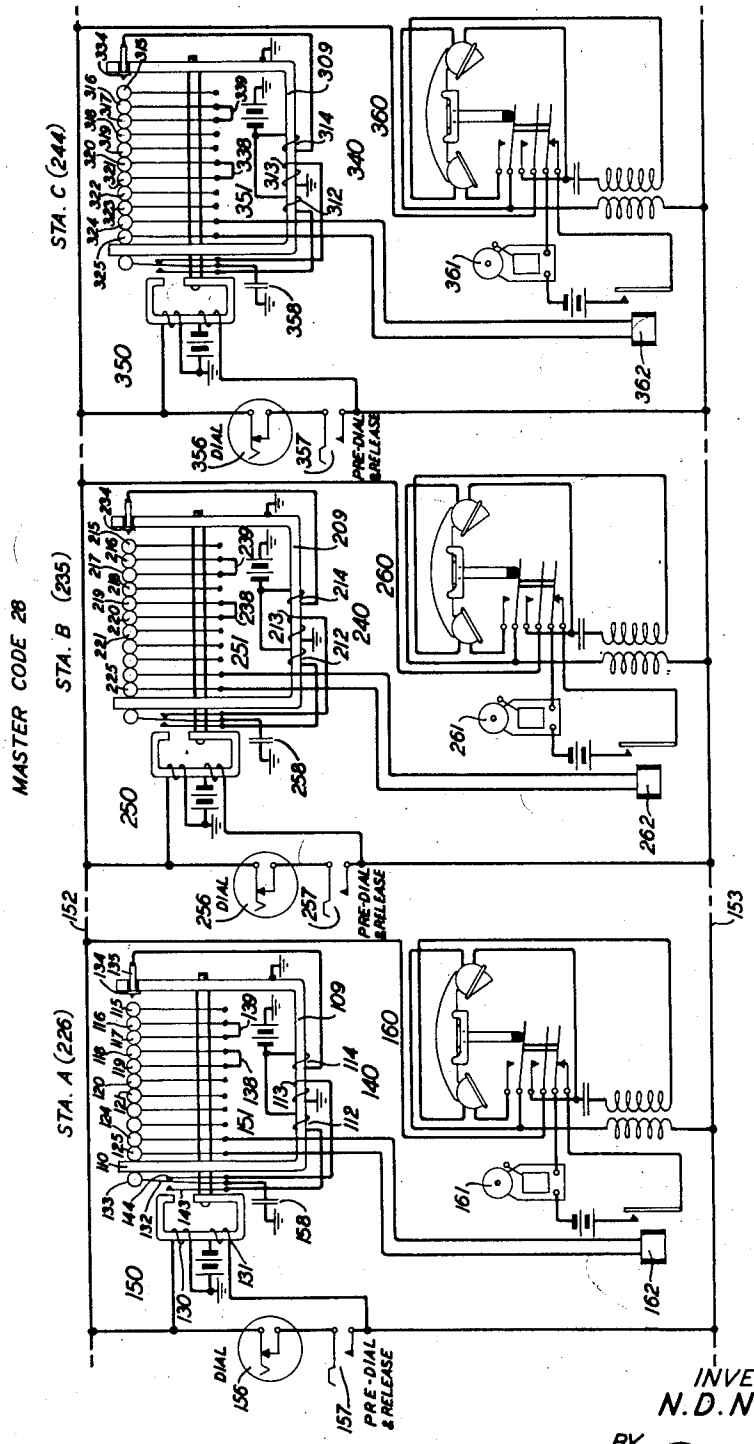

FIG. 1

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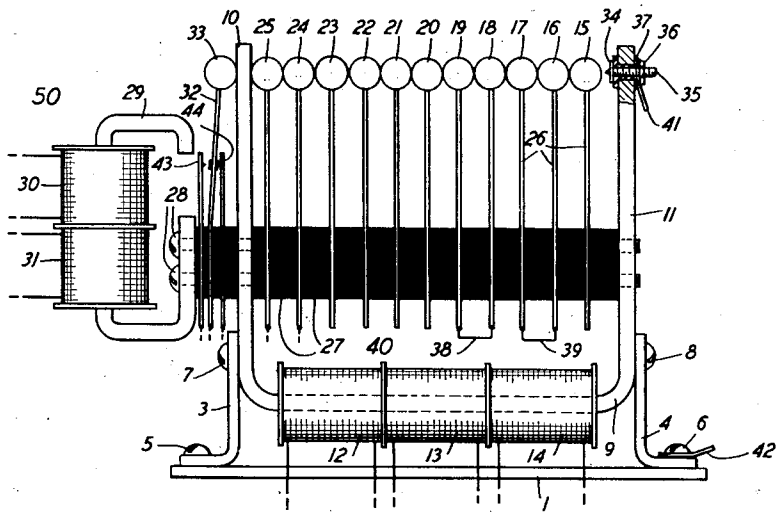
FIG. 2



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SELECTING SYSTEM

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9 Claims. (Cl. 177—342)

This invention relates to selective systems and has for its object to provide code selective arrangements which may be controlled by the standard telephone dial.

In the well-known code selective systems employed for train dispatching, a plurality of selectors are connected to a single conductor or pair of conductors. Each selector has a set of contacts aranged in accordance with a code to hold the selector against release whenever it is advanced to such a code position. Although every selector operates in response to each digit transmitted over the line, only a limited number of selectors will be held in their advanced position at the end of the first digit of the code. In response to a second digit, a smaller number will be in position to be held and at the end of the series of digits only one selector will have been placed in position to control its signal. Standard train dispatching systems employ pulses of alternate positive and negative polarities and, therefore, require rather complicated transmitting equipment.

In accordance with the present invention, a selector is provided which may be operated under control of the ordinary telephone dial.

Furthermore, the invention contemplates a selector comprising a series of resilient balls having two positions of rest, with means under the control of dial pulses for driving one ball at a time from one position of rest to the other together with means including the balls themselves, effective after reception of code numbers of pulses, for holding the balls in their alternate positions.

More specifically, the balls of the selector are composed of magnetic material and are held in their alternate positions under the control of an electromagnet, the circuit of said electromagnet being closed through the balls themselves if, and only if, the corresponding code digits have been dialed.

These and other features of the invention will be more clearly understood from a consideration of the following description in connection with the drawings in which:

Fig. 1 shows three stations of a train dispatching system employing selectors of the present invention; and

Fig. 2 shows the structure of the selector in detail. The same reference numerals have been applied to the various parts of the selector wherever they occur but in the circuit of Fig. 1 hundreds digits have been prefixed to the reference numerals in order to distinguish between the stations.

The structure of Fig. 2 will first be described. A somewhat similar device used for counting is disclosed in United States Patent 2,292,489, granted to G. R. Stibitz on August 11, 1942. Secured on a base 1 are two L-shaped brackets 3 and 4 held in place by screws 5 and 6. The screw 6 also holds in place a soldering lug 42. Between the brackets 3 and 4 an electromagnet 40 is held in place by screws 7 and 8. The magnet 40 consists of a U-shaped core 9 having two legs 10 and 11, and three windings 12, 13 and 14. Between the legs 10 and 11 are mounted a set of eleven resilient magnetic balls 15 to 25, each ball carried by a spring, such as spring 26. The springs are insulated from one another and from the legs 10 and 11 of the magnet core 9 by spacers of insulating material 27 and are held in place by means of screws 28 which extend through the legs of the magnet, the mounting springs and the spacers of insulating material. Outside of leg 10 and suitably insulated therefrom and from each other are mounted an electromagnet 50, having a C-shaped core 29 and two windings 30 and 31, together with a spring 32 carrying a ball 33 which serves as the armature for magnet 50 and contact carrying springs 43 and 44 which cooperate with contacts carried by spring 32. Balls 15 to 25 and 33 are arranged so that their centers lie in alignment. The screws 28 which hold the springs 26 in place also pass through one leg of the core 29 and through springs 32, 43 and 44 and through the insulation between them, thereby retaining the structure in operative relationship. Screws 28 are insulated from the springs and core members in any suitable manner.

The end of leg 11 has been shown broken away to disclose a contact arrangement carried by it. Screw 35 extends through an opening in leg 11 and terminates in a contact member 34. Screw 35 is insulated from leg 11 by means of insulating bushing 37 and is held firmly in place by means of nut 36. A soldering lug 41 is clamped between nut 36 and the bushing 37. The springs 26 terminate in soldering terminals by which they may be wired together by wire loops, such as loops 38 and 39.

Fig. 1 shows three of a plurality of stations comprising a train dispatching system which are connected together by line wires 152 and 153. Each station is equipped with the same apparatus, for example, station A includes a selector 151 like that shown in detail in Fig. 2, a telephone set 160, a dial 156 and a signal bell 161. Both the selector 151 and the telephone set 160 are connected between the line wires 152 and 153

but the telephone circuit is normally opened at the switchhook contacts. Winding 130 of magnet 150 is connected to line wire 152 and winding 131 is connected to line wire 153. When the subscriber at one of the stations, for example, station A, wishes to signal another station, he will first listen to determine that the line is not in use and then operate key 157, thereby closing a bridge across conductors 152 and 153 through key 157 and dial 156, and completing an operating circuit for all of the magnets 150, 250, 350, etc. on the line. Magnet 150 attracts spring 132 and draws ball 133 out of contact with leg 110 of magnet core 109. In addition it closes a circuit from ground through condenser 158 over springs 132 and 143 through winding 112 of magnet 140 to battery, thereby setting up a charging circuit for condenser 158. Winding 112 is energized by this charging current which creates a magnetic flux through the balls 115 to 125, holding the balls against leg 110. Similar operations take place at all of the stations connected to conductors 152 and 153.

Assuming that station C is to be signaled, the subscriber at substation A will then dial the digits 2, 4 and 4, which make up the code assigned to station C. At the first opening of the contact of dial 156, magnet 150 is deenergized and releases spring 132 which falls back sharply, causing ball 133 to strike against leg 110 and transmit an impact through balls 125 to 115 which causes ball 115 to move to the right and come to rest against contact 134. Due to the magnetic flux through the balls, ball 115 remains in its alternate position.

With spring 132 in its normal position, a circuit is closed from ground through condenser 158, springs 132 and 144, through winding 113 of magnet 140 to ground. Condenser 158, which has been charged, now discharges through the middle winding of magnet 140, maintaining the magnetic flux through the balls. The same action takes place at stations B, C, etc.

When the dial contact closes, magnet 150 again attracts spring 132 and recloses the charging circuit for the condenser 158 through winding 112 of magnet 140. At the second opening of the dial, balls 116, 216 and 316 are also driven into their alternate positions.

After this the dial contacts remain closed for an interval while the subscriber prepares to dial the next digit. Under this condition the charging current through the winding 112 would die down leaving magnet 140 deenergized. However, in the three stations shown, all of which have the digit 2 as the first digit of their respective codes, with two balls resting against the contact carried by the right leg of the holding magnet core, a circuit is closed which may be traced in the case of station A from battery through winding 114 of magnet 140, contact 134, balls 115 and 116, wire 139, balls 117 to 125 to ground over core 109. Therefore, magnets 140, 240 and 340 remain energized and hold the balls in position during the interdigital interval.

The subscriber now dials the second digit of the code of station C, that is the digit 4, causing balls 117, 118, 119 and 120, 217, 218, 219 and 220, 317, 318, 319 and 320 to be driven to the right. At the end of this digit a holding circuit is completed for magnet 340 which may be traced from battery through coil 314, contact 334, balls 315 to 320, wire 338, balls 321 to 325 to ground over core 309. In station A the springs of balls 120 and 121 are not connected and no holding circuit is established for magnet 140. The same is true of station B so that, as soon as the charging current for condensers 158 and 258 ceases, magnets 140 and 240 are deenergized and the balls of stations B and C return to their normal position.

When now the third digit of the code of station C is dialed, that is, the digit 4, balls 115 to 118 at station A and balls 215 to 218 at station B, are driven to the right, while at station C balls 321 to 324 are driven to the right. At station C, therefore, at the end of the third digit, a circuit is closed from battery through winding 314 of magnet 340, contact 334, balls 315 to 324, inclusive, winding of relay 362, ball 325 to ground through the core 309. Relay 362 operates in this circuit and closes an obvious circuit for bell 361 thereby signaling the subscriber at station C. When the subscriber raises his handset in response to this signal, the circuit of the bell is opened and the bell is silenced. Conversation may now take place between the subscribers at stations A and C.

At the end of the last digit, the selector pulse magnets 150, 250 and 350 are held operated due to the closure of the dial contacts and the continued closure of key 157. In the selector of station A, balls 115 to 118 are held in their alternate positions, at station B all the balls are normal, while at station C balls 315 to 324 are held in their alternate positions. At any time after the subscriber of station C has answered, the subscriber at station A may open his key 157 thereby releasing magnets 150, 250, 350, etc. at all stations. At station A, ball 119 is driven to the right, opening the interdigital holding circuit for magnet 140 and, when the discharge current for condenser 108 dies away, magnet 140 is deenergized, permitting all of the balls 115 to 125 to return to normal.

At station B, where all the balls were restored at the end of the third digit, ball 215 is driven to the right in response to the release of magnet 250, but, since no holding circuit is provided between balls 215 and 216, ball 215 returns to normal as soon as the condenser 258 is discharged. At station C ball 325 is driven to the right, also breaking the interdigital holding circuit, permitting magnet 340 to deenergize on the decay of the condenser discharge current and all of the balls to return to normal.

It is apparent that the structure of the present invention provides a convenient form of selector in which the selectors are arranged for responding to the various codes by merely changing the wiring between the ball-mounting springs. The only limitation on the code is that the digit 1 may never be used. It will also be apparent that all three stations may also be signaled by dialing either the group master code 28 or the general master code 0 (ten impulses), since an interdigital holding circuit is provided for all of these stations with two balls or with ten balls at the right. The arrangement of the selector wiring for other stations in this group and for other groups will be apparent.

It is also to be understood that a selector employing a larger number of balls, for example twenty, might be used to provide means for making selections in a system including a larger number of stations.

What is claimed is:

1. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative

position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses, means controlled by said balls to energize said holding magnet between trains of pulses in accordance with the number of balls in said alternative position at the end of each train of pulses, a signal, and means to operate said signal when a predetermined number of balls are held in said alternative position at the end of a train of pulses.

2. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses under the control of said pulse responsive means, means controlled by said balls to energize said holding magnet between trains of pulses in accordance with the number of balls in said alternative position at the end of each train of pulses, a signal, and means to operate said signal when a predetermined number of balls are held in said alternative position at the end of a train of pulses.

3. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses under the control of said pulse responsive means comprising a condenser and means for charging said condenser through said holding magnet and discharging it through said holding magnet at each pulse, means controlled by said balls to energize said holding magnet between trains of pulses in accordance with the number of balls in said alternative position at the end of each train of pulses, a signal, and means to operate said signal when a predetermined number of balls are held in said alternative position at the end of a train of pulses.

4. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses, a circuit for energizing said holding magnet over said balls between trains of pulses, said circuit completed only when predetermined numbers of balls are in said alternative position at the end of each train of pulses, a signal, and means to operate said signal when a particular predetermined number of balls are held in said alternative position at the end of a train of pulses.

5. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses, a circuit for energizing said holding magnet over said balls between trains of pulses, means to connect certain of said balls in pairs to complete said circuit at the end of each train of pulses in accordance with predetermined codes, a signal, and means to operate said signal when a predetermined number of balls are held in said alternative position at the end of a train of pulses.

6. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses under the control of said pulse responsive means, a plurality of circuits for energizing said holding magnet between trains of impulses, said circuits extending through said balls and completed only when a plurality of different numbers of said balls are in said alternative position at the end of each train of pulses in accordance with a predetermined code, said circuits becoming successively effective in response to successive trains of impulses, a signal, and means for operating said signal when the number of balls moved into and held in said alternative position is equal to the total number of impulses in all of said trains.

7. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses under the control of said pulse responsive means, a plurality of circuits for energizing said holding magnet between trains of impulses, said circuits extending through said balls and completed only when a plurality of different numbers of said balls are in said alternative position at the end of each train of pulses in accordance with a predetermined code, said circuits becoming successively effective in response to successive trains of impulses, and a signal in one of said circuits, said one circuit being completed when the number of balls moved into and held in said alternative position is equal to the total number of impulses in all of said trains.

8. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses, means to connect a plurality of pairs of said balls together in accordance with a predetermined code, a circuit for said holding magnet completed whenever one ball of a pair is in its normal position and the other ball of the pair is in its alternative position at the end of a train of pulses, said circuits being effective to prevent the return of said balls to their normal position between trains of pulses made up of corresponding numbers of pulses, and a signal, said signal operated over a particular one of said circuits if the total number of balls held in the alternative position equals the total number of pulses in all trains.

9. In a selecting device, a row of resilient magnetic balls in contact with one another, pulse responsive means for delivering an impact to the ball at one end of said row to drive one ball from

the other end of said row into an alternative position at each pulse, a magnet for holding said balls in said alternative position, means to energize said holding magnet during trains of pulses, means to connect a plurality of pairs of said balls together in accordance with a predetermined code, a circuit for said holding magnet completed whenever one ball of a pair is in its normal position and the other ball of the pair is in its alternative position at the end of a train of pulses, said circuits becoming successively effective to prevent the return of said balls to their normal position between successive trains of pulses made up of code numbers of pulses, and a signal, said signal operated over a particular one of said circuits if the total number of balls held in the alternative position equals the total number of pulses in all trains.

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