

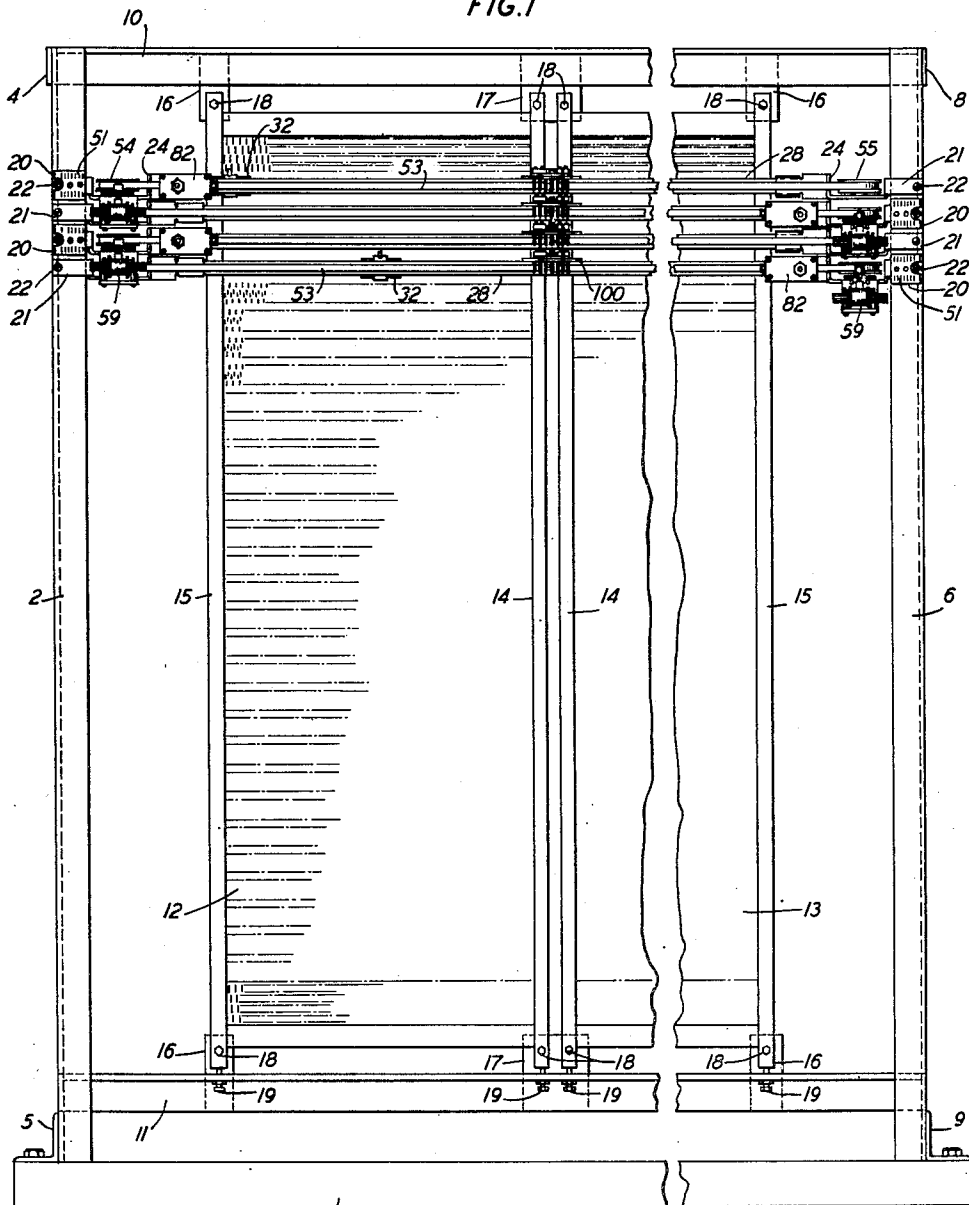
W. W. CARPENTER ET AL

SELECTOR SWITCH

Filed March 31, 1937

4 Sheets-Sheet 1

FIG.1



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July 12, 1938.

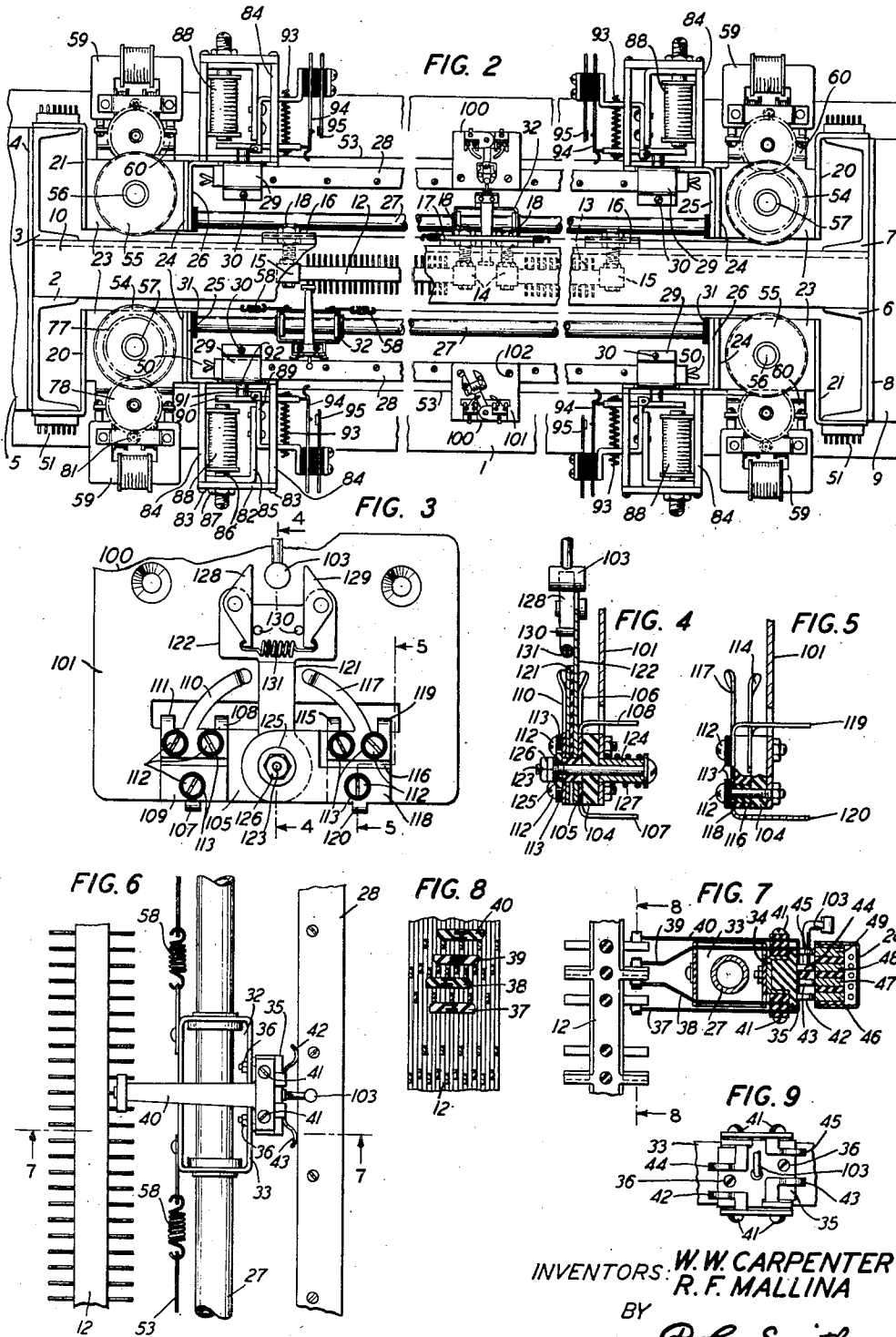
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2,123,229

SELECTOR SWITCH

Filed March 31, 1937

4 Sheets-Sheet 2



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2,123,229

SELECTOR SWITCH

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FIG. 10

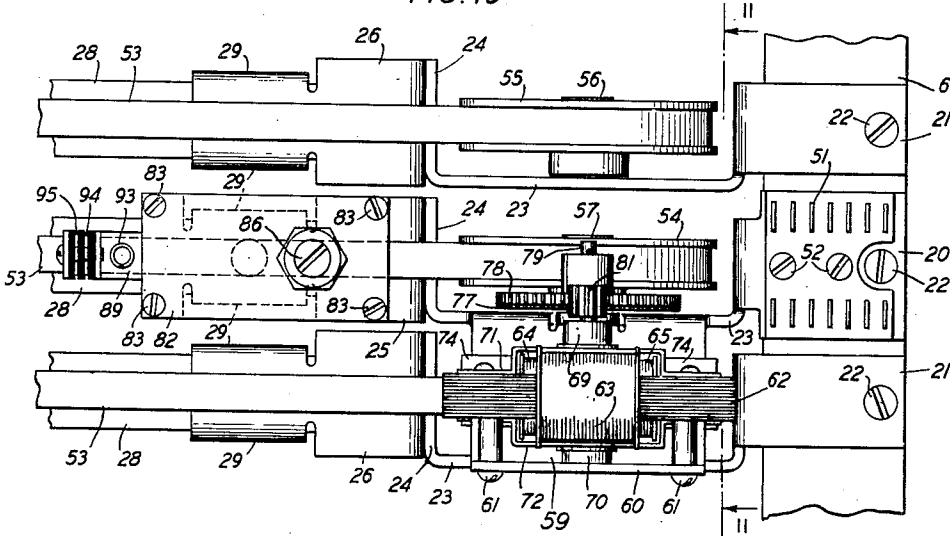
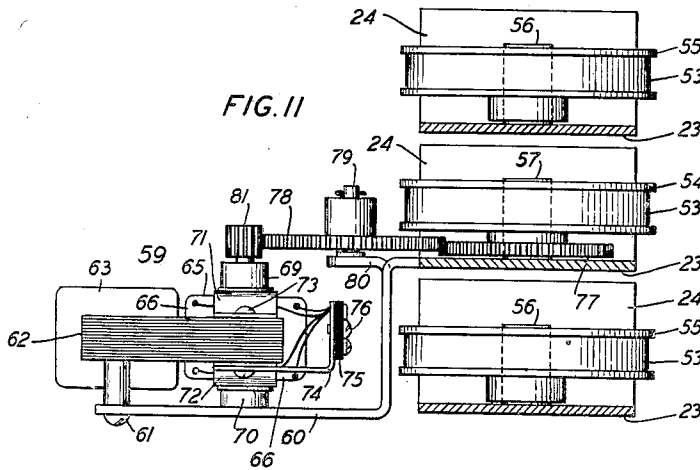


FIG. 11



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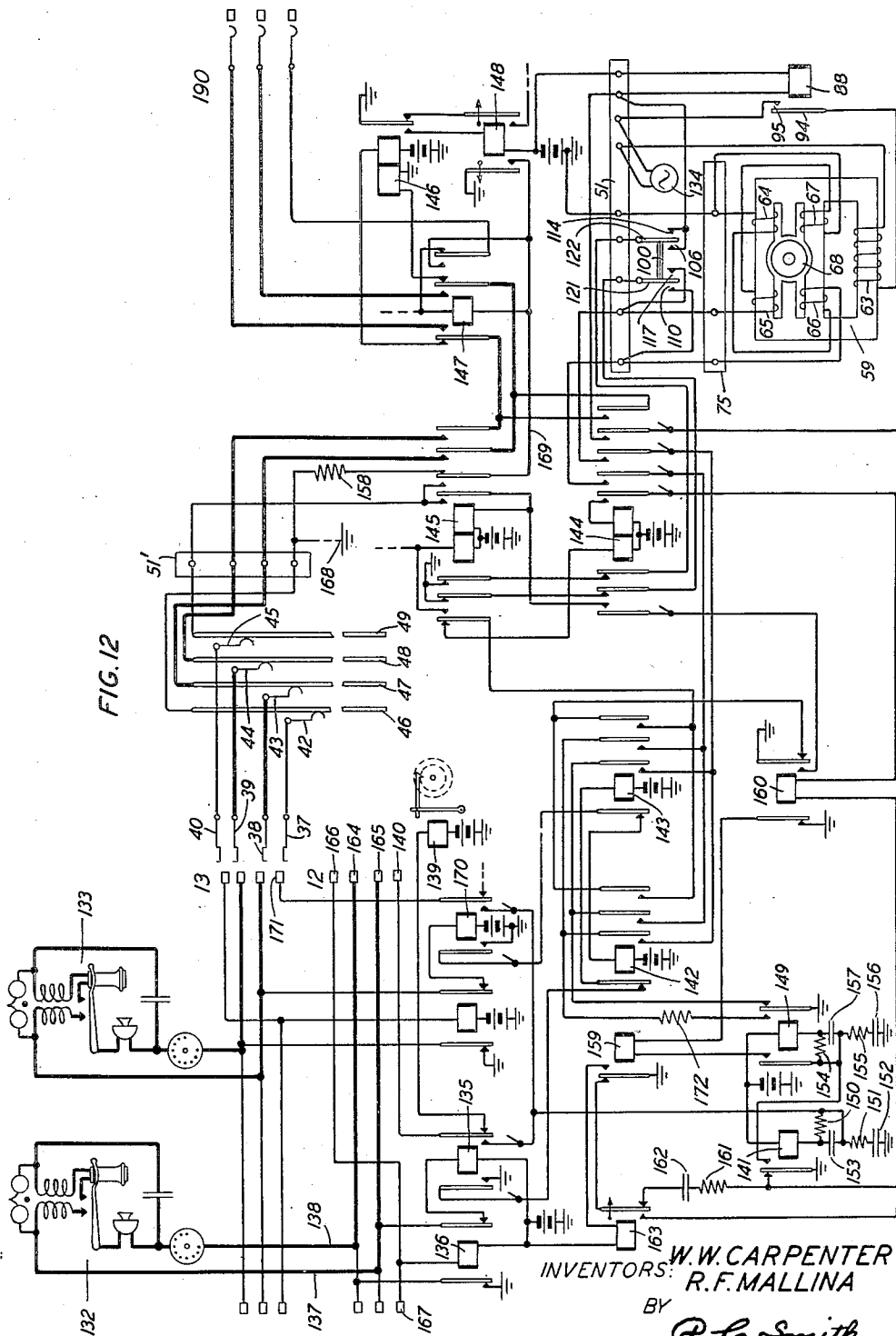
W. W. CARPENTER ET AL

2,123,229

SELECTOR SWITCH

Filed March 31, 1937

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UNITED STATES PATENT OFFICE

2,123,229

SELECTOR SWITCH

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Application March 31, 1937, Serial No. 133,970

18 Claims. (Cl. 179—25)

This invention relates to selector switches applicable for use in machine switching telephone systems and more particularly to switches of the terminal hunting type having access to large groups of line or trunk terminals.

In machine switching telephone systems selector switches either of the step-by-step or power driven panel type are used extensively as line or trunk finders and in some systems as trunk finders at selection stages under the control of controllers or markers. Heretofore such switches have been limited in their speed of operation by their inherent physical characteristics; in the case of step-by-step type switches, by the speed at which the stepping mechanism can be operated without undue wear and vibration and in the case of power driven switches of the well-known panel type, by the speed at which the brushes may be stopped and accurately centered by the commutator on the desired bank terminal.

For example, the panel type line finder, now widely used, employs ten sets of brushes mounted on a single elevator rod, the ten brush sets having access to ten banks of terminals in which subscribers' lines terminate. With this construction it is necessary that the distances between the brush sets on the elevator rod and the distances between terminals in the bank be in accurate relationship thus increasing the cost of manufacture and assembly. Each line finder is also equipped with a stationary commutator with which brushes mounted on the elevator rod engage for making electrical connections between the brush sets and outside wiring and for controlling the stopping of the hunting movement of the switch when one of the brush sets engages the terminals of a calling line. Since the accurate centering of a brush set upon the terminals of a calling line is dependent upon the commutator, it is therefore essential that the commutator be constructed and assembled on the switch with its segments in accurate relationship with the terminals of the bank. Furthermore, since the total mass of the switch to be accelerated and decelerated comprises the elevator rod, the ten brush sets, the commutator brushes and the wiring between the brush sets and the commutator brushes, the energy necessary for starting and stopping the movement of the switch is such that the hunting speed must be kept low, or at approximately forty terminals per second. It is customary to mount the ten panel banks upon a single frame and to assemble thirty elevators on the frame on each side of the double-faced bank. A unit of this type is too large and heavy for ship-

ment as an entirety and therefore it is necessary to partially disassemble the frame before shipment and to reassemble it at the place of installation thus further adding to the cost.

Since the central office equipment for machine switching systems is expensive, it is particularly essential therefore that it be used with the utmost efficiency. If equipment is slow in operation, a larger amount of equipment must be installed to handle peak loads than would be the case if equipment of a faster operating type were available thus increasing the first cost of installation and increasing the carrying charges and cost of maintenance. Furthermore, it is essential that connections shall be established between subscribers' lines and central office equipment as speedily as possible to guard against the possibility of wrong connections should subscribers start dialing within a short interval after the removal of their receivers from the switchhooks.

It is therefore the object of the present invention to provide a switch of the hunting type which may be driven at a high terminal hunting speed, which has small mass to be accelerated and decelerated whereby small energy is required for its operation, which makes provision for the accurate centering of a brush set on a set of bank terminals which has been placed in a calling condition without the use of a centering commutator, and which is economical to manufacture and assemble.

A further object of the invention is to provide a switch which may be used in any type of machine switching system where line finders, trunk finders or marker controlled selectors of the hunting type may be employed.

In accordance with the present invention these objects are attained by providing a line finder frame capable of accommodating the customary sixty finder switch units. Two panel banks of the same general type as are commonly used on the well-known panel type switch frames are mounted vertically thereon side by side, each bank being provided with one hundred sets of vertically disposed multiple terminal strips, each set having multiples for accessibility from thirty finder switch units on each side of the bank. By the provision of the two banks of one hundred terminal sets each, two hundred lines, trunks or links may be terminated thereon.

Mounted horizontally on each side of the switch frame in front of the thirty horizontal rows of two hundred terminal sets of the two banks are thirty finder switch units. Each switch unit comprises a single brush set of three

or more brush springs mounted on a light carriage slidable on a tubular guide rod secured at its opposite ends to brackets attached to the end uprights of the switch frame. Each brush spring terminates at one end in a contact shoe for engagement with bank terminals and in the other end in a commutator brush. Positioned parallel to the guide rod and in the same horizontal plane therewith is a channel member also secured at its opposite ends to the brackets and having within its channel as many commutator strips as there are brush springs in the brush set, the commutator strips being suitably insulated from each other and from the channel member. By the engagement of the commutator brushes of the brush springs with these commutator strips, electrical connection to the brush springs may be made irrespective of the position of the brush carriage along its supporting guide rod.

The brush carriage is traversed along the guide rod in either direction by a steel tape which runs over two pulleys or flanged drums mounted for rotation on spindles secured to the two brackets. The ends of the tape are secured to the brush carriage by coiled springs which serve to tension the tape and to act as shock absorbers when the movement of the tape is abruptly arrested. One pulley is an idler and the other is a driving pulley which may be rotated in either a clockwise or counter-clockwise direction through suitable gearing by an individual reversible alternating current motor, the gearing and motor being supported by the same bracket as the driving pulley.

To insure a quick stopping of the tape and brush carriage attached thereto, a magnetically releasable brake is provided. The brake includes two cooperating brake shoes, one on either side of a traverse of the tape, one being fixed and the other secured to the armature of the brake magnet. The brake mechanism is secured to the bracket upon which the driving pulley is journaled. The armature is normally operated by a spring to press the shoes together to embrace the tape, the leverage of the armature being such that the movement of the shoe attached thereto is very slight, but that the braking force supplied by the spring is quite large. The brake magnet winding is arranged to be operated simultaneously with the driving motor so that when the motor is operated to traverse the tape in either direction the brake magnet is energized to release the brake.

The brush carriage is normally positioned at the mid-point between the two banks and when started in either direction operates a double throw normalling switch mounted on the channel member at the mid-point thereof. This switch is instrumental for reversing the direction of rotation of the driving motor to return the brush carriage to its normal position when the connection established by the switch unit is released.

Since the moving parts of the switch unit have very little mass, the brush carriage may be accelerated and de-accelerated rapidly and the switch is therefore capable of being operated with a very small amount of power at hunting speeds far in excess of those heretofore attained. In fact, a hunting speed of two hundred and fifty terminals per second is easily attainable and a hunting speed up to four hundred terminals per second is possible.

To insure that the brush set when traversed at these high hunting speeds shall be stopped and accurately centered on a terminal set which has been marked as in a calling condition, a par-

ticularly sensitive test circuit is provided. The test circuit comprises a test relay the winding of which is normally connected in a charging circuit extending from battery through a first and second resistance and a first condenser to ground, the first resistance being shunted by a second condenser, both condensers being thus fully charged. When, however, the test brush to which ground is connected encounters the test terminal, the first condenser partially discharges and the relay tends to operate in the circuit over the test brush. If the test brush overruns the test terminal due to the speed at which it is moving, the test relay will not have time to fully operate and, with ground then removed from the test terminal, the first condenser will become fully charged and the test relay will be operated by the charging current until it decays when the relay will release. The test relay upon operating stops the movement of the brush carriage and prepares circuits for driving it back to the marked terminal set. If the brush set has overrun the terminal set then when the test relay releases the brush carriage is driven back until the brush set again engages the set of terminals. Since the second condenser is now fully charged it offers a low resistance shunt around the first resistance and the test relay reoperates opening the motor circuit to arrest further movement of the brush carriage.

Although in the foregoing brief description of the invention the two terminal banks have been described as mounted vertically on the switch frame with the switch units mounted horizontally, it will be obvious that the banks could be mounted horizontally, one above the other, with the switch units mounted vertically. It should be particularly noted that the entire frame with sixty switch units mounted thereon is very compact and occupies relatively small floor space and that due to the relatively light weight of each switch unit, the entire frame may be assembled and wired at the factory and shipped ready for installation. Furthermore, the replacement of any switch unit may be readily and speedily accomplished.

For a more complete understanding of the invention and the mode of its operation, reference may be had to the following detailed description taken in connection with the accompanying drawings of which:

Fig. 1 is a side elevational view of a switch frame embodying the invention showing a plurality of the switch units installed thereon;

Fig. 2 is a top plan view of the switch frame;

Fig. 3 is a plan view of the normalling switch;

Fig. 4 is a sectional view of the normalling switch as viewed along section line 4-4 of Fig. 3;

Fig. 5 is a partial sectional view of the normalling switch as viewed along section line 5-5 of Fig. 3;

Fig. 6 is a horizontal plan view of a portion of a terminal bank, guide rod, brush carriage and associated channel member;

Fig. 7 is a vertical view of a portion of a terminal bank, brush carriage and channel member as viewed along section line 7-7 of Fig. 6;

Fig. 8 shows a portion of the face of a terminal bank and contact shoes of the brush set as viewed along section line 8-8 of Fig. 7;

Fig. 9 is a partial end view of the brush carriage showing the commutator brush extensions of the brush springs;

Fig. 10 is a side elevational view showing a portion of three switch units including the idler pul-

leys of two units and the brake magnet, driving pulley and driving motor of a third unit;

Fig. 11 is an end elevational view taken along section line 11—11 of Fig. 10; and

Fig. 12 is a circuit diagram illustrating the manner in which the improved switch may be used as a line finder in a telephone system of the step-by-step type.

Referring now to the drawings, the invention will be described in more detail. Considering first Figs. 1 and 2 the switch frame comprises a base member 1 on one end of which are secured two channel-shaped uprights 2 and 3 joined at their upper ends by the strap 4 welded or otherwise secured thereto and joined at their lower ends by the angle bar 5 welded or otherwise secured thereto and by which the uprights are secured to the base 1. Similar uprights 6 and 7 joined by the strap 8 and angle bar 9 are similarly mounted on the other end of base 1. The upper ends of uprights 2 and 3 are also joined to the upper ends of uprights 6 and 7 by the angle bar 10 welded or otherwise secured thereto. The lower ends of uprights 2 and 3 are also suitably joined to the lower ends of uprights 6 and 7 by angle bar 11.

Positioned side by side between the end members of the switch frame are two panel terminal banks 12 and 13. Each bank is of the general type disclosed, for example, in Patent 1,127,741 granted February 9, 1915 to A. F. Dixon, and comprises two vertical side members 14 and 15 between which one hundred sets of multiple terminal strips and insulating separators are clamped. The banks are secured to the angle bars 10 and 11 by straps 16 and 17 which are attached to the angle bars by screws, not shown, and to the side members 14 and 15 of the banks by bolts 18. Each terminal strip is provided with thirty multiple terminals extending outwardly on each side of the bank, as shown in Figs. 6 and 7, and with soldering terminals at each end whereby accessibility is afforded to sixty selector switch units, thirty on each side of the bank. The terminal strips are arranged in sets of four, as most clearly disclosed in Figs. 7 and 8, to which the tip, ring, sleeve and metering leads of a subscriber's line may be connected, as disclosed in Fig. 12, although in some instances, as for example where the switch frame is to be used for other purposes, each set might comprise three terminal strips. The corresponding sets of multiple terminals of the several sets of strips in both banks are aligned horizontally and individualized to different selector switch units. To enable the alignment of the horizontal rows of terminal sets of one bank with the corresponding rows of terminal sets of the other bank, adjusting screws 19 are provided which extend through the lower angle bar 11 and engage beneath the side members 14 and 15 of the banks.

For supporting each selector switch unit on the switch frame in proper relation to the horizontal row of bank terminal sets to which it is individualized, two brackets 20 and 21 are provided, the supporting brackets of the switch units on the front of the frame being secured to the outside flanges of the upright channel members 2 and 6 by screws 22 and the brackets of the switch units on the rear of the frame being similarly secured to the outside flanges of the upright channel members 3 and 7. Each bracket is in general channel-shaped having a horizontal web 23, an outer flange by which it is attached to a vertical upright of the switch frame and an upwardly extending flange 24.

Secured respectively to the flanges 24 of the brackets 20 and 21 of each switch unit, as by screws or welding, are two L-shaped members 25 and 26 which serve to support the tubular guide rod 27 and channel member 28 of the switch unit in parallel relation to the face of the terminal banks. Each of these members is provided at its free end with two parallel inwardly extending ears 29 which together form a square socket for supporting one end of the channel member 28 which is clamped therein by a bolt 30 extending through the ends of the ears. The ends of the tubular guide rod 27 are seated in insulated bushings 31 which are secured to the members 25 and 26 in any desired manner.

Slidable on the guide rod 27 of each switch unit is a brush carriage 32 having a rectangular frame 33, the ends of which slidably embrace the guide rod. As shown in Figs. 6, 7 and 8, which disclose the brush carriage in more detail, a channel member 34 and insulating member 35 are bolted to the front side of the frame 33 by bolts 36. To the flanges of member 34 four brush springs 37 to 40, inclusive, are secured by the screws 41. The brush springs are insulated from each other, from the member 34 and from the screws 41 and each is provided at one end with a contact shoe for engagement with bank terminals, as most clearly shown in Fig. 8. The brush spring 37 serves as a testing and metering brush and engages the lower edges of test terminals of the bank, brush spring 38 serves as a ring brush and engages the lower edges of the ring terminals of the bank, brush spring 39 serves as a tip brush and engages the upper edges of the tip terminals of the bank and brush 40 serves as a sleeve brush and engages the upper edges of sleeve terminals of the bank, as viewed in Figs. 7 and 8.

The inner end of each brush spring is also extended as a feeder brush, the brush extensions 42 to 45, inclusive, of brush springs 37 to 40, respectively, being vertically staggered, as shown in Figs. 7 and 9, for sliding engagement with feeder strips 46 to 49, inclusive, insulatedly secured in the inside of channel member 28. The feeder strips are each provided at one end with a soldering terminal, indicated at 50 in Fig. 2, which may be connected to terminals on the terminal block 51 secured by screws 52 to the bracket 20. By means of the feeder strips and feeder brush extensions, conductive connections may be established from the terminals on the terminal block 51 to the brush springs 37 to 40, inclusive, irrespective of the position of the brush carriage 32 on the guide rod 27.

For traversing the brush carriage 32 along the guide rod 27 a steel tape 53 is provided which runs over two pulleys or flanged drums 54 and 55 preferably made of bakelite to render them of small mass. The pulley 55 is an idler pulley and is journaled on a spindle 56 secured to the web 23 of bracket 21. Pulley 54 is a driving pulley and is similarly journaled on a spindle 57 secured to the web 23 of bracket 20. The two ends of the tape 53 are attached to the opposite ends of the brush carriage 32 by spiral springs 58 which serve the dual purpose of tensioning the tape and absorbing the shock incident to starting and stopping the brush carriage.

For driving the pulley 54 a reversible alternating current motor 59 is provided which is mounted on a lateral extension 60 of the bracket 20 and is secured thereto by screws 61 as most clearly disclosed in Figs. 10 and 11. The motor comprises a laminated stator core 62 having

thereon a stator winding 63 and four shaded pole windings 64, 65, 66 and 67, shown more clearly in Fig. 12, and a rotor 68. The rotor shaft is journaled in two self-lubricating bearings 69 and 70 attached to brass supports 71 and 72 which are secured to the stator core 62 by the rivets 73. Also secured to the core 62 by the rivets 73 are two brackets 74 to which an insulating terminal strip 75 is attached by the screws 76. The terminal strip is provided with three binding posts to which the terminals of the pole windings 64 to 67, inclusive, of the motor are connected and which are in turn jumpered to terminals on the terminal block 81, as most clearly shown in Fig. 12.

The pulley 54 is driven by the motor 50 through a train of gearing comprising a gear 77 secured to the hub of pulley 54, an intermediate gear 78 journaled on a stub shaft 79 secured to the extension 80 of the bracket 20 and a pinion 81 secured to the rotor shaft of the motor. It will be noted by referring to Figs. 1, 10 and 11 that the driving motors of certain switch units are mounted at the right end thereof and that the motors of alternate units are mounted at the left end thereof for the purpose of permitting the units to be mounted compactly on the switch frame thereby materially reducing the height of the switch frame and enabling the use of standard panel banks.

Associated with each switch unit adjacent to the driving motor 50 thereof is a magnetically controlled brake which cooperates with the tape 53. Each brake comprises an end support 82 which is secured to the free arm of the L-shaped member 25 by screws 83 which extend through the support 82 and the spacing sleeves 84 and engage in threaded openings in the member 25. Secured to the inner side of the support 82 is an L-shaped return pole-piece 85 through which and through the support 82 the magnet core 86 is threaded. The threaded end of the core is provided with a slotted end portion by means of which the core may be turned in the threaded opening in the support 82 for adjusting the air-gap between the free end of the core and the magnet armature. For clamping the core in its adjusted position the lock nut 87 is provided. A magnet coil 88 is supported on the free end of the core 86.

Secured to the free end of the pole-piece 85 by screws is an L-shaped bracket 89 provided at the end adjacent to the free end of the pole-piece with ears between which the magnet armature 90 is pivoted. One end of the armature overlies the end of the pole-piece 85 and the magnet core 86 and is provided near its pivot with a brake shoe 91 which cooperates with the brake shoe 92 attached to the member 25. The coiled spring 93, one end of which is secured to the outer end of the armature 90 and the other end of which is secured to the free end of bracket 89, is provided for normally retracting the armature 90 and forcing the brake shoe 91 carried thereby toward the stationary brake shoe 92 to clamp the tape 53 therebetween. The position of the brake shoe 91 with respect to the pivot point of the armature, to the point of attachment of the spring 93 to the armature and to the end of the armature which overlies the end of core 86 is so chosen that the motion of the brake shoe is very slight, in the order of a few thousandths of an inch, but that the braking effort applied thereto by the spring 93 is quite

large. Since, however, the end of the armature which overlies the magnet core has considerable leverage, the magnet coil 88 when energized is quickly able to overcome the spring 93 to disengage the brake shoe 91 from the tape 53.

Insulatedly supported on the outer end of bracket 89 is a pair of contact springs 94 and 95, the inner one of which 94, is engageable by an insulating stud secured to the outer end of the armature 90 whereby when the armature is attracted to release the brake the contact springs are moved into engagement with each other for a purpose to be later described.

Each switch unit is provided with a normalling switch 100 mounted on the channel member 23 of the switch unit opposite the mid-point between the two banks 12 and 13. The normalling switch which is disclosed in detail in Figs. 3 to 5, inclusive, comprises a horizontal mounting plate 101 secured by screws 102 to the top flange of the channel member 23, two contact pile-ups secured thereto and insulated therefrom by the hard rubber insulating strip 104 and a switch bar pivoted to the mounting plate between the two contact pile-ups.

The left-hand contact pile-up comprises two separate bottom members 105 and 106 positioned adjacent to the insulating strip 104 and out of contact with each other, the member 105 having a soldering terminal 107 and the member 106 having a soldering terminal 108. Superimposed on the members 105 and 106 is a hard rubber insulating strip 109 on the upper portion of which is superimposed the contact member 110 having the soldering terminal 111. The contact members 105 and 110 are arcuate in formation and extend parallelly toward the pivoted switch bar. For securing the members of the contact pile-up to the support 101 bolts 112 are provided which extend through the contact members and insulating strips 104 and 109 and which are insulated from the contact members by insulating sleeves surrounding their shanks and by insulating washers 113 inserted beneath their heads.

The right-hand contact pile-up comprises a bottom contact member 114 positioned adjacent to the insulating strip 104 and having a soldering terminal 115, an insulating strip 116 superimposed thereon and two contact members 117 and 118 superimposed on the strip 116, the member 117 having a soldering terminal 119 and the member 118 having a soldering terminal 120. The contact members 114 and 117 are arcuate in formation and extend parallelly toward the pivoted switch bar. For securing the members of the contact pile-up to the support 101, bolts 112 are provided which extend through the contact members and insulating strips 104 and 116 and are insulated from the contact members by insulating sleeves surrounding their shanks and by the insulating washers 113 inserted beneath their heads.

The pivoted switch bar is a composite member comprising two blades 121 and 122 separated from each other by an interposed strip of insulating material. The composite switch bar is pivoted on a bolt 123 which extends through the metal sleeve 124, the mounting plate 101, insulating strip 104, contact member 105, the composite switch bar, the contact member 118 and the insulating washer 125 and is held in place by the lock nuts 126. For insulating the bolt from the contact members 104 and 118 and from the blades 121 and 122, the bolt is surrounded by an insulating sleeve, as most clearly shown in Fig. 4.

As thus assembled the switch blade 121 is in electrical contact with the contact member 118 and the blade 122 is in electrical contact with the contact member 105, good contact between them being insured by the spiral spring 127 which is interposed between the head of the bolt 123 and the mounting plate 101 surrounding the sleeve 124.

Pivoted to the outer end of the switch blade 122 are two fingers 128 and 129, the inner ends of which are normally positioned against the stop pins 130 by the coiled spring 131, the ends of which are secured to the inner ends of the fingers. In the upper portion of Fig. 2 the switch unit brush carriage is shown in its normal position at the mid-point between the terminal banks, in which position the insulated tip of the trip finger 103 attached to the brush carriage is engaged between the fingers 128 and 129 of the switch bar of the associated normalling switch 100 and the switch bar is thus held in its neutral position, or the position disclosed in Fig. 3.

Should the brush carriage move to the left, as viewed in Fig. 3, and engage the insulating tip of its trip finger 103 against the finger 128, due to the engagement of the finger against the stop pin 130, the movement of the brush carriage will rotate the switch bar about the pivot bolt 123 thereby engaging its blades 121 and 122, respectively, with the contacts 110 and 106 whereby two circuits are established, one from soldering terminal 107 of contact member 105, through switch blade 122 and contact member 106 to the soldering terminal 108 thereof, and the other from soldering terminal 120 of contact member 119 through switch blade 121 and contact member 110 to soldering terminal 111. Should the brush carriage move to the right as viewed in Fig. 3, and engage the insulating tip of its trip finger 103 against the finger 129, the switch bar then will be rotated to the right thereby engaging its blades 121 and 122, respectively, with the contact members 117 and 114 whereby two circuits are established, one from soldering terminal 107 of contact member 105 through switch blade 122 and contact member 114 to the soldering terminal 115 thereof and the other from soldering terminal 120 of contact member 119 through switch blade 121 and contact member 117 to the soldering terminal 118 thereof. The purpose of these circuits will be apparent from the following description of the application of the invention to a typical telephone system.

For the purpose of illustrating one of the many possible uses of the selector switch hereinbefore described, the switch has been shown in Fig. 12 as a line finder in a machine switching telephone system of the well-known step-by-step type. It is to be understood, however, that it could be equally well used in any type of telephone system where line, trunk or link hunting functions are to be performed.

Referring now to Fig. 12, two of the subscribers' lines 132 and 133 of a group of two hundred lines are shown terminating, respectively, in the banks 12 and 13 of a line finder frame. The brushes 37 to 40, inclusive, associated commutator brushes 42 to 45, inclusive, commutator strips 46 to 49, inclusive, reversible driving motor 59, brake magnet 88, terminal block 51 and normally switch 100 of one of the switch units on the line finder frame, the control relays individual thereto, the control relays common to all switch units on the frame and the brushes and some of the relays of

the first selector switch 190 individual to the line finder unit are also shown.

It will first be assumed that the subscriber whose line is indicated at 132 as terminating in bank 12 or the left bank of the line finder frame, initiates a call by removing the substation receiver from the switchhook thereby establishing a circuit for the line relay 135. This circuit may be traced from battery through the winding of relay 135, the right back contact of cut-off relay 136, ring conductor 137 of the line, through the sub-station, returning over tip conductor 138 to ground at the left back contact of relay 136. Line relay 135 thereupon operates, disconnecting at its back contact the winding of the subscriber's message register 139 from the metering and test terminal 140 of the bank 12, at its right front contact connecting the terminal 140 to the winding of test relay 141, which is common to all two hundred subscribers' lines which terminate in banks 12 and 13 and, at its left contact, establishing a circuit from ground there-over, over the back contact of group relay 142, which is common to the one hundred lines including line 133 terminating in bank 13, to battery through the winding of group relay 143 which is common to the one hundred lines including line 132 terminating in bank 12.

Group relay 143 upon operating opens at its back contact the operating circuit of group relay 142 to prevent any line in its one hundred line-group from starting a line finder at this time and at its outer right contact establishes a circuit for start relay 144 which is individual to the line finder unit disclosed. This circuit may be traced from battery through the left winding of relay 144, the outer left back contact of start circuit relay 145, also individual to the line finder unit disclosed, outer right contact of relay 143 to ground at the right back contact of common relay 100.

Relay 144 upon operating prepares an operating circuit over its left front contact through the right winding of relay 145, at its left back contacts disconnects ground from the switch blades 121 and 122 of the normalling switch 100, at its inner right front contact prepares a locking circuit for itself, at its next-to-inner right front contact prepares a short-circuiting path for the pole windings 64 and 66 of the motor 59, at its middle right front contact establishes a short-circuiting path for the pole windings 65 and 67 of the motor, at its next-to-outer right front contact establishes an operating circuit for the brake magnet 88 and at its outer right front contact establishes a loop circuit for operating the line relay 106 of the first selector switch 190. This latter circuit may be traced from battery through the right winding of relay 146, left back contact of cut-through relay 147, outer right front contact of relay 144, inner right back contact of relay 147 to ground through the left winding of relay 146. Relay 146 operates over this circuit and establishes an obvious operating circuit for slow-to-release relay 143 thereby preparing the selector switch for subsequent operation and connecting ground to holding conductor 169.

Brake magnet 88 now operates in a circuit extending from battery over a terminal of terminal block 51 through its winding, a second terminal on terminal block 51, the next-to-outer right front contact of relay 144 to ground at the back contact of common test relay 141. With magnet 88 operated the brake shoe 91 is with-

drawn from the tape 53 of the line finder switch unit and the stator winding 63 of the motor 59 is connected to the source of alternating current 134 over a circuit extending from the source 134, a terminal of terminal block 51, stator winding 63, contacts 94 and 95 closed by the energization of magnet 88, over another terminal of terminal block 51 to the source 134. Simultaneously with the operation of brake magnet 88 the short-circuiting path for pole windings 65 and 67 is closed from ground over a terminal of terminal block 51, right terminal of terminal block 75, thence serially through windings 67 and 65, center terminal of strip 75, a terminal on terminal block 51, middle right front contact of relay 140, inner right front contact of relay 143 to ground at the back contact of relay 143.

With the stator winding 63 energized by alternating current, the pole windings 65 and 67 short-circuited and the pole windings 64 and 66 open-circuited, the rotor 68 of motor 59 rotates in a counter-clockwise direction and through the train of gears 81, 78 and 77, rotates the driving pulley 54 in a counter-clockwise direction whereby the tape 53 is driven in such a direction as to move the brush carriage 32 of the switch unit toward the left in a hunting movement over a horizontal row of sets of terminals of the bank 12 to which the switch unit has access.

Upon the initial movement of the brush carriage from its normal position between the two banks of terminals, the trip finger 103 carried thereby moves the switch blades 121 and 122 of the normalling switch 100 to the left in which position the blade 121 engages terminal 110 and the blade 122 engages terminal 106 for a purpose to be later described. As the brush carriage advances the brushes 37 to 40, inclusive, carried thereby successively engage the sets of bank terminals of the one hundred lines including line 132 which appear in the left bank 12.

For arresting the movement of the brush carriage when the test brush 37 thereof encounters the test terminal of a calling line, the fast operating test relay 141 is provided whose winding is normally connected in a series circuit from battery through the one thousand ohm resistance 150, the one hundred ohm resistance 151 and a first condenser 152 to ground, the resistance 150 being shunted by a second condenser 153. Condensers 152 and 153 are thus normally fully charged over this circuit. When now in the advance of the brush carriage the test brush 37 engages the test terminal 140 of the calling line to which the winding of the test relay 141 has been connected, as previously described, a circuit is established from ground at the left front contact of relay 148 over holding conductor 169, right back contact of relay 145, resistance 156, a terminal on terminal block 51' which is a portion of terminal block 51, feeder strip 46, feeder brush 42, test brush 37, test terminal 140, right front contact of relay 135, resistance 150 and winding of relay 141 to battery. Relay 141 will tend to operate over this circuit, but does not have time to fully operate as the brush carriage is then travelling at high speed and the test brush 37 will overrun the test terminal 140 and make a passing contact therewith for only a small fraction of a second. This time is not sufficient to operate relay 141 for releasing the brake magnet 88 and for stopping the brush set on the calling line terminal set. Condensers 152 and 153 and resistances 150 and 151 are there-

fore provided to insure a positive and uniform circuit for operating the test relay while without them the relay would not have time to operate either due to the testing speed of the brush 37, or due to the vibration of the test brush on the test terminal.

When therefore the test brush 37 momentarily engages the test terminal, a discharge path for condenser 152 is established from ground through resistance 158 applied over the test brush, thence through resistance 151 and condenser 152 to ground over which path condenser 152 discharges sufficiently so that when the test brush overruns and leaves the test terminal 140 sufficient current will flow from battery through the winding of relay 141, condenser 153 which is now charged and offers a low resistance, resistance 151 and condenser 152 to ground to cause the operation of test relay 141. Relay 141 will now remain operated until condenser 152 becomes fully charged at which time, due to the decay of the charging current, relay 141 will release.

As soon as relay 141 operates it opens at its back contact the operating circuit or brake magnet 88 which releases clamping the moving tape 53 of the finder switch unit between the brake shoes 91 and 92 to immediately arrest the movement of the tape. Magnet 88 is made slightly slow to release at this time by the removal of the shunt from the circuit extending through resistance 161, condenser 162, back contact of relay 163 and the back contact of relay 159 to ground. Brake magnet 88 upon releasing also disconnects the source of alternating current 134 from the stator winding 63 of the motor.

At substantially the same instant the energization of test relay 141 reestablishes an operating circuit for relay 149 extending from ground over its front contact through resistance 154 and the winding of relay 149 to battery. Relay 149 upon operating opens at its back contact the short-circuit path through the pole windings 65 and 67 and locks itself in a circuit extending from battery through its winding, resistance 154 and its own left contact, winding of relay 159 to ground at the left back contact of relay 160. Relay 159 does not, however, operate in this locking circuit since its winding is shunted by ground applied over the front contact of test relay 141 so long as relay 141 remains operated.

To insure that relay 149 will operate and lock even though its operating circuit is momentarily opened due to the vibration of the front contact of test relay 141, resistances 154 and 155 and condensers 156 and 157 are provided, the condensers being normally charged over a path extending from battery through the winding of relay 149, condenser 157, resistance 155, condenser 156 to ground. Should the front contact of relay 141 chatter upon closing, a momentary closure thereof while of insufficient duration to cause relay 149 to operate and lock, will cause condenser 156 to discharge sufficiently over the discharge path traced from ground over the front contact of relay 141, through resistance 155 and condenser 156 to ground so that if the front contact of relay 141 should then momentarily open due to chatter, sufficient current will flow from battery through the winding of relay 149, condenser 157 which is now charged and offers a low resistance, resistance 155 and condenser 156 to ground to cause the operation of relay 149 which will then lock as previously described.

As soon as relay 149 operates it completes a shunting path through the pole windings 64 and 66 of the motor 59 which may be traced from ground over a terminal of terminal block 51, right terminal of terminal strip 75 thence serially through windings 64 and 66, left terminal of strip 75, a terminal of block 51, next-to-inner right contact of relay 144, middle right front contact of relay 143 through resistance 172 to ground at the right front contact of relay 149. Upon the release of test relay 141, as previously described, ground is removed from the operating circuit of relay 149 and one terminal of the winding of relay 159 and relay 159 now operates in the locking circuit of relay 149 in turn establishing an obvious operating circuit for slow-to-release relay 163. At its back contact relay 141 again establishes the previously traced operating circuit for brake magnet 83. With brake magnet 83 operated the brake shoe 91 is released from the tape 53 and the stator winding 63 of the motor 59 is connected to the alternating current source 134.

With the stator winding 63 now energized, the pole windings 64 and 66 short-circuited through resistance 172 and the pole windings 65 and 67 open-circuited, the rotor 68 of the motor 59 rotates at a slower speed in a clockwise direction thus rotating the driving pulley 54 in the same direction to advance the brush carriage 32 towards the right until the test brush 37 again engages the test terminal 100 of the calling line, at which time, since the brush carriage does not now attain a high speed, an operating circuit for test relay 141 is established. This circuit may be traced from ground applied to the test brush 37 through resistance 158, thence over test terminal 100, condenser 153 which being fully charged offers a low resistance to the flow of current in parallel with resistance 150, winding of relay 141 to battery. Relay 141 now operates to open the circuit of brake magnet 83 and since with relay 162 operated the circuit through resistance 161 and condenser 162 is ineffective magnet 83 releases quickly to arrest the movement of the brush carriage with the brushes thereof in engagement with the terminal set of the calling line 102 and to open the circuit of the stator winding 63 of the motor 59.

Relay 141 upon operating now shunts down relay 159 which immediately releases and opens the circuit of relay 163. Before slow-to-release relay 163 has time to release, with relay 159 released an operating circuit is established for relay 160 which may be traced from ground at the back contact of relay 159, front contact of relay 163, winding of relay 160, inner right front contact and right winding of relay 144 to battery. Relay 160 now operates, opening at its right back contact the initial operating circuit of relay 143, opening at its left back contact the locking circuit of relay 149 which, however, is now maintained operated under the control of relay 141, and at its right front contact establishes the operating circuit of start circuit relay 145. The circuit of relay 145 may be traced from battery through its right winding, the outer left front contact of relay 144 to ground at the right front contact of relay 160. Relay 145 upon operating locks in a circuit from ground at the left front contact of relay 143 over holding conductor 169, its next-to-inner and inner right front contacts and right winding to battery. When relay 163 finally releases after a predetermined interval following the release of relay 159, the circuit through the winding of relay 160

and the locking winding of relay 144 is opened and relays 160 and 144 now both release since the initial operating circuit of relay 144 has been opened through the operation of relay 145. With relay 144 now released the short-circuiting path through the pole windings 64 and 66 of the motor 59 is opened.

With start circuit relay 145 operated the tip conductor 138 of the calling line is extended over tip terminal 164, tip brush 39, feeder brush 44, feeder strip 48, terminal of terminal block 51', outer right front contact of relay 145, left back contact of cut-through relay 147 to battery through the right winding of relay 146 and the ring conductor 137 of the calling line is extended over ring terminal 165, ring brush 30, feeder brush 43, feeder strip 47, a terminal of terminal block 51', next-to-outer right front contact of relay 145, inner right back contact of relay 147 to ground through the left winding of relay 146. Relay 146, whose initial operating circuit was previously established over the outer right front contact of relay 144, is now maintained operated over the calling line loop thus maintaining relay 146 operated. The operation of relay 145 also establishes a circuit for cut-off relay 136 of the calling line which may be traced from ground at the left front contact of relay 143, over holding conductor 169, the next-to-inner right front contact of relay 145, a terminal of terminal block 51', feeder strip 49, feeder brush 45, sleeve brush 40, sleeve terminal 106, winding of relay 136 to battery. This same ground is also applied to the test multiples 107 of the calling line appearing in the banks of all connector switches having access to the line to mark the line busy to such connector switches. Relay 145 at its outer left front contact also extends the start wire extending from the contacts of group relays 142 and 143 so that if any other line in the two hundred line-group of subscribers' lines is calling the start relay of another available line finder unit, corresponding to relay 140, may be operated to start such other line finder unit. At its right back contact relay 145 also opens the circuit of test relay 141 which releases and in turn releases relay 149.

The cut-off relay 136 upon operating disconnects the winding of line relay 135 from the calling line whereupon relay 135 releases reconnecting the message register magnet 139 to the terminal 100, opening at its right front contact a second point in the operating circuit of relay 141 and at its left contact opening the operating circuit of group relay 143 which will now release if no other line in the same one hundred line-group of lines in which the calling line is located, is at the time in a calling condition. The common control relays 141, 149, 159, 160 and 163 are now released in readiness to control another line finder switch unit for establishing a connection with another calling line.

The calling line being now operatively connected with the first selector switch 190, the calling subscriber may proceed to operate his substation dial to set up a connection to a desired subscriber's line, cut-through relay 147 operating in the usual manner after the operation of the selector switch 190 to cut the talking circuit through to the succeeding selector switch and to disconnect the winding of relay 146 which thereupon releases in turn releasing relay 148. Holding ground for relay 145 and for maintaining cut-off relay 136 operated is thereafter supplied in the usual manner from the succeeding selector switch over a front contact of cut-

through relay 147 and conductor 169. If the call is successfully made, metering ground is connected as indicated at 168 in the usual manner thereby establishing a circuit from such ground over a terminal of block 51, feeder strip 46, feeder brush 42, test brush 37, terminal 140 and the back contact of line relay 135 to battery through the message register magnet 139.

When the established connection is no longer required and the subscribers restore their receivers to their switchhooks, the selector switches employed in establishing the connection are restored in the usual manner and holding ground is removed from conductor 169 thereby releasing cut-off relay 136 of the calling line and releasing relay 145. With both relays 145 and 144 released, ground is connected over the back contacts thereof to switch blades 121 and 122 of the normalling switch 100. It will be recalled that the blades of this switch were moved to the left by the movement of the brush carriage 32 to the left. Therefore, a circuit is now established from ground over the middle left back contact of relay 145, the outer left back contact of relay 144, a terminal on terminal block 51, switch blade 121, contact terminal 110, terminal of terminal block 51, the left terminal of terminal strip 75, thence serially through pole windings 66 and 64 of motor 59, right terminal of strip 75 and a terminal of block 51 to ground thus short-circuiting these windings. A second circuit is also established from ground over the inner left back contact of relay 145, inner left back contact of relay 144, a terminal on terminal block 51, switch blade 122, contact terminal 106, a terminal on terminal block 51, winding of brake magnet 88, a terminal on terminal block 51 to battery. Magnet 88 now operates releasing the brake shoe 91 from the tape 53 and closing the circuit of stator winding 63 of motor 59.

The rotor 68 of the motor now rotates in a clockwise direction thereby moving the brush carriage to the right. When the trip finger 103 engages the finger 128 carried by the switch bar 122 of the normalling switch, it rotates it away from the associated stop pin 130 against the tension of spring 131 and snaps over it into engagement with the finger 129 and since the finger 129 is prevented from pivoting by its associated stop pin 130 the switch blades 121 and 122 are moved by the continued movement of the brush carriage into their neutral position. As soon as the switch blades become disengaged from the contact terminals 110 and 106 the circuit of magnet 88 is opened and the short circuit of the pole windings 66 and 64 is also opened thereby arresting the further movement of the brush carriage. The brush carriage is now in its normal position midway between the two terminal banks, as disclosed in Fig. 2.

It will now be assumed that the subscriber whose line 133 is disclosed as terminating in the right terminal bank 13 initiates a call thereby operating line relay 170 to mark the test terminal 171 with calling potential and to operate the group relay 142. The circuit of relay 142 may be traced from ground at the left contact of relay 170, back contact of group relay 143, winding of group relay 142 to battery. In response to the operation of group relay 142, relay 144 is operated in the manner previously described and an operating circuit for the brake magnet 88 and a short-circuiting path for the pole windings 64 and 66 are established thereby. The operating circuit for magnet 88 is the same

as previously traced and the short-circuiting path for windings 64 and 66 extends from ground over a terminal on terminal block 51, the right terminal on strip 75, thence serially through windings 64 and 66, left terminal on strip 75, a terminal on block 51, next-to-inner right front contact of relay 144, middle right front contact of relay 142 to ground at the back contact of relay 149.

Upon the energization of magnet 88 the brake shoe 91 is released from the tape 53 and the circuit of the stator winding 63 of the motor 59 is closed and with the pole windings 64 and 66 short-circuited and the pole windings 65 and 67 open-circuited, the rotor 68 of the motor is rotated in a clockwise direction thus moving the brush carriage 32 to the right for hunting in the right terminal bank 13. The initial movement of the brush carriage now moves the blades 121 and 122 of the normalling switch 100 to the right into engagement respectively with contact terminals 117 and 114. The circuits now function in the manner previously described except that the test relay 141 is now controlled to stop and center the brushes 37 to 49, inclusive, on the terminal set of the calling line 133 due to the engagement of the test brush 37 with the test terminal 171. In this case, however, in the event that the brushes overrun the terminal set, the operation of relay 149 causes the short-circuiting of the pole windings 65 and 67 of the motor to rotate its rotor counter-clockwise thereby driving the brush carriage back to the terminal set. The path over which the windings 65 and 67 are short-circuited may be traced from ground over a terminal of terminal block 51, right terminal of strip 75, thence in series through windings 67 and 65, center terminal of strip 75, a terminal of block 51, middle right front contact of relay 144, inner right front contact of relay 142, resistance 172 to ground at the right front contact of relay 149.

When ground is removed from holding conductor 169 upon the termination of the connection and relay 145 releases, with relay 144 at that time released and the switch blades 121 and 122 in their right operated positions, a circuit is established for brake magnet 88 extending from ground over the inner left back contacts of relays 145 and 144, a terminal of terminal block 51, switch blade 122, contact terminal 114, a terminal of block 51, winding of magnet 88, a terminal of block 51 to battery. Magnet 88 operates releasing the brake shoe 91 from the tape 53 and closing the energizing circuit of the stator winding 63 of the motor. A short-circuiting path for the pole windings 65 and 67 is also established from ground over the middle left back contact of relay 145, the outer left back contact of relay 144, a terminal on terminal block 51, switch blade 121, contact terminal 117, a terminal on terminal block 51, the center terminal on strip 75, thence serially through pole windings 65 and 67, the right terminal on strip 75 and a terminal on block 51 to ground. The rotor 68 of the motor now rotates in a counter-clockwise direction to advance the brush carriage to the left into its normal position, in which position the switch blades are restored to their neutral position opening the circuit of magnet 88 and the path through pole windings 65 and 67.

What is claimed is:

1. In a selector switch having a bank of terminals and a brush set cooperating therewith, a brush carriage upon which said brush set is mounted, a belt for traversing said brush carriage

across said bank, means for driving said belt, and yielding means for attaching said brush carriage to said belt.

2. In a selector switch having a bank of terminals and a brush set cooperating therewith, a brush carriage upon which said brush set is mounted, a belt for traversing said brush carriage across said bank, supporting pulleys for said belt, means for driving said belt, and coiled springs by which each end of said belt is attached to said brush carriage for tensioning said belt.

3. In a selector switch having a bank of terminals and a brush set cooperating therewith, a brush carriage upon which said brush set is mounted, a guide rod positioned parallel to the face of said bank upon which said brush carriage is slidable, a channel bar positioned parallel to said guide rod, a plurality of feeder strips positioned within said bar and insulated therefrom and from each other, and feeder brush extensions of the brushes of said brush set engaging with said feeder strips.

4. In a selector switch having a bank of terminals and a brush set cooperating therewith, a brush carriage upon which said brush set is mounted, a belt for traversing said brush carriage across said bank, supporting pulleys for said belt, means for driving said belt, coiled springs by which each end of said belt is attached to said brush carriage, and a magnet operated brake for arresting the movement of said belt, said springs serving to tension said belt and to absorb the kinetic energy of said brush carriage and brush set when the movement of said belt is arrested.

5. In a selector switch having a bank of terminals and a brush set cooperating therewith, a brush carriage upon which said brush set is mounted, a belt for traversing said brush carriage across said bank, supporting pulleys for said belt, means for driving said belt, and a brake arresting the movement of said belt, said brake comprising a fixed and a movable brake shoe positioned respectively on opposite sides of a traverse of said belt, an electromagnet having an armature on which said movable brake shoe is supported, and a spring for holding said armature normally retracted whereby said belt is clamped between said brake shoes.

6. In a selector switch, a supporting frame having end members, two panel banks of terminals supported on said frame, and a switching unit for cooperation with said banks of terminals comprising end brackets for attachment to said frame members, a guide rod and a supporting bar joining said brackets, a brush carriage normally positioned opposite the mid-point between said banks and slidable on said guide rod and carrying a single set of brushes, a belt for traversing said carriage in either direction along said guide rod, an idler pulley journaled on one of said brackets and a driving pulley journaled on the other of said brackets over which said belt runs, and a reversible alternating current motor mounted on the last named bracket and geared to said driving pulley for driving said belt.

7. In a selector switch, a supporting frame having end uprights, two panel banks of terminals supported on said frame and a switching unit for cooperation with said banks of terminals comprising end brackets for attachment to said frame uprights, a guide rod and a supporting bar joining said brackets, a brush carriage normally positioned opposite the mid-point between said

banks and slidable on said guide rod, a single set of brushes and a trip finger mounted on said carriage, a belt for traversing said carriage in either direction along said guide rod, an idler pulley journaled on one of said brackets and a driving pulley journaled on the other of said brackets over which said belt runs, a reversible motor mounted on the last named bracket and geared to said driving pulley for driving said belt, and a normalling switch mounted on said supporting bar at the mid-point thereof and operable by the trip finger on said brush carriage to control said motor to return said brush carriage to its normal position.

8. In a selector switch, a supporting frame having end uprights, two panel banks of terminals supported on said frame and a switching unit for cooperation with said banks of terminals comprising end brackets for attachment to said frame uprights, a guide rod and a supporting bar joining said brackets, a brush carriage normally positioned opposite the mid-point between said bank and slidable on said guide rod, a single set of brushes and a trip finger mounted on said carriage, a belt for traversing said carriage in either direction along said guide rod, an idler pulley journaled on one of said brackets and a driving pulley journaled on the other of said brackets over which said belt runs, a reversible motor mounted on the last named bracket and geared to said driving pulley for driving said belt, a magnet controlled brake cooperating with said belt secured to said last named bracket adjacent to said motor, and a normalling switch mounted on said supporting bar at the mid-point thereof and operable by the trip finger on said brush carriage to control said brake and said motor to return said brush carriage to its normal position.

9. In a telephone system, a selector switch having a panel bank of terminals and a brush set cooperating therewith, a belt for traversing said brush set across said bank, a reversible alternating current motor for driving said belt, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means effective when a terminal of said bank is marked as in a calling condition for causing the energization of said stator winding and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to traverse said brush set in a hunting movement over said bank, testing means for arresting the hunting movement of said brush set when it engages said marked terminal, and means operated by said testing means for open-circuiting said short-circuited pole windings and for short-circuiting said other pole windings whereby said motor is reversed to return said brush set to said marked terminal when said brush set overruns said terminal in its hunting movement.

10. In a telephone system, a selector switch having two panel banks of terminals and a brush set cooperating therewith normally positioned midway between said banks, a belt for traversing said brush set across said banks, a reversible alternating current motor for driving said belt, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means operative in accordance with the bank in which a marked terminal is located for causing the energization of said stator winding and the short-circuiting of one pair of pole windings whereby said motor is operated in a direction to traverse said brush set in a hunting movement over the bank in which the marked terminal is

located, and testing means for arresting the hunting movement of said brush set when it engages said marked terminal.

11. In a telephone system, a selector switch
5 having two panel banks of terminals and a brush set cooperating therewith normally positioned midway between said banks, a belt for traversing said brush set across said banks, a reversible alternating current motor for driving said belt, said
10 motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means operative in accordance with the bank in which a marked terminal is located for causing the energization of said stator winding and the
15 short-circuiting of one pair of pole windings whereby said motor is operated in a direction to traverse said brush set in a hunting movement over the bank in which the marked terminal is located, testing means for arresting the hunting
20 movement of said brush set when it engages said marked terminal, and means operated by said testing means for open-circuiting said short-circuited pole windings and for short-circuiting said other pole windings whereby said motor is reversed to return said brush set to said marked
25 terminal when said brush set overruns said terminal in its hunting movement.

12. In a telephone system, a selector switch having a panel bank of terminals and a brush set
30 cooperating therewith, a reversible alternating current motor for advancing said brush set over said bank, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means effective when a terminal of said
35 bank is marked as in a calling condition for causing the energization of said stator winding and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance said brush set in a hunting movement
40 over said bank, testing means for arresting the hunting movement of said brush set when it engages said marked terminal, an off-normal switch controlled by the movement of said brush set from its normal position, and means including said off-
45 normal switch for causing the energization of said stator winding and the short-circuiting of the other pair of said pole windings whereby said motor is operated in the reverse direction to return said brush set to its normal position.

13. In a telephone system, a selector switch
50 having two panel banks of terminals and a brush set cooperating therewith normally positioned midway between said banks, a reversible alternating current motor for advancing said brush
55 set over either of said banks, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means operative in accordance with the bank in which a marked terminal is located for causing the energization of
60 said stator winding and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance said brush set in a hunting movement over the bank in which the marked terminal is located, testing means
65 for arresting the hunting movement of said brush set when it engages a marked terminal in either bank, a normalling switch controlled by the movement of said brush set in either direction from its normal position, and means including said normalling switch for causing the energization of
70 said stator winding and the short-circuiting of the other pair of said pole windings whereby said motor is operated in the reverse direction to return said brush set to its normal position.

75 14. In a telephone system, a selector switch

having a panel bank of terminals and a brush set cooperating therewith, a belt for traversing said brush set over said bank, a reversible alternating current motor for driving said belt, said motor
5 having a stator winding and two pairs of normally open-circuited shaded pole windings, a brake for normally holding said belt against movement, a magnet operable to release said brake and to cause the energization of said stator
10 winding, means effective when a terminal of said bank is marked as in a calling condition for causing the energization of said magnet and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance
15 said brush set in a hunting movement over said bank, testing means operative when said brush set engages said marked terminal to release said magnet to apply said brake and to deenergize said stator winding whereby the hunting
20 movement of said brush set is arrested, and means effective when said brush set overruns said marked terminal to reoperate said magnet, reenergize said stator winding, open-circuit said short-circuited pole windings and to short-circuit
25 said other pole windings whereby said motor is operated in the reverse direction to return said brush set to said marked terminal.

15. In a telephone system, a selector switch having two panel banks of terminals and a brush
30 set cooperating therewith and normally positioned midway between said banks, a belt for traversing said brush set over said banks, a reversible alternating current motor for driving said belt, said motor having a stator winding and two pairs of
35 normally open-circuited shaded pole windings, a brake for normally holding said belt against movement, a magnet operable to release said brake and to cause the energization of said stator winding, means operable in accordance with the
40 bank in which a marked terminal is located for causing the energization of said magnet and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance said brush set in a hunting movement
45 over the bank in which the marked terminal is located, testing means operative when said brush set engages said marked terminal to release said magnet to apply said brake and to deenergize said motor whereby the hunting movement of said
50 brush set is arrested, and means effective when said brush set overruns said marked terminal to reoperate said magnet, reenergize said stator winding and to short-circuit said other pole winding whereby said motor is operated in the reverse
55 direction to return said brush set to said marked terminal.

16. In a telephone system, a selector switch having two panel banks of terminals and a brush
60 set cooperating therewith and normally positioned midway between said banks, a belt for traversing said brush set over said banks, a reversible alternating current motor for driving said belt, said motor having a stator winding and two
65 pairs of normally open-circuited shaded pole windings, a brake for normally holding said belt against movement, a magnet operable to release said brake and to cause the energization of said stator winding, means operable in accordance with the bank in which a marked terminal is located for causing the energization of said magnet
70 and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance said brush set in a hunting movement over the bank in which the marked terminal is located, testing means operative when
75

said brush set engages said marked terminal to release said magnet to apply said brake and to deenergize said motor whereby the hunting movement of said brush set is arrested, a normalling switch controlled by the movement of said brush set in either direction from its normal position, and means including said normalling switch for operating said brake magnet and for short-circuiting the other pair of said pole windings whereby said motor is operated in the reverse direction to return said brush set to its normal position.

17. In a telephone system, a selector switch having a panel bank of terminals and a brush set cooperating therewith, a belt for traversing said brush set across said bank, a reversible alternating current motor for driving said belt, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, means effective when a terminal of said bank is marked as in a calling condition for causing the energization of said stator winding and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to traverse said brush set in a hunting movement over said bank, testing means for arresting the hunting movement of said brush set when it engages said marked terminal, and means operated by said testing means for open-circuiting said short-circuited pole windings and for short-circuiting said other pole windings through a resistance whereby said motor is operated at a slower speed in the reverse direction to return said brush set to said marked terminal when said brush set overruns said terminal in its hunting element.

18. In a telephone system, a selector switch

having a panel bank of terminals and a brush set cooperating therewith, a belt for traversing said brush set over said bank, a reversible alternating current motor for driving said belt, said motor having a stator winding and two pairs of normally open-circuited shaded pole windings, a brake for normally holding said belt against movement, a magnet operable to release said brake and to cause the energization of said stator winding, means effective when a terminal of said bank is marked as in a calling condition for causing the energization of said magnet and the short-circuiting of one pair of said pole windings whereby said motor is operated in a direction to advance said brush set in a hunting movement over said bank, testing means operative when said brush set engages said marked terminal to release said magnet after a predetermined interval to apply said brake and to deenergize said stator winding whereby the hunting movement of said brush set is arrested, means effective when said brush set overruns said marked terminal to reoperate said magnet, reenergize said stator winding, open-circuit said short-circuited pole windings and to short-circuit said other pole windings whereby said motor is operated in the reverse direction to return said brush set to said marked terminal, and means effective upon the reoperation of said testing means when said brush set re-engages said marked terminal to quickly release said brake magnet to arrest the return movement of said brush set.

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