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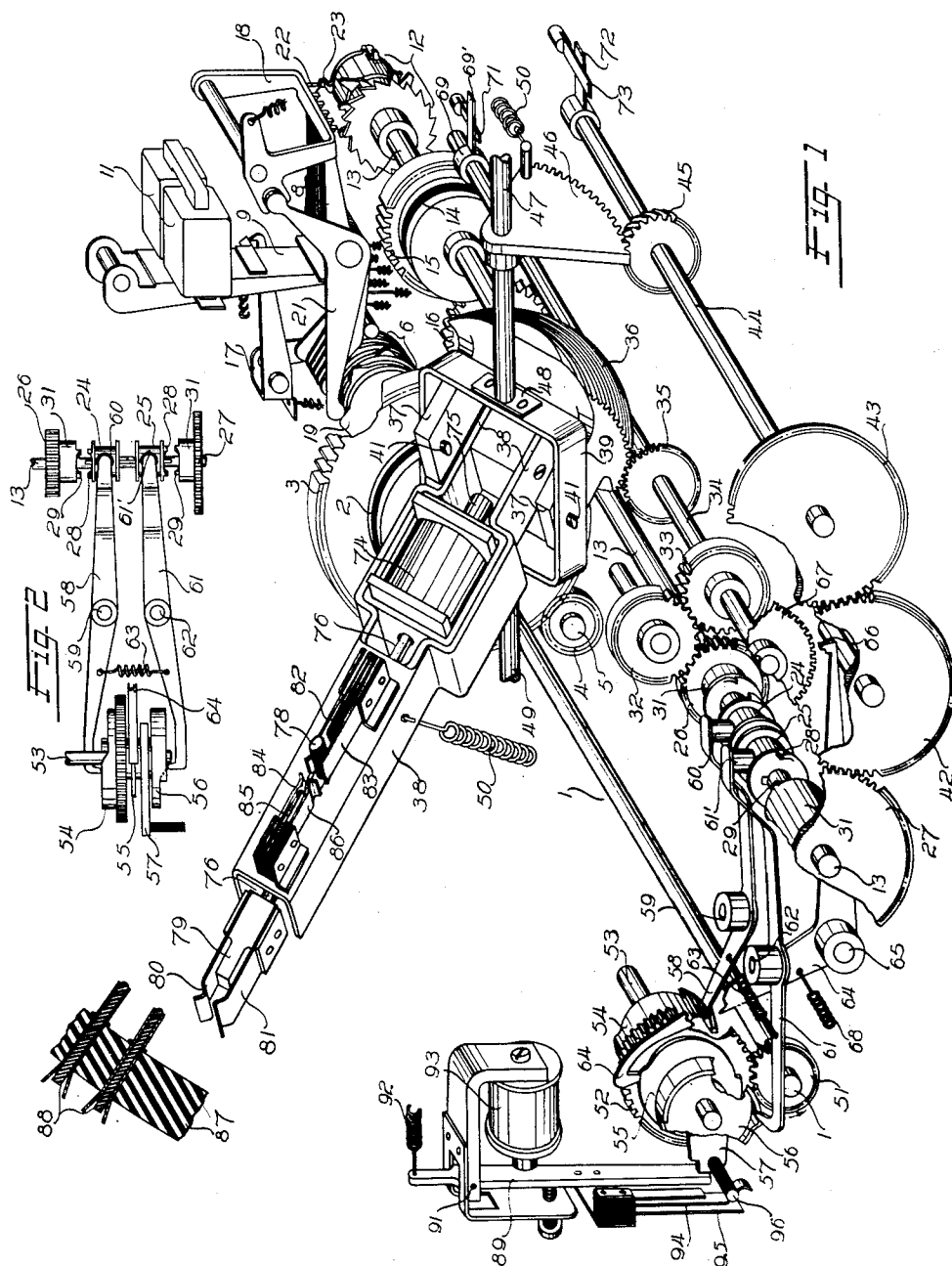
E. E. KLEINSCHMIDT

2,334,205

SELECTIVE SWITCHING

Filed April 10, 1940

3 Sheets-Sheet 1



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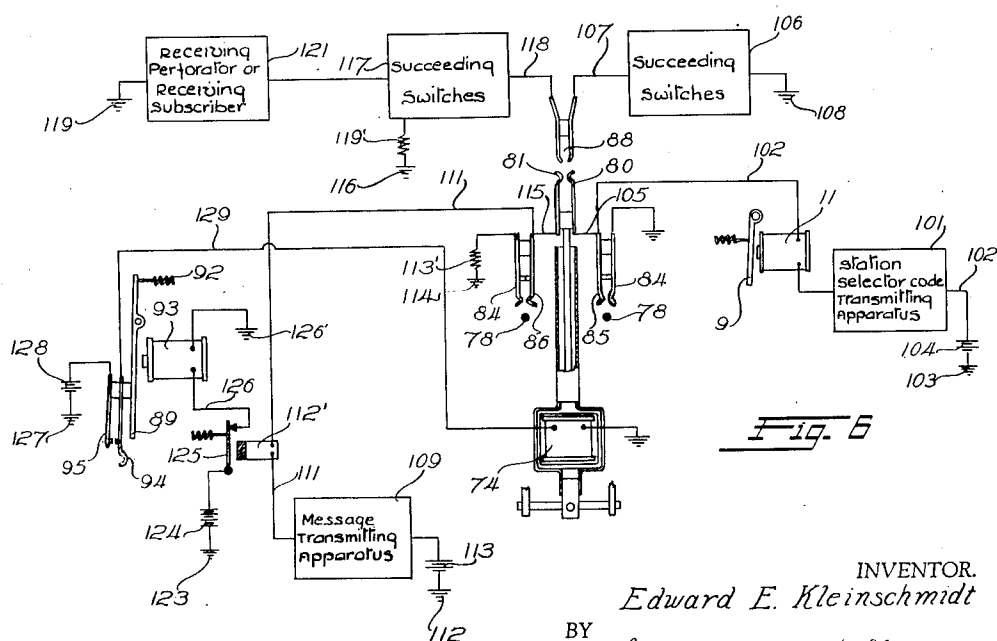
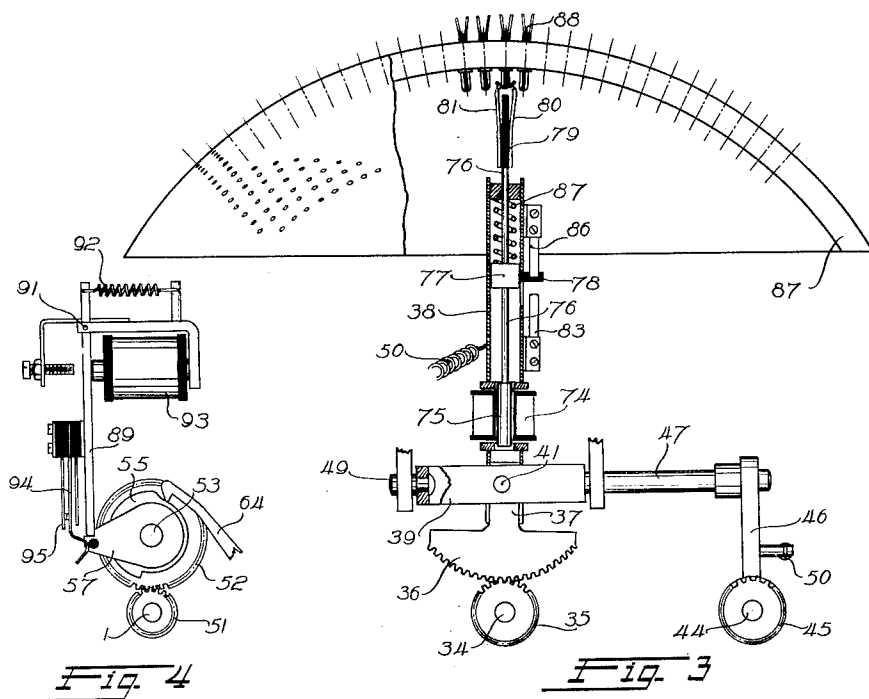
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3 Sheets-Sheet 2



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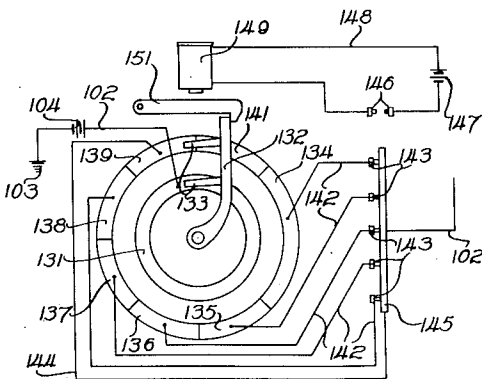
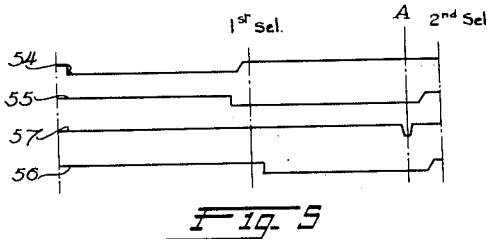
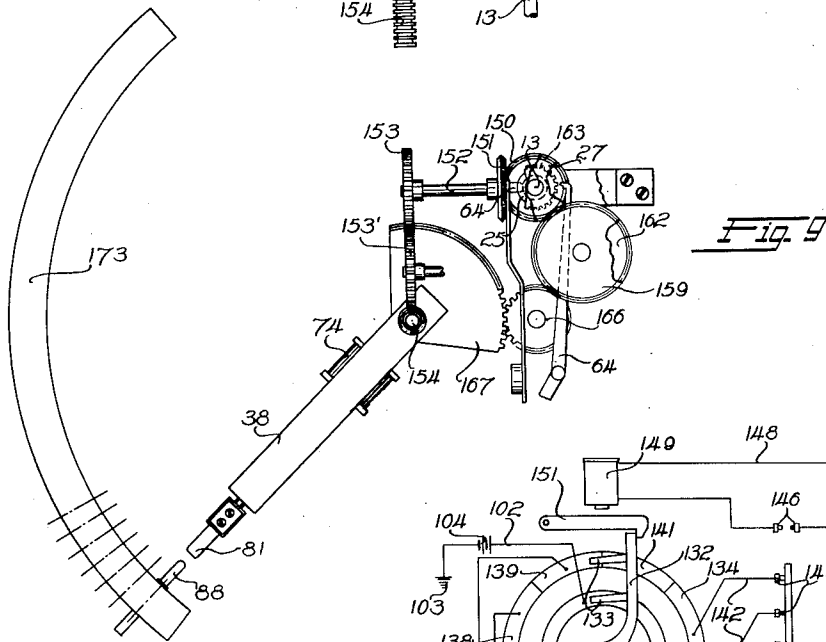
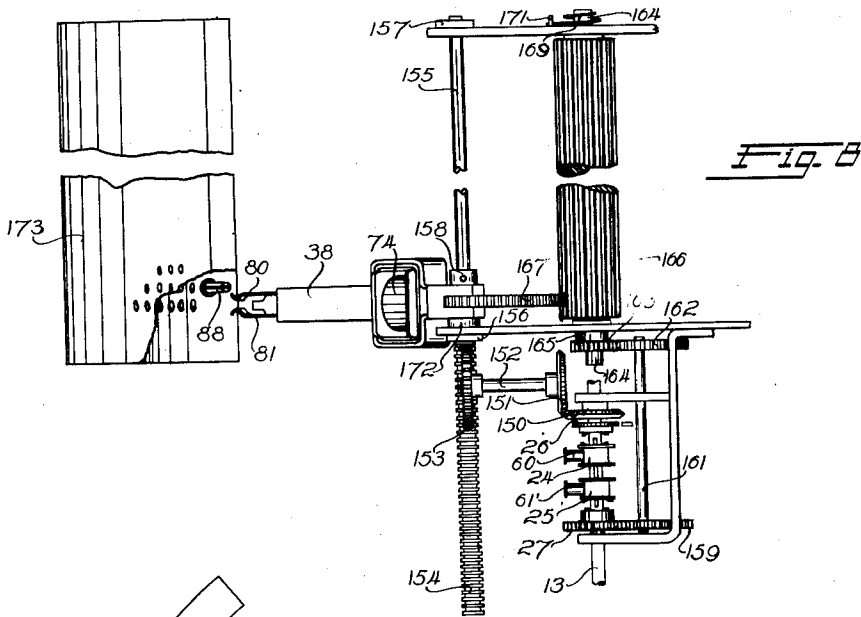
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3 Sheets-Sheet 3



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2,334,205

SELECTIVE SWITCHING

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Application April 10, 1940, Serial No. 328,958

22 Claims. (Cl. 177—353)

This invention relates to improvements in selective switching systems and mechanisms, and more particularly to switching arrangements for use in automatic telegraph, telephone, and supervisory control systems.

In such systems, as for example in the Automatic telegraph switching system disclosed in my application Serial No. 651,737, filed January 5, 1933 and issued March 19, 1940, as Patent No. 2,193,967, the speed of operation and reliability of switching devices to establish the selected transmission line connection, is an important commercial factor. It is accordingly a primary object of the present invention to provide novel and improved automatic switching mechanisms and improved switching methods that are more rapid and reliable in operation than the devices hereto proposed for the performance of such operations.

While the devices and arrangements herein-after disclosed are primarily designed to operate in the system disclosed in said Patent No. 2,193,967, as will be apparent to those skilled in the art, it can, with such modifications in the circuit arrangements as are well known in the art applied thereto, be used in other types of automatic telegraph switching systems, also in automatic telephone switching systems.

The commonly used automatic switching devices are step-by-step devices controlled by successive series of impulses which move a set of connecting brushes in two successive directions past rows of contact groups arranged in a bank to the selected position. The number of contact groups that can be efficiently selected by a single selector switch in such prior art step-by-step mechanisms is comparatively limited and the time of making each selection furthermore varies with the number of stepping impulses required to step the selecting brushes to the selected position. A further object of my invention accordingly, is to provide improved switching mechanisms having a much larger number of available efficiently selectable contacts or contact groups and in which the time of each selective movement is substantially uniform.

Other objects of the invention will appear from the detailed description of the preferred embodiments hereinafter set forth, and from the terms of the appended claims.

The objects of my invention are accomplished by the use of improved switching mechanisms having stationary banks of contacts arranged in a series of rows and a set or group of bodily movable contactors operated by a permutation code selector mechanism under the control of two successive groups of permutation code signals which act upon the selector and the switch mechanism connected thereto to position the group of bodily movable contacts to contact with any selected

group of contacts in the stationary banks in accordance with nature of the two successive groups of code signals received by the permutation code selector.

5 In the drawings:

Figure 1 is a perspective view of a preferred form of switching in which for clarity of disclosure parts are broken away, only one corner of a bowl-shaped support for the stationary banks of contacts is shown, and the supporting framework is eliminated.

10 Figure 2 is a detailed fragmental view showing cam and clutch mechanism utilized in the device shown in Figure 1.

15 Figure 3 is a view more or less diagrammatic, and partially in section of the movable contact member of the device of Figure 1 in operated position, and of part of the operating mechanism therefor.

20 Figure 4 is a fragmental view showing the stop magnet of the device of Figure 1 and its armature with the control contacts mounted thereon, and a cam unit all of which are shown in the operated position, corresponding to the operated position of the parts shown in Figure 3.

25 Figure 5 is a timing layout of the clutch control cams of the device shown in Figures 1, 2, 4, 8 and 9.

30 Figure 6 is a simple circuit diagram illustrating one form of system for operating my improved switching mechanism.

Figure 7 shows a preferred form of distributor for transmitting permutation code signals to operate my improved selective switch.

35 Figure 8 is a fragmental, more or less diagrammatic side elevation of a modified form of switching device embodying my invention in which the movable contact member has a vertical and rotary, instead of the spherical motion of the form of my invention shown in Figures 1 to 7.

40 Figure 9 is a more or less diagrammatic bottom view of the form of invention shown in Figure 8.

In the preferred embodiments of my invention I preferably utilize a selecting mechanism of the well known permutation code, single magnet printing telegraph type having, a start-stop control shaft and a selector shaft, the selected position of which is determined by the received code combination of impulses. Various types of such telegraph selectors are well known, and in the drawings I have therefore illustrated, and hereinafter will describe only so much of one form of such well known mechanisms as will be necessary to make clear its relation to and co-operation with the further mechanism of the present invention. I have accordingly illustrated, and will briefly describe the selector mechanism fully disclosed in my application Serial No. 95,883, filed August 13, 1936, and issued March 5, 1940 as Pat-

ent No. 2,192,351, as the initial receiving mechanism of the present invention.

Referring to Figure 1, start-stop shaft 1 is rotated through the friction coupling 2 attached to gear 3 which in turn is constantly rotated by a gear 4 mounted on shaft 5 of a motor not shown. Shaft 1 has fixed to it a group of selector cams 6 which actuate pivoted selector stop levers 8 under control of the armature 9 of magnet 11. Stop levers 8 control the progressive stopping of a stop wheel assembly 12 mounted on selector shaft 13 that is frictionally rotated through friction coupling 14 fastened to gear 15 and shaft 13. Gear 15 is constantly driven from gear 3 through a connecting idler gear 16. Stop lever 17 operated by armature 9 releases shaft 1 and selector cams 6 for rotation when a start impulse is received on magnet 11. Latch frame 18 releases and locks the stop levers 8 in succession as they are operated under influence of armature 9 in response to received code combinations of signals, and finally, through the action of cam 19 on lever 21, the last set stop lever 8 is released permitting stop wheel 12 and shaft 13 to assume the start or normal position in which the normal stop lever 22 engages the normal stop 23, as shown in Figure 1. The foregoing selector mechanism and its operation is described in said Patent No. 2,192,351 and as above pointed out, any one of a number of well known telegraph selecting mechanisms may be utilized in carrying out my invention now about to be described.

The normal rest position of my improved switch mechanism which is operated by the start-stop shaft 1, and the selector shaft 13 is shown in Figure 1. On the left hand end of shaft 13 (Figures 1 and 2) is mounted a clutch assembly consisting of clutch members 24 and 25 that are keyed to, and slidably mounted on, shaft 13. Adjacent to each of the clutch members 24 and 25, respectively, are gears 26 and 27 which are free to revolve on shaft 13 but held in position relative to clutch members 24 and 25 by suitable collars (not shown). Projecting lugs 28 on the clutch members 24 and 25 co-act with projecting lugs 29 on hubs 31 of gears 26 and 27, respectively, to ensure engagement of the clutch members and gears when the respective clutches are actuated as hereinafter set forth.

Gear 26 is connected through an idler gear 32 to gear 33 fastened to shaft 34 (Figures 1 and 2). Gear 35 also fastened to shaft 34 meshes with a spherical gear 36. Gear 36 is provided with projections 37 upon which movable switch member 38 is supported, and this assembly is pivoted in frame 39 on pivots 41.

Gear 27 is connected through idler gear 42 to gear 43 fixed to shaft 44 (Figures 1 and 2). Spiral gear 45 also fastened to shaft 44 is in mesh with a segmental spiral gear 46, which in turn is fastened through suitably journaled shaft 47. The end of shaft 47 is fastened at 48 to, and pivotally supports one side of frame 39 in which the movable contact carrying member 38 is mounted. The opposite side of frame 39 is pivotally supported on spindle 49 suitably journaled in the supporting frame work (Figure 3). The axis of pivotal movement of frame 39 about shaft 47 and spindle 49 is perpendicular to the axis of movement of member 38 about pivots 41. Member 38 is, therefore, mounted for universal movement under the influence of gear 26 and gear 27. Springs 50 connected to member 38 and segment gear 46 resiliently urge member 38 to its normal position of rest shown in Figure 1.

Mounted on the end of shaft 1 is a gear 51 (Figures 1 and 4) which revolves in direction of the arrow and meshes with gear 52 in a two to one ratio. Gear 52 is fixed to shaft 53 on which the cams 54, 55 and 56 (Figures 1, 2 and 4) and stop arm 57 are secured. One end of clutch lever 58 mounted on a pivot 59, engages the face of cam 54. A pin 60 on the opposite end of lever 58 engages in a groove of, and operates clutch member 24. One end of clutch lever 61 mounted on a pivot 62 engages the face of cam 56 and pin 61' on the opposite end of lever 62 engages in a groove of, and operates clutch member 25. Spring 63, the ends of which are attached to clutch levers 58 and 61 holds the ends of the clutch levers 58 and 61 against the faces of cams 54 and 56 respectively. One end of locking lever 64 mounted on a pivot 65 engages the periphery of cam 55, and the opposite end is provided with locking projection 66 adapted to engage the teeth of lock wheel 67 under the influence of spring 68.

A band 69 is fastened to shaft 34 and carries a stop arm 69' which in the normal or unoperated position rests against stop 71. Shaft 44 carries stop arm 72 which in the normal or unoperated position rests against stop 73 under influence of springs 50.

Solenoid 74 (Figures 1 and 3) is mounted in the movable contact member 38 and operates plunger 75. Attached to plunger 75 is rod 76 which actuates block 77 (Figure 3) carrying insulated stud 78 (Figures 1 and 3). Mounted on the outer end of rod 76 is an insulated block 79 to which are fastened the switch contact springs 80 and 81. The insulated stud 78 operates contact springs 82, 83, 84 and 86 in a manner and for a purpose that will more fully hereinafter appear. Spring 87 (Figure 3) returns rod 76 to its unoperated position when plunger 75 is released by solenoid 74.

A bowl-shaped frame 87, more clearly shown in Figure 3, supports a bank of switch contact units 88 adapted to be selectively engaged by contacts 81 and 82. The number of possible contact units in a row, as well as the number of rows of such contact units 88 depends on the number of stop positions made available by the permutation code selector. The telegraph selector unit disclosed specifically is responsive to five-unit permutation code combinations which provides for thirty-two selective positions of shaft 13. As hereinafter set forth, each selective operation of the switch is the result of two successive selecting code combinations. Therefore, thirty-two rows of thirty-two possible selective positions may be provided on frame 87, providing 1024 possible sets of switch contact assemblies 88.

Stop arm 57 (Figures 1 and 4) is controlled by a stop armature 89 pivotally supported at 91 and retracted by spring 92. Armature 89 is attracted into the path of stop arm 57 by magnet 93 which is normally energized and when stop arm 57 engages armature 89, the position of the stop arm 57, with relation to clutch control cams 54 and 56 is shown in Figure 5 at the position of the letter A. In this position of the cams, cam 55 permits spring 68 to retain locking lever 64 in locked position against lock wheel 67, and cam 56 permits spring 63 to retain clutch lever 61 in its operated position engaging clutch member 25 with gear 27.

Contacts 94 and 95 mounted on an insulating block carried by armature 89 are closed by the insulated pin 96 when stop arm 57 engages the stop armature 89.

Operation of the switching mechanism

In operation of the switch mechanism so far described, and with the parts in normal position as shown in Figure 1, gears 3 and 18 are revolving constantly under influence of motor driven gear 4. Shaft 1 is normally held stationary by stop lever 17, and shaft 13 is held stationary by normal stop lever 22 which engages the normal stop 23 of stop wheel assembly 12, all as described in detail in said application Serial No. 95,883. To operate the switch two successive groups of permutation code impulses each including a start impulse and a stop condition, are transmitted to selector magnet 11. The start impulse releases shaft 1 and cams 6, in cooperation with armature 3, operate stop levers 8 in accordance with the first received code combination. Stop levers 8 act on stop wheel 12 to successively stop shaft 13 in accordance with the positioning of stop levers 8 and finally stop shaft 13 in its first selected position.

As shown in Figure 1, at the beginning of the cycle of operations armature 89 of magnet 93, which is normally energized, abuts the end of arm 57, accordingly permitting rotation of shaft 1 without interference.

Immediately after the start of shaft 1, cam 54 releases clutch lever 58 which, under the influence of spring 63, shifts clutch member 24 into engagement with gear 26. Gear 26 now revolves with shaft 13 and, through idler gear 32 and gear 33 revolves shaft 34 and gear 35 turning spherical gear 36 and frame 38 about pivots 41 against the action of spring 50 to a position corresponding to the first selected stop position of stop wheel assembly 12.

Immediately after the first group of code signals is received on magnet 11, shaft 1 will have turned gear 52 through gear 51 to a position where cam 55 will release locking lever 64 to engage its projection 66 with lock wheel 67, thereby holding shaft 34 and, through the connected gear 35 and spherical gear 36, the carrying frame member 38 in the first selected position.

After receipt of the first group of permutation code signals by magnet 11 the normal stop impulse is received and shaft 1 is stopped. The cam shaft 53 at this stage of operation will have turned through one half revolution, and will be stopped at the position indicated by "1st Sel." in Figure 5. Clutch member 24 is now disengaged from gear 26 and locking projection 66 of lever 64 is engaged with the teeth of lock wheel 67. Immediately thereafter a start impulse and a second group of permutation code signals is received by magnet 11 which again releases shaft 1 and shaft 13 as above described. Selector cams 6 and armature 9 will again cooperate in accordance with the code signals received to successively stop the stop wheel assembly 12 at its final selected position and shaft 13 will be rotated to the same selected position.

When shaft 1 is again released on receipt of the second group of permutation code signals, gear 51 again revolves gear 52 and cam 56 attached to gear 52 immediately releases clutch lever 61 which, under influence of spring 63 moves clutch member 25 into engagement with gear 27. Gear 27 now turns with shaft 13 and, through idler gear 42, gear 43, shaft 44 and spiral gear 45, turns segmental spiral gear 46 a distance corresponding to the selected positioning of shaft 13. Segmental spiral gear 46 turns the pivoted frame 39 through shaft 47, 75

and so turns movable contact frame member 38 and the connected spherical gear 36 at right angles to the motion imparted to it by the gear 35 through spherical gear 36. During this motion the teeth of gear 36 slide in the teeth of gear 35. Cams 54, 55 and 56 are now in the position indicated in the timing layout, Figure 5, by A.

When the second set of code signals has been received, as hereinafter set forth in describing the operation of the system, magnet 93 being energized, as shown in Figure 4, armature 89 is positioned to engage arm 57, and to stop rotation. This occurs before cam 19 acts on lever 21 to release the last set stop lever 8, thus holding stop wheel assembly 12, shaft 13, and, through the connecting gears, movable contact frame 38 in the final selected position until the message transmission or other control operation has been completed over the selected circuit. As stop arm 57 comes to rest against armature 89, contacts 94 and 95 are closed completing a circuit for solenoid 74 which then is actuated to engage contacts 80 and 81 with the selected contact group 88, and to operate the contacts 82 to 86 through stud 78, thus completing the selected circuit.

After the control operations have been completed, and the message is transmitted or directly after the control operations are completed, as would be the case in a system where the message or talking circuits are joined by auxiliary apparatus, the magnet 93 is momentarily de-energized, armature 89 is released, and arm 57 is then freed so that it can rotate to the normal position shown in Figure 1. When armature 89 is released contacts 94 and 95 will be separated, de-energizing solenoid 74 and permitting spring 87 to disengage contacts 80 and 81 from the selected contacts 88, and to restore contacts 82 to 86. Cam 55 will also disengage projection 66 of lever 64 from wheel 67, and springs 50 will then restore the parts to the normal position shown in Figure 1, with stop arms 69 and 72 engaging stops 71 and 73, respectively. Shaft 1, upon being released by armature 89 assumes its normal stop position and the last set stop lever 8 is released permitting stop lever 22 to engage normal stop 23.

Telegraph switching system

The arrangement of contacts on the contact carrying member 38 is adapted for a telegraph switching system, such for example as is illustrated in Figure 6, comprising a station selecting circuit, and a message transmitting circuit.

It is intended that a selective switch shall be made available to groups of subscribers by connecting the station selector code transmitting apparatus and the message transmitting apparatus to the subscriber through line finders and circuits in the manner shown in my Patent No. 2,193,967, or in the manner generally in use for telephone switching systems.

The signals for operating the selective switch originate in the box 101 marked "station selector code transmitting apparatus" which is connected in line 102, grounded at 103, and provided with a source of signalling current 104. Selector magnet 11 of the switch is connected in line 102 which is normally grounded through normally closed contact springs 84 and 85 carried on switch contact member 38 and controlled by stud 78. Contact spring 85 is connected by conductor 105 to contact 80. When the selec-

tive switch completes a connection in a small exchange having a single selector the signal circuit is grounded through the selected subscribers circuit. In large exchanges the circuit is carried through succeeding selector switches 106 through contacts 88, line 107 and ground at 108.

The message transmitting apparatus is located in the box 109 connected in line 111 grounded at 112 and provided with a current supply source 113. Line 111 passes through slow acting relay 112', normally closed contact springs 86 and 84 carried on member 38, through resistance 113' to ground 114. Contact spring 86 is connected by conductor 115 to contact 81. The message circuit 111 is progressively carried to ground 116 at each succeeding switch 117 through conductor 118 and 119' equal to that of resistance 113' which is comparatively high. The purpose of this arrangement being to keep the message circuit 111 closed until the calling subscriber is connected to ground 119 through the receiving perforator or called subscriber 121, and also to control the automatic starting of the message when the connection is finally completed. This is accomplished by providing a marginal relay (not shown) that operates to start the transmitter when the high resistance 113' is cut out at the final receiving apparatus which occurs when the receiving apparatus is connected and in operating condition, all as described in said Patent No. 2,193,967.

Switch contacts 88, contact springs 80 and 81, and contact springs 85 and 86 are so arranged that insulated stud 78 will not open the connections between ground contact 84 and contact springs 85 and 86 until after the switch contact springs 80 and 81 are in contact with the selected switch contacts 88.

Magnet 93 is normally energized in the normal rest position of the selective switch through a circuit comprising ground 123, current supply 124, armature 125 of slow relay 112', conductor 126 to ground 126'. Stop armature 89 of magnet 93 rests against the end of stop arm 57 (Figure 1) and insulated pin 96 is out of the path of the contact spring 94 so that contacts 94 and 95 are open at this time. When however, the selective switch has been set to selected position as above described by two sets of permutation code impulses in succession, stop arm 57 will engage the end of armature 89 and insulated pin 96 will close the contacts 94 and 95, closing a circuit from ground 127 battery 128 through conductor 129 to energize solenoid 74 which thereupon operates plunger 75 and through rod 76 moves insulated stud 78 to open the contact springs 85 and 86 and brings switch contact springs 80 and 81 into contact with the selected switch contacts 88 completing the selected circuit so that transmission of the message from transmitter 109 may proceed.

After a circuit connection is made and a message has been transmitted, the transmitter opens the message circuit a sufficient time to release slow acting relay 112' which opens the circuit to magnet 93 releasing stop armature 89 from stop arm 57 to permit shaft 1 to assume its normal stop position. When this occurs contact springs 94 and 95 will open the circuit 129 to the solenoid 74, spring 87 will withdraw contacts 80 and 81 from the switch contacts 88, and insulated stud 78 will permit contact springs 85 and 86 to return to their position against ground contact 84. After the stop arm 57 is released cams 54, 55 and 56 as well as stop arm 57 assume their normal

stop position, as shown in Figure 1, thus releasing locking lever 64 from engagement with lock wheel 67. Clutch lever 61 is also moved by cam 56 to disengage clutch member 25 from gear 27. The movable contact arm 38 is now disengaged from the operating mechanism of the selecting switch and is returned to its normal position, as shown in Figure 1, by the springs 50.

Contacts 82 and 83 controlled by stud 78, which perform no function in the operations hereinbefore described may be utilized for various control operations in switching systems to which the mechanism is adapted. It will also be understood by those skilled in the art that provision for busy indications and other functions will be made in switching systems utilized in my improved switching mechanisms, such for example as are made in my Patent No. 2,193,967.

Improved transmitting distributor

The type of permutation code selector described for operating the selective switch reaches its selective positions in selected steps of one half, one quarter, one eighth, one sixteenth, and one thirty-second of a revolution, and movable contact member 38 which is positioned directly by the selector mechanism will therefore assume its ultimate selected position in corresponding steps, moving one half of its operating arc under the control of the first impulse, one quarter during the next, and so on. To provide more time for moving member 38 during the first selected positioning than would ordinarily be available with transmission from a standard type of transmitting distributor, I have provided a special type of transmitting distributor (Figure 7). In this distributor ring 131 is connected to line 102, battery 104 and ground 103. The motor driven distributor arm 132 through brushes 133 establishes contact successively between segments 134 to 141. Contacts 134 to 138 are connected by conductors 142 to the transmitter contacts 143. Segment 139 is connected by means of conductor 144 to transmitter contact bar 145 which in turn is connected to line 102. The start-stop rotation of arm 132 is controlled by transmitter contacts 146 which are connected through battery 147 and conductor 148 to magnet 149. Armature 151 of magnet 149 normally holds arm 132 from rotation. Contacts 146 are closed at the beginning of a code signal to energize magnet 149, freeing arm 132 for a single revolution. As brushes 133 establish contact with segment 141, line 102 is interrupted transmitting a start condition. Thereafter as brushes 133 establish contact successively with segments 134 to 138, line 102 is made and broken depending upon the position of contacts 143 which are set in accordance with the code combination to be transmitted. Arm 132 then comes to rest on segment 139 closing line 102 to establish a stop condition.

Segment 134 which controls the length of the first code impulse is about twice as long as the succeeding segments 135 to 138 to provide a longer interval for moving the comparatively heavy movable contact member 38 over the first positioning of one half of its operating arc.

Modified switching mechanism

Figures 8 and 9 show a modification in which the movable contact member 38 has a translatory motion for its first positioning, and a rotary motion for its second positioning. The selector and control mechanism, illustrated in Figures 1 to 5, is used and similar parts bear the same reference

numerals. In this modification gear 26 controlled by clutch member 24 is bevel gear 150 that meshes with a bevel gear 151 attached to suitably journaled shaft 152 which drives gear 153, also attached to shaft 152. Gear 153 meshes with idler gear 153', which in turn meshes with a cylindrical rack 154 which terminates in an extension rod 155. Rack 154 slides in a bearing 156 and the rod 155 slides in a bearing 157. Movable contact member 38 is attached to the rod 155 at 158 and moves therewith. Gear 27 meshes with gear 159, driving shaft 161, which drives gear 162 that in turn meshes with pinion 163. Pinion 163 is mounted on and drives a shaft 164, journaled at 165 in a suitable supporting frame work. Mounted on and driven by shaft 164 is a cylindrical gear 166 which meshes with and drives a segment gear 167. The opposite end of gear 167 is fastened to shaft 155 and the end of contact carrying member 38. A spiral spring 169 fastened to shaft 164 at one end, and to pin 171 at its other end, holds gears 166 and 167, and arm 38 in normal rotary position and gravity or a suitable spring holds the contact arm and rock assembly against stop abutment 172 in normal vertical or translatory position. Contacts 88 are carried on a cylindrical segment frame 173 so positioned with respect to arm 38 and its contacts, that the connections are effected upon energization of solenoid 74 after the arm has been selectively positioned.

In operation, as above set forth clutch 24 is actuated to cause rotation of gear 26 in accordance with the selected position assumed by shaft 13 in response to the first received code combination. Rotation of gear 26, through gear 151, 153 and 153' shifts rack 154 axially (vertically) a distance determined by the first selected movement of shaft 13. Locking lever 64 is then actuated to hold rack 154 in its selected translatory or vertical position until the mechanism is restored. Contact arm 38 is thus positioned adjacent the selected row of contacts 88 on frame 173.

Clutch 25 is then actuated as above set forth in response to the second received code combination to rotate gear 27 the distance selected by the second received code combination. This results in corresponding rotation of gears 162, 166 and 167 to position arm 38 adjacent the selected contact group 88 in the previously selected contact row.

After the second selecting movement of arm 38 has been completed, armature 89 engages arm 57, the selector is locked in selected position and solenoid 74 operates to engage contacts 80 and 81 with switch contact 88. When the control operation has been completed magnet 93 is momentarily de-energized, all as above set forth, to permit restoration of arm 38 under influence of gravity and spring 169 to normal position shown in Figures 8 and 9.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a selecting mechanism, a selecting member having a normal position and movable in

two directions to a substantially equal number of selectable positions in each direction; a first mechanism for moving said member from said normal position in its first direction to any one of a plurality of said selectable positions by a single movement of said member; means operable after the movement period for holding said member at the end of said first movement; a second mechanism for moving said member from its position at the end of said first movement through its second direction to any one of a plurality of said available selectable positions by a single movement of said member; means operable after said second movement period for holding said member in the selected position; selector mechanism responsive to two successive received code combinations of signals of equal length selectively controlling said mechanisms and holding means; and means controlling the release of said holding means to restore said member to its normal rest position.

2. The combination as set forth in claim 1 in which said last mentioned means comprises an electro-magnet and energizing means therefor.

3. The combination as set forth in claim 1 in which said last mentioned means comprises an electro-magnet, energizing means therefor, and a slow release relay in circuit with a permutation code message transmission circuit controlling said magnet.

4. In a selecting mechanism, a selecting member having a normal position and movable in two series of successive steps of varying length to a selected position; mechanism for moving said member from said normal position through its first series of steps; and operative to move said member from its position at the end of said first series of steps through its second series of steps to the selected position; and selector mechanism responsive to successive received code combinations of signals directly and selectively controlling said mechanisms.

5. Selective switching mechanism comprising a group of selectable contacts arranged in rows; a member carrying contacts adapted to engage said selectable contacts and having a normal position; means carried by said member for engaging and disengaging said contacts; a first clutch controlled operating mechanism for moving said member from its normal position to a position adjacent the selected row of contacts in said group; means for holding said member adjacent said selected row of contacts; a second clutch controlled mechanism for positioning said member adjacent the selected contact in said selected row; means for holding said member adjacent the selected contact and for operating said first mentioned means to engage said contacts; selector mechanism responsive to successive received code combinations of signals selectively controlling said clutch controlled operating mechanisms; and means controlling the disengagement of said contacts, the release of holding means, and the restoration of said member to said normal position.

6. In a selective switching system, switching mechanism selectively responsive to permutations of selecting signalling conditions in a series of steps of progressively decreasing length; and transmitting means for said permutations of conditions operative to prolong the first selecting condition for each permutation with respect to the remaining selecting conditions thereof.

7. In a selective switching mechanism, a group of selectable contact means; a movable arm

adapted to be selectively positioned with respect to said contacts; means for moving said arm; movable contact means carried by said arm for engaging said selectable contact means; actuating means for engaging said selectable and movable contact means; and control contacts carried by said arm, controlling the means for moving said arm and actuated by said actuating means.

8. In combination, a telegraph selector including selector cams, selector levers, and a magnet connected in a receiving circuit; a shaft set in various positions under the control of said telegraph selector; a first and a second storing means; and means including control cams and a stop magnet to store a first selected position of the shaft in said first storing means, and to store a second selected position of said shaft in said second storing means.

9. In a signalling system, receiving mechanism selectively responsive to permutations of selecting signalling conditions in a series of steps of progressively decreasing length; and transmitting means for said permutations of conditions operative to increase the operating time of the first step of the receiving mechanism by prolonging the first selecting condition for each permutation with respect to the remaining selecting conditions thereof.

10. In a telegraph system, a permutation code transmitter operable to transmit code combinations of signalling conditions in which the first signalling condition is of greater length than the remaining signalling conditions; and a telegraph receiver responsive to said code combinations in a series of steps of progressively decreasing length.

11. In a telegraph system, a permutation code transmitter operable to transmit code combinations of signalling conditions of progressively decreasing length in which the first signalling condition is of substantially twice the length of the next succeeding signalling condition; and a telegraph receiver responsive to said code combinations in a series of steps of progressively decreasing length.

12. In a telegraph system, a permutation code transmitter operable to transmit code combinations of signalling impulses in which the first impulse of a code combination is of greater length than other impulses in the combination; and a receiver including a switch operably connected to said transmitter and movable in a series of steps of decreasing length to a position determined by the code combination transmitted.

13. In combination, electromagnetic signal receiving means; a start-stop shaft operable by said receiving means in timed relation with permutation code signals received by said means; a selector shaft operable to be set in various selectable positions under control of said receiving means and successive operations of said start-stop shaft; and means controlled jointly by said selector shaft and said start-stop shaft operable to store any pair of successive selectable positions of said selector shaft responsive to said successive operations of said start-stop shaft.

14. A switching mechanism requiring two groups of permutation code signals to complete a switching operation, comprising electromagnetic signal receiving means; a start-stop shaft operable by said receiving means in timed relation with permutation code signals received by said means; selecting elements operable to be set in various positions in accordance with the

signals received by said means, under the control of said receiving means and successive operations of said start-stop shaft; and means operable under the joint control of said start-stop shaft and said selecting elements to store any pair of selectable positions of said selecting elements responsive to successive operations of said start-stop shaft.

15. The combination as set forth in claim 13 together with contact means operable by said selecting elements to close switch circuits when both selections are stored.

16. The combination as set forth in claim 13 together with means operable to lock the start-stop shaft when the second group of permutation code signals have been received, and release means for said locking means.

17. A selector responsive to two successive permutation code signals comprising a selector member movable in two directions to a selected position from a normal position; a selector shaft; means adjustable by said permutation code signals for positioning said shaft in accordance with said signals; a mechanical connection between said shaft and said selector member for adjusting said member in one of said directions in accordance with the position of said shaft; another mechanical connection between said shaft and said selector member for adjusting said member in the other direction in accordance with the position of said shaft; and means controlled by said successive permutation code signals to render said mechanical connections successively effective to cause the successive adjustments of said selector member.

18. Switching means responsive to two successive permutation code signals; means for adjusting said switching means to a selected position; a selector member; means adjustable by said permutation code signals for positioning said selector member in accordance with said permutation code signals; a mechanical connection between said selector member and said adjusting means for adjusting the same in accordance with one of said permutation code signals; another mechanical connection between said selector member and said adjusting means for adjusting the same in accordance with the other of said permutation code signals; and means controlled by said successive permutation code signals to render said mechanical connections successively effective to cause successive adjustments of said switching means to selected position.

19. The combination set forth in claim 18 in which said selector member is a rotatable shaft which sets said switching means in selected position.

20. The combination as set forth in claim 18 in which said adjustable means comprises a selecting magnet and a start-stop shaft, and said last-mentioned means comprises clutch mechanism controlled by said start-stop shaft.

21. The combination as set forth in claim 18 in which said selector member comprises a rotatable shaft; and said mechanical connections each comprises gearing driven by said rotatable shaft.

22. The combination as set forth in claim 18, together with means for locking said adjustable means after receipt of the second of said permutation code signals, and means for releasing said locking means.