Jan. 6, 1953 G. DEAKIN 2,624,807

HOMING ARRANGEMENT FOR SELECTOR SWITCHES

Filed April 2, 1949 4 Sheets-Sheet 1

Fig. 1.

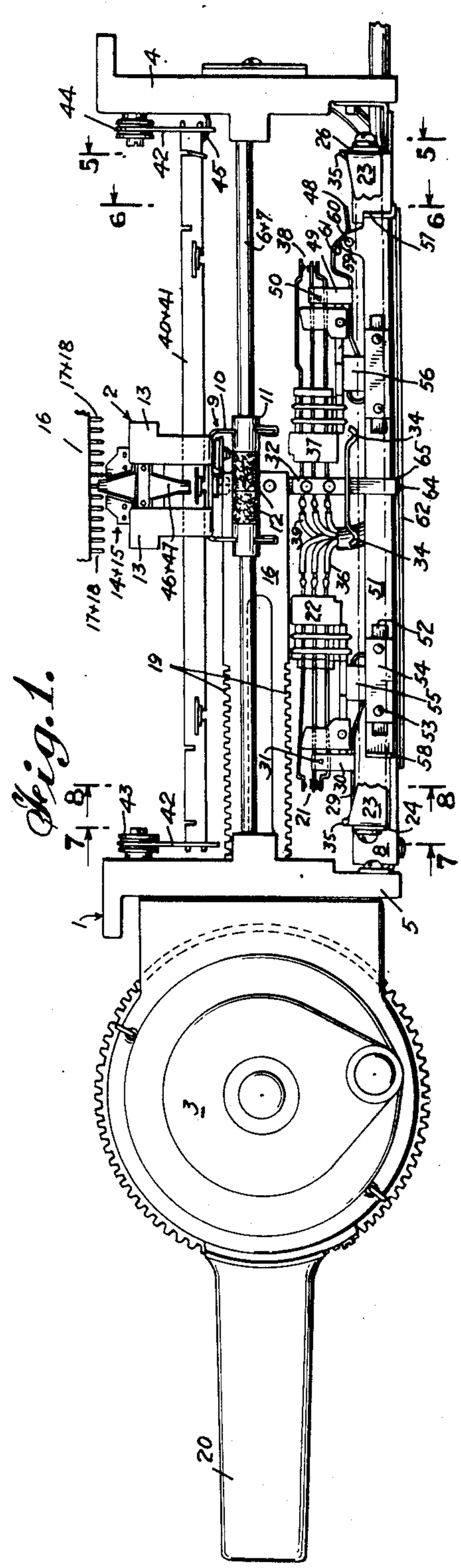
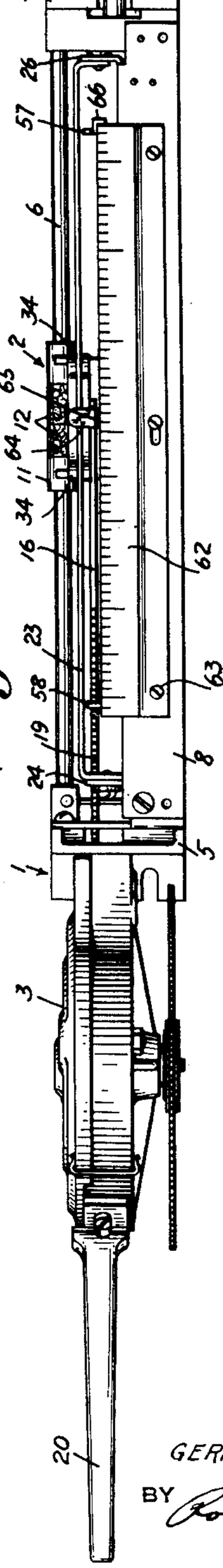


Fig. 2.



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HOMING ARRANGEMENT FOR SELECTOR SWITCHES

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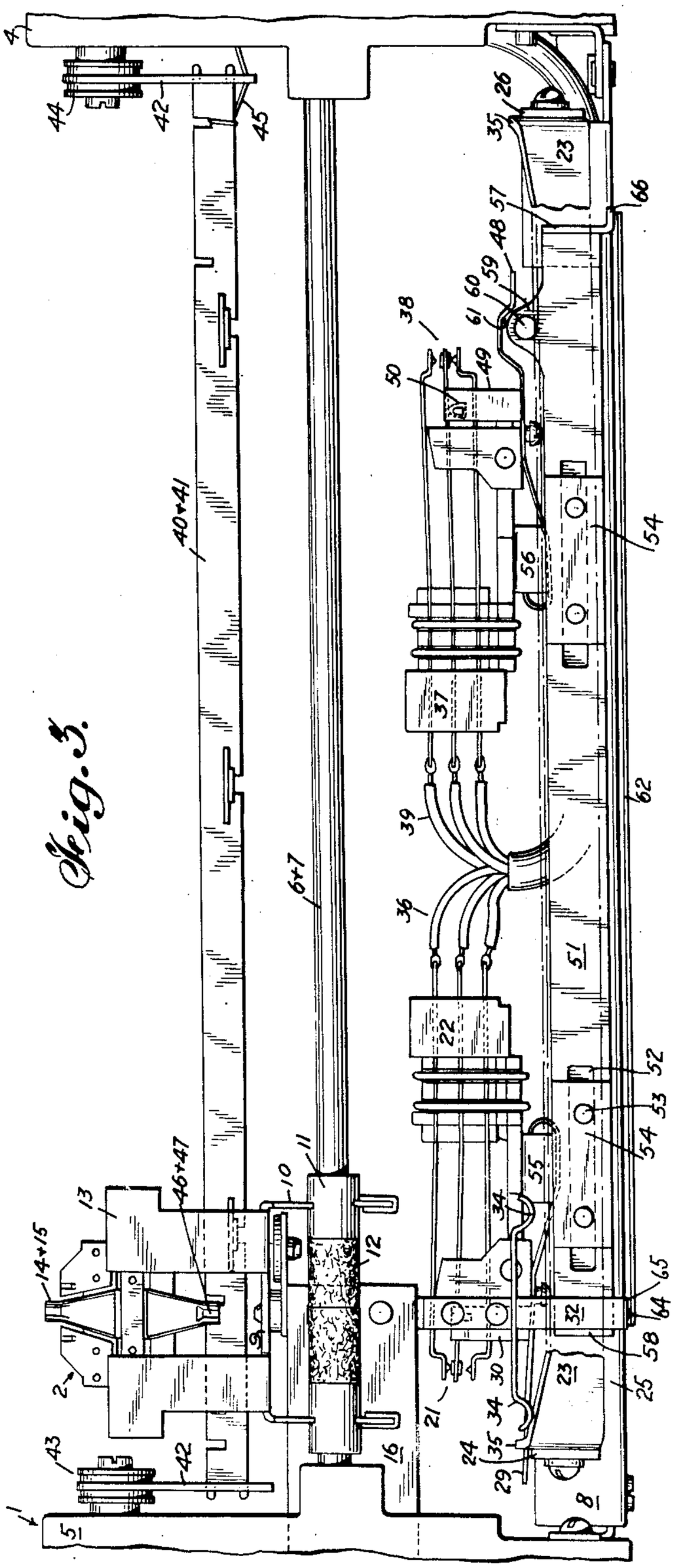

Fig. 3.

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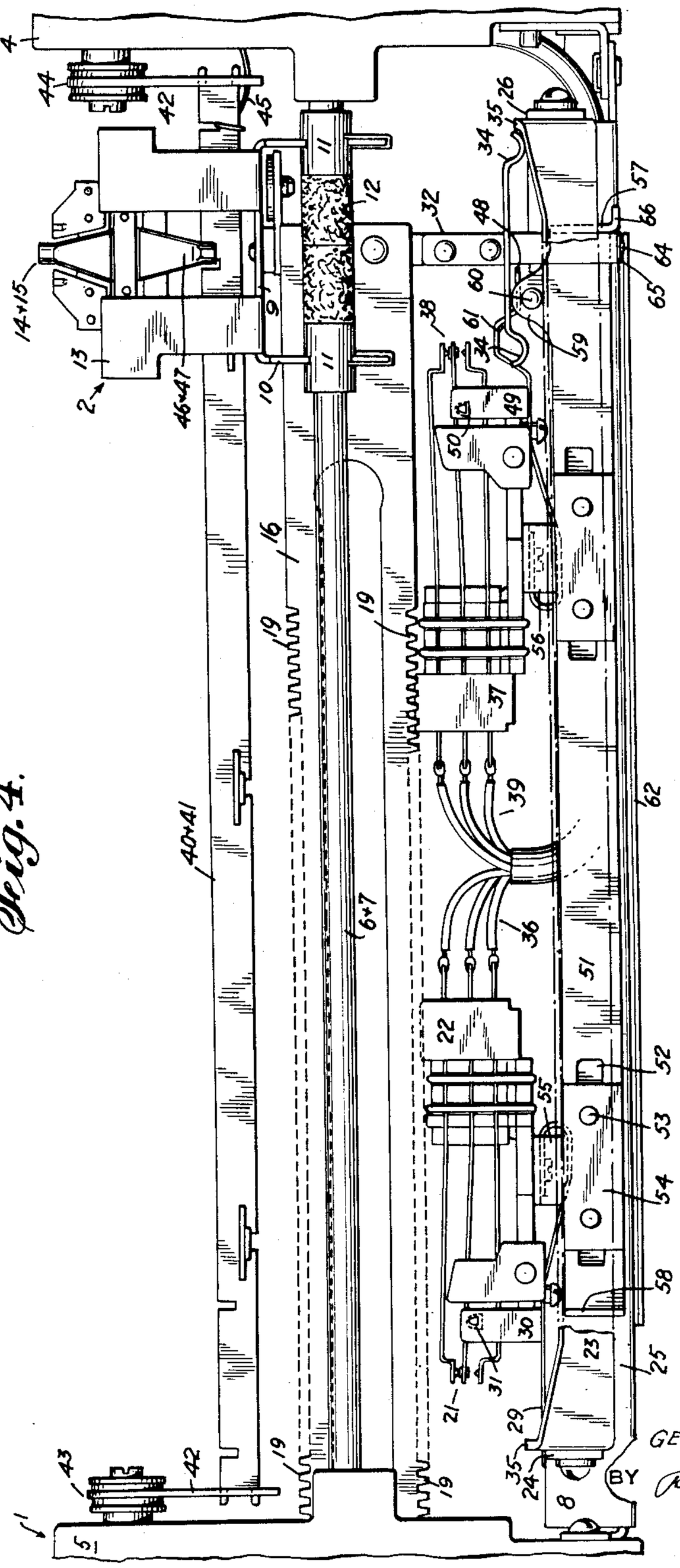
Fig. 4.



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HOMING ARRANGEMENT FOR SELECTOR SWITCHES

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Fig. 8.

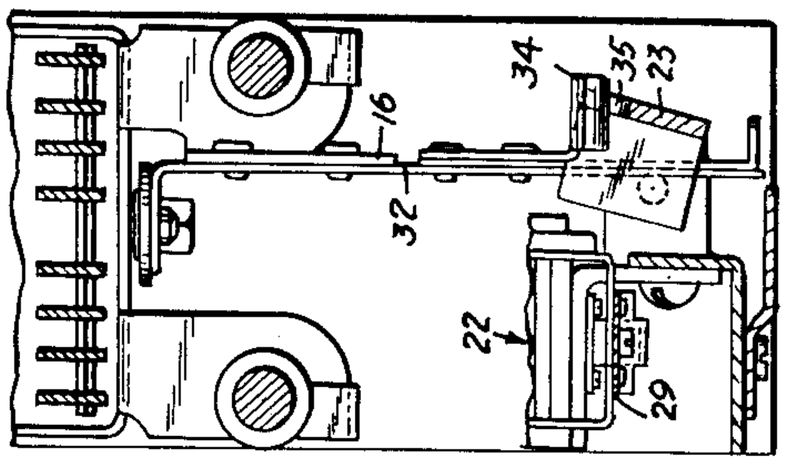


Fig. 7.

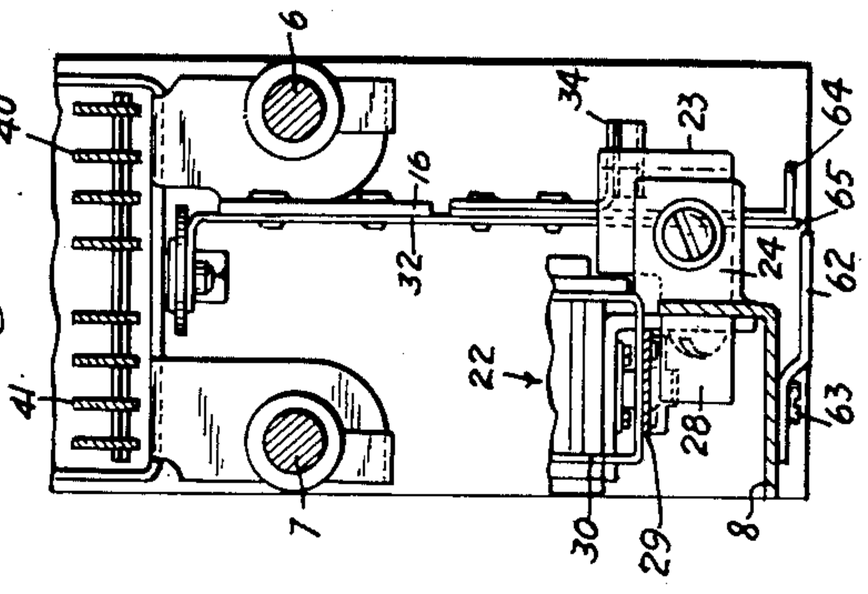


Fig. 6.

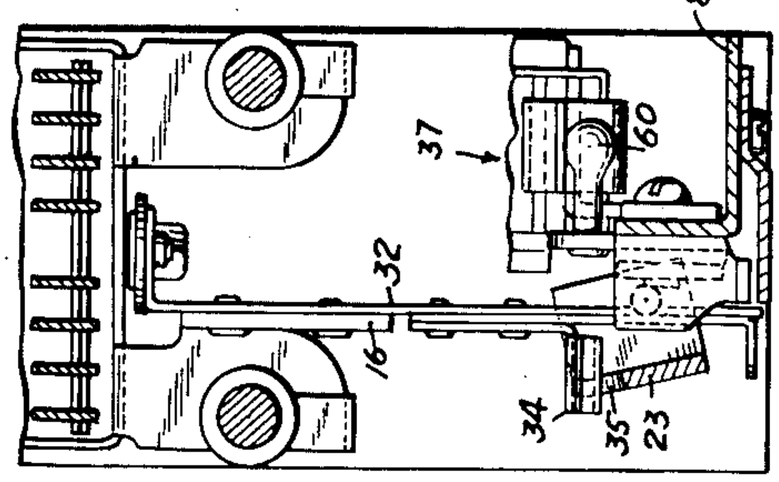
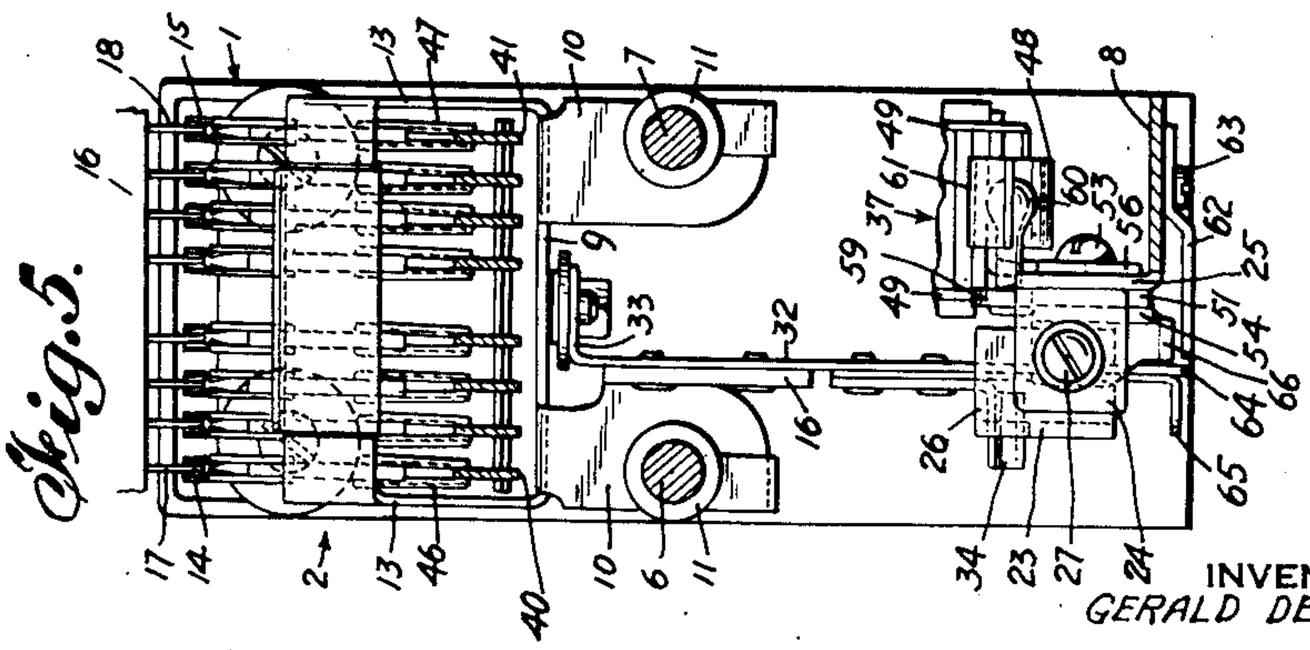


Fig. 5.



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Patented Jan. 6, 1953

2,624,807

UNITED STATES PATENT OFFICE

2,624,807

HOMING ARRANGEMENT FOR SELECTOR SWITCHES

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Application April 2, 1949, Serial No. 85,186

9 Claims. (Cl. 179—27.53)

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This invention relates to selector switches for telephone exchanges and particularly to an arrangement for automatically controlling certain operations of a selector switch.

An object of the invention is to provide a selector switch of the reciprocating carriage type with a simple and effective mechanism for causing the carriage to stop at a predetermined "homing" position or positions.

Another object of the invention is to provide a selector switch with two sets of brushes engaging rows of terminals arranged in sets and with automatic means to connect an operating circuit to the brushes engaging one set of terminals when the carriage is moving in one direction and to the brushes engaging another set of terminals when the carriage is moved in the opposite direction.

Another object of the invention is to provide a signalling device for use when a selector switch is at rest in determining which direction the carriage was moving when it came to rest, and also an indicating means for identifying the terminal pins upon which the switch has stopped.

Briefly, the invention comprises a selector switch provided with two contact spring assemblies attached to the frame of the switch. Mechanism mounted on the frame is provided which is engaged by a member attached to the reciprocating carriage of the switch for operating one of the contact spring assemblies for controlling the carriage driving mechanism so as to cause it to stop at a predetermined position or predetermined positions. And another mechanism also mounted on the frame is caused to be moved by the movement of the carriage to operate the other contact spring assembly to transfer the connection of the operating circuit from one set of brushes to another at the end of each reciprocatory movement of the carriage.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent, and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings wherein:

Figure 1 is a bottom plan view of a complete assembly of the selector switch of the invention with the terminals removed and a portion of the bail for operating the homing contacts removed in order to disclose mechanism for changing the connection from one set of brushes to another;

Figure 2 is an elevational view of the switch shown in Figure 1;

Figure 3 is a bottom plan view, greatly enlarged, of a portion of the switch of Figure 1 showing the

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mechanism for operating the homing contacts and for transferring the connections between the two sets of brushes, the carriage being shown at the left end of its movement;

Figure 4 is a similar bottom plan view of the mechanism showing the carriage at the right end of its movement;

Figures 5, 6, 7 and 8 are sectional end views of the switch taken on the lines **5—5**, **6—6**, **7—7**, and **8—8** respectively of Figure 1, with Figures 6 and 8 showing the bail slightly rotated.

Where a plurality of selector switches of the type used in this invention are connected in a telephone circuit and are multiplied together, all the switches not busy may be caused to start when a call is received. It will be apparent that when the desired terminal is near the end of the movement of the brush carriage more time will be involved in reaching it than when such terminal is near the beginning of the movement. By arranging two automatic homing positions one at each end of the switch, some of the switches will always be at rest with their brush carriage at one end, while other switches will be at rest with their brush carriages at the opposite end. Therefore, when two switches having brush carriages at rest on opposite ends start to find a given terminal, one of those switches will have its brush carriage nearer the terminal than the other and will therefore arrive at this terminal before the other, and considerable time is thus saved. This is especially true with the type of switch in which one set of brushes is electrically connected to a set of terminals while the brushes are moving in one direction, and another set of brushes is electrically connected to another set of terminals while the brushes are moving in the opposite direction, since without the two homing positions a brush carriage might have to move clear across the switch and back again before the second set of brushes would find a terminal on the second set of terminals.

Referring now more particularly to the drawings, a selector switch has been shown having a frame **1**, a carriage **2**, mounted for reciprocation on said frame, and a mechanism **3** for driving the carriage.

The frame **1** comprises two end brackets **4** and **5** spaced apart by two parallel guide rods **6** and **7** and an angle member **8**. The rods are connected between spaced opposed points midway between the ends of the brackets and may be attached to the brackets in any desirable manner. The angle member **8** is connected between two opposing corners of the brackets and may have one edge flush with the bracket sides,

the adjacent side parallel to the ends of the brackets, and the other side at right angle to the ends towards the center. The angle member may be attached to portions of the brackets by screws or rivets.

The carriage 2 may comprise a plate 9 having four integral right angle extensions 10 at the corners thereof, which are secured to four cylindrical bearings 11 which slide upon the guide rods 6 and 7, so as to support the plate on the opposite side of said rods from said angle member for reciprocation parallel to the guide rods.

Any suitable arrangement for lubricating the guide rods as the cylindrical bearings slide thereon may be used, although in the arrangement illustrated I have shown sleeves 12 of felt or other oil saturable material mounted on the guide rods between the bearings of each pair.

The plate 9 is provided with flanges 13 bent from opposite sides of the plate in a direction opposite to that of the extensions 10 to provide corner posts for a brush assembly comprising two sets of brushes 14 and 15 which are insulatedly mounted in any suitable manner so as to be spaced apart in aligned sets, there being four brushes to each set in the particular switch illustrated. The manner of assembling these brushes forms no part of the present invention.

The switch frame and brush mechanism are supported upon a suitable rack 16, a portion of which is illustrated in Figures 1 and 5, which in turn, supports two sets of terminal pins 17 and 18 arranged in parallel rows so that the brushes engage one pin in each row at a time as the carriage reciprocates. In this arrangement shown there are four rows of terminal pins, one row for each brush of a set.

The driving mechanism 3 for the switch forms no part of the present invention and may be any suitable type as, for example, as described in my copending U. S. application Serial No. 35,202/48, filed June 25, 1948, which shows alternately driven gears (not shown) which mesh with two rack bars 19 attached to the plate 9 of the carriage 2 between the guide rods 6 and 7 and moving in a suitable housing including the homing member 20. Although the mechanism for driving the rack bars is not shown in detail, it will be understood that it is controlled by a clutch mechanism which includes the flexible driving gear 3*a*, shown in Figures 1 and 2. The clutch mechanism may be operated electrically and it will be sufficient for the purpose of this description to state that a suitable circuit is provided for controlling the clutch mechanism which includes the contact springs 21 of any suitable contact spring assembly 22 mounted upon the angle member between it and the rack bars.

These contact springs are caused to be operated when the carriage reaches a predetermined point in its movement after the release of the switch, so that the carriage will stop at a predetermined point which may be called the "homing position".

The contact springs 21 are operated by means of a bail 23 which extends adjacent and substantially parallel to the angle member 8 and is pivotally secured to flanges 24 which are bent outwardly from the flange 25 of the angle member 8. The bail 23 comprises a flat bar having end flanges 26 arranged to be parallel to the flanges 24 to which they are pivoted by means of suitable screws 27. The flat bar of the bail normally lies parallel to the flange 25 of the angle member 8 but may be rotated about its pivot in

a counterclockwise direction, as viewed in Figure 6 to operate the contact springs 21. To this end an arm 28 (see Figure 7) is provided extending from one of the bail end flanges 26 on the side of the pivot screw 27 opposite to the flat portion of the bail. This arm 28 engages a spring finger 29 mounted on the contact spring assembly 22 and carrying a pair of arms 30 which in turn support an insulating member 31 which engages the contact springs to make and break the contacts as the spring finger 29 is moved. The tension of the spring finger 29 normally maintains the bail in this position, as shown in Figure 1.

In order to cause rotation of the bail I provide an arm 32 which is attached to the plate 9 of the carriage at about the center thereof, the arm having a flange 33 for attaching to the carriage and thus being spaced nearer the guide rod 6 than the guide rod 7 because of the flange arrangement. This arm 32 may form the means for attaching the rack bars 19 to the carriage, as indicated.

The arm 32 extends outwardly from the plate 9 to a point beyond the angle member 8 and has attached to it cam members 34 which extend a short distance on each side of the arm 32 and are adapted to be positioned adjacent the edge of the bail 23. The bail 23 throughout most of its length is narrower than it is at the end flanges 26, as clearly shown in Figures 1, 3 and 4, and the change in width adjacent the ends provides cam surfaces 35 upon which the cam members 34 attached to the arm 32 may ride. As shown, when one of the cam members 34 engages a cam surface 35 at its associated end of the bail and the carriage continues to move towards the end of the bail, the cam member 34 will cause the bail to rotate to a position shown in Figures 3, 4, 6 and 8, and will thus cause the bail arm 28 to push the spring finger 29 against its own tension, so as to operate the contact springs 21 and cause the center spring, in the particular switch illustrated, to break its contact with the lower spring and make its contact with the upper spring. By means of the circuit already referred to and illustrated by the wires 36 which are attached to the contact springs, the clutch mechanism controlling the movement of the carriage will be operated to stop the carriage.

In the embodiment shown, I have provided cam surfaces 35 at each end of the bail and cam members 34 arranged to engage these surfaces, as indicated in Figures 3 and 4, at each end of the carriage movement. Therefore, the carriage will stop under control of its homing mechanism at each end of its movement. It will be understood however that the homing position of the switch may be chosen at any desirable point, in which case a suitable cam may be provided at that point on the edge of the bail and a cooperating cam member 34 may be positioned on the arm so as to engage this cam at the proper moment and rotate the bail to operate the spring contacts 21. By this means the switch may be normally held in an unoperated homing position and only caused to move in search of the proper terminal when the call is being made.

The contact spring assembly 22 is preferably provided at one end of the switch mechanism leaving room at the other end for a second contact spring assembly 37 which may be used for transferring the circuit connections from the first set of brushes 14 to the second set of brushes 15 and vice versa when the carriage reaches the ends

of its stroke. This second contact spring assembly 37 carries contact springs 38 which are connected by means of wires 39 to a circuit which includes either of the brushes 14 or the brushes 15 in the operation of the switch.

The connections to the brushes are made by means of bus bars 40 and 41 which are mounted in spaced relation parallel to the guide rods 6 and 7 and between the guide rods and the brushes by means of insulating plates 42 which are mounted on the end brackets 4 and 5 by means of suitable supports 43 and 44 respectively. Each of these bus bars may be connected by a wire shown at 45 to the circuit referred to above but which has not been otherwise indicated. The brushes 14 and 15 are each provided with contact members 46 and 47 which engage the bus bars 40 and 41 so as to connect the brushes thereto. As indicated in the drawing, when the central contact spring 38 engages the lower spring, as is shown in Figure 3, the circuit is connected to the brushes 14, whereas if the center contact spring 38 engages the upper contact spring, as is shown in Figure 4, the circuit will be connected to the other set of brushes 15.

In order to shift the contact springs 38, a spring finger 48 is provided, somewhat similar to the spring finger 29 of the contact spring assembly 22. This spring finger 48 is provided with arms 49 at right angles thereto which support an insulating member 50 for moving the center spring 38.

In order to move the finger 48 I provide a flat bar 51 and mount it for reciprocation along the surface of the flange 25 of the angle member 8. To this end I provide slots 52 in the bar 51 and screw the bar 51 to the flange 25 by means of screws 53 passing through plates 54, thus holding the bar 51 between the plates 54 and the flange 25 but permitting reciprocating motion of the bar, limited only by the length of the slots. The same screws 53 which thus guide the bar 51 in its reciprocating movement may be used to secure the contact spring assemblies 22 and 37 to the angle member 8 by means of flanged brackets 55 and 56 respectively.

The ends of the bar 51 are provided with flanges 57 and 58 and these flanges are adapted to be engaged by an extended portion of the arm 32 attached to the carriage 2. The length of the bar 51 is such that the arm 32 attached to the carriage 2 will strike the flanges 57 and 58 just before the carriage reaches the end of its stroke. Thus as the carriage moves towards the right, as viewed in Figure 4, the arm 32 will strike the flange 57 and move the bar 51 toward the right. When the carriage moves to the left the bar will not move until the arm 32 strikes the flange 58, as shown in Figure 3, at which time the bar 51 will be moved from its former position towards the left.

The bar 51 is provided with a lug 59 adjacent the end near the contact spring assembly 37 and this lug carries a pin 60 which extends at right angles to the bar adjacent the spring finger 48. The spring finger 48 is bent to form a cam surface 61 which co-operates with the pin 60, so as to move the spring finger 48 against its own tension when the bar 51 is moved to the right, as in Figure 4, and thus operate the center contact spring 38 to move it into contact with the upper spring, as viewed in that figure.

When the bar 51 is moved to the left, as shown in Figure 3, the pin 60 will ride over the cam surface 61, so as to permit the spring finger 48 to return to normal and the center contact spring 38 to engage with the lower contact spring, as viewed in that figure.

It will be seen that when the carriage is moving towards the right, the contacts will be in the condition shown in Figure 3, and when the carriage reaches its right limit of movement the bar is shifted to place the contacts into condition shown in Figure 4, where it will remain until the carriage reaches its left limit of movement. Thus the brushes 14 and 15 are connected in the circuit alternately as the carriage moves from left to right and from right to left. The selector switch will therefore operate to make contact with the set of terminal pins 17 when the carriage is moving in one direction and with the set of terminal pins 18 when the carriage is moving in the other direction, thus providing twice the number of pins engageable by the brushes by one sweep of the carriage.

As has been stated, there are four brushes to a set and four rows of co-operating terminal pins; hence in order to make the proper connections I provide four sets of the contact springs 38 which are in alignment and are all controlled by the spring finger 48. Similarly, as many sets as necessary contact springs 21 may be provided for controlling the homing operation.

It is desirable when the carriage is stopped with the brushes engaging a particular group of terminals, to be able to identify the terminals with which contact is made and, at the same time, the direction of movement of the carriage, so that it can be readily ascertained which of the groups of brushes, and therefore which of the terminal pins are connected in the circuit. In order to accomplish this, a scale 62 is secured to the angle member 8 in any suitable manner as by means of screws 63, the edge of the scale coming close to the ends of the arm 32 which is decreased in size to form an indicating point 64 which indicates on the edge of the scale the position of the carriage at any particular instant. The scale may be graduated in any desired way to indicate the numbers of the terminals involved. In addition to the point 64*a* slightly larger spring flange 65 may be attached to the end of the arm 32 to provide a more easily discernable signal to locate the position of the indicating point.

In order to indicate which direction the carriage was moving before it stopped at any particular location, the flange 57 of the bar 51 may have its edge toward the scale 62 bent so as to form a signal 66, and the length of the scale may be such as to hide this signal, as indicated in Figure 3, when the bar 51 is moved to the left, but to disclose the signal when the bar is moved to the right, as indicated in Figure 4. Thus, the operator has only to glance at the signal 66 whenever the switch is stopped in some particular position in order to obtain the desired information.

It will be seen from the above description that I have provided a selector switch which includes simple and effective mechanism for causing a desired homing action of the carriage when the carriage is not in actual use and simple and effective mechanism for transferring the brush connections as the carriage changes direction. In addition, I have provided a simple device for indicating the exact set of terminals with which the brushes engage at any particular stopping of the switch and at the same time a mechanism for quickly indicating the direction in which the carriage was moving before the stoppage occurred.

While I have described above the principles of my invention in connection with specific appa-

ratus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What I claim is:

1. In a selector switch comprising a frame, a plurality of terminals supported by said frame and arranged in at least two parallel rows, a carriage mounted on said frame for reciprocating movement in a path parallel to said rows of terminals, brushes carried by said carriage and adapted to engage respectively the terminals of said rows as said carriage reciprocates, means for reciprocating said carriage, and an electrical circuit, the combination of said selector switch with means controlled by the movement of said carriage for connecting said circuit with one brush when the carriage is moving in one direction and with the other when the carriage is moving in the other direction, said last-mentioned means including spring contacts, a member movable into two positions and engaging said contacts to connect said circuit to one brush when said member is in one position and to the other brush when said member is in the other position, and means attached to said carriage for moving said member into one position at the end of the movement of the carriage in one direction and into the other position at the end of the movement of the carriage in the other direction.

2. The combination of a selector switch with spring contact means according to claim 1, in which the member is a bar slidably mounted in the frame parallel to the path of the carriage and having end extensions substantially perpendicular to the path of the carriage, and the means for moving said member is an arm attached to the carriage and extending outwardly to engage said end extensions.

3. The combination of a selector switch with spring contact means according to claim 1, in which the means for connecting the circuit to the brushes includes a signal operative to indicate which brush is connected.

4. The combination of a selector switch with spring contact means according to claim 1, comprising a signal for indicating which position said member is in at a given instant.

5. The combination of a selector switch with spring contact means according to claim 1, in which the member is a bar slidably mounted in the frame parallel to the path of the carriage and having end extensions substantially perpendicular to the path of the carriage, the means for moving the member is an arm attached to the carriage and extending outwardly to engage said end extensions, and the signal comprises an indica attached to one of said extensions and a shield attached to said frame to cover said indicia when said member is in one of its positions.

6. The combination of a selector switch with spring contact means according to claim 1, in which the means for connecting the circuit to the brushes includes a signal operative to indicate which brushes are connected, and in which an indicating scale is provided mounted on said frame and an arm is provided on said carriage cooperating with said scale to indicate the terminals in contact with said brushes when said carriage is at rest.

7. In a selector switch comprising a frame, a bank of terminal pins mounted in said frame in rows arranged in two groups, a carriage mounted on said frame for reciprocation in a path parallel to said rows, driving means for reciprocating said carriage, a first circuit for controlling said driving means, two sets of brushes mounted on said carriage, each set being arranged for cooperation with the terminal pins of one of said groups, and a second circuit to be controlled by said switch, the combination of said selector switch with a first switching means mounted on said frame for controlling said first circuit, cam means movably mounted on said frame for operating said first switching means, and means carried by said carriage for engaging and moving said cam means at each end of the carriage stroke, whereby the driving means may be stopped at each end of the stroke when the switch is not in use for making a call; and second switching means having two operating positions mounted on said frame for connecting said second circuit to either one or the other of said sets of brushes, and means controlled by the carriage for causing said second switching means to assume one operating position at one end of the stroke of said carriage and the other position at the other end of said stroke.

8. The combination of a selector switch with switching means according to claim 7, in which the means controlled by the carriage for operating the second switching means comprises a bar having projections at the end thereof mounted on said frame parallel to the path of the carriage and arranged for limited longitudinal movement with respect to said frame and an arm carried by said carriage and adapted to engage said projections for shifting said bar at each end of the carriage movement.

9. The combination of a selector switch with switching means according to claim 7 in which the cam means comprises a bail pivotally mounted on the frame on an axis parallel to the path of the carriage and having cam surfaces at the ends of said bail, a cam arm carried by said carriage for engaging said cam surfaces, and an arm on said bail for operating the first switching means when the bail is rocked about its pivot.

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