March 18, 1930. C. A. W. HULTMAN 1,751,406

SELECTOR SWITCH FOR AUTOMATIC TELEPHONE SYSTEMS

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Fig. 1.

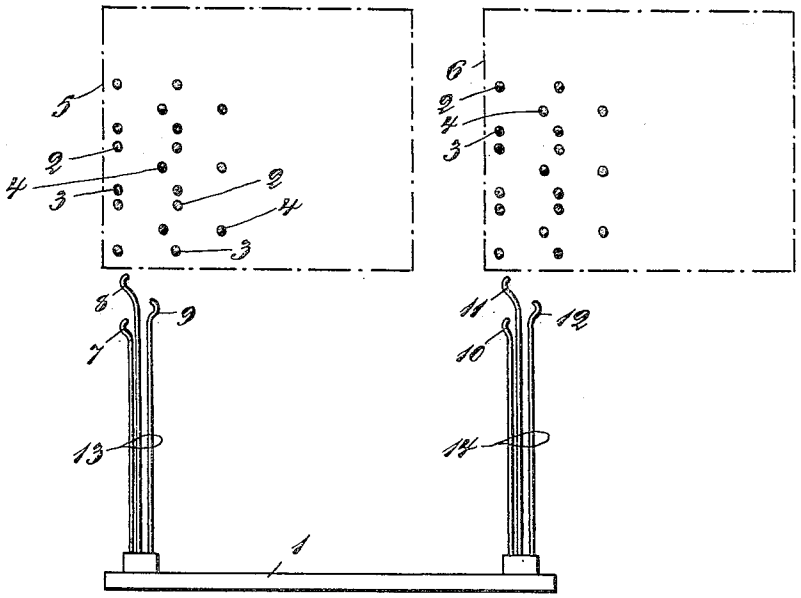

Fig. 2.

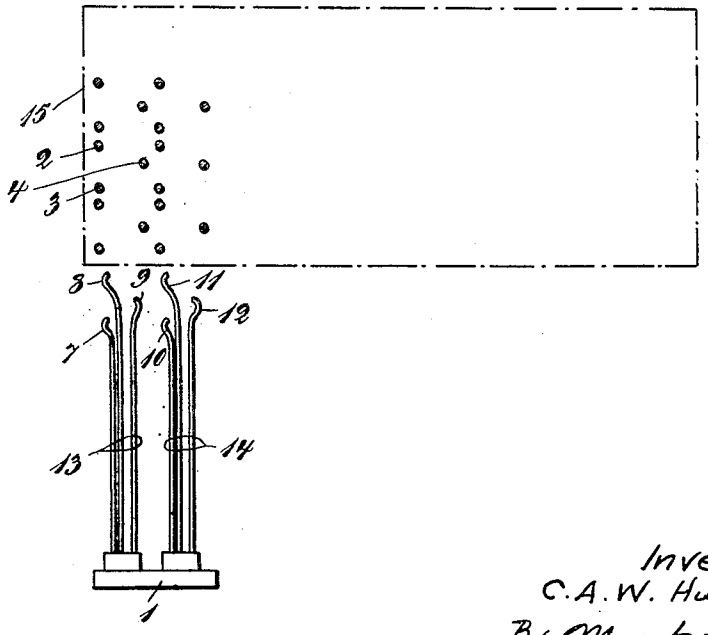

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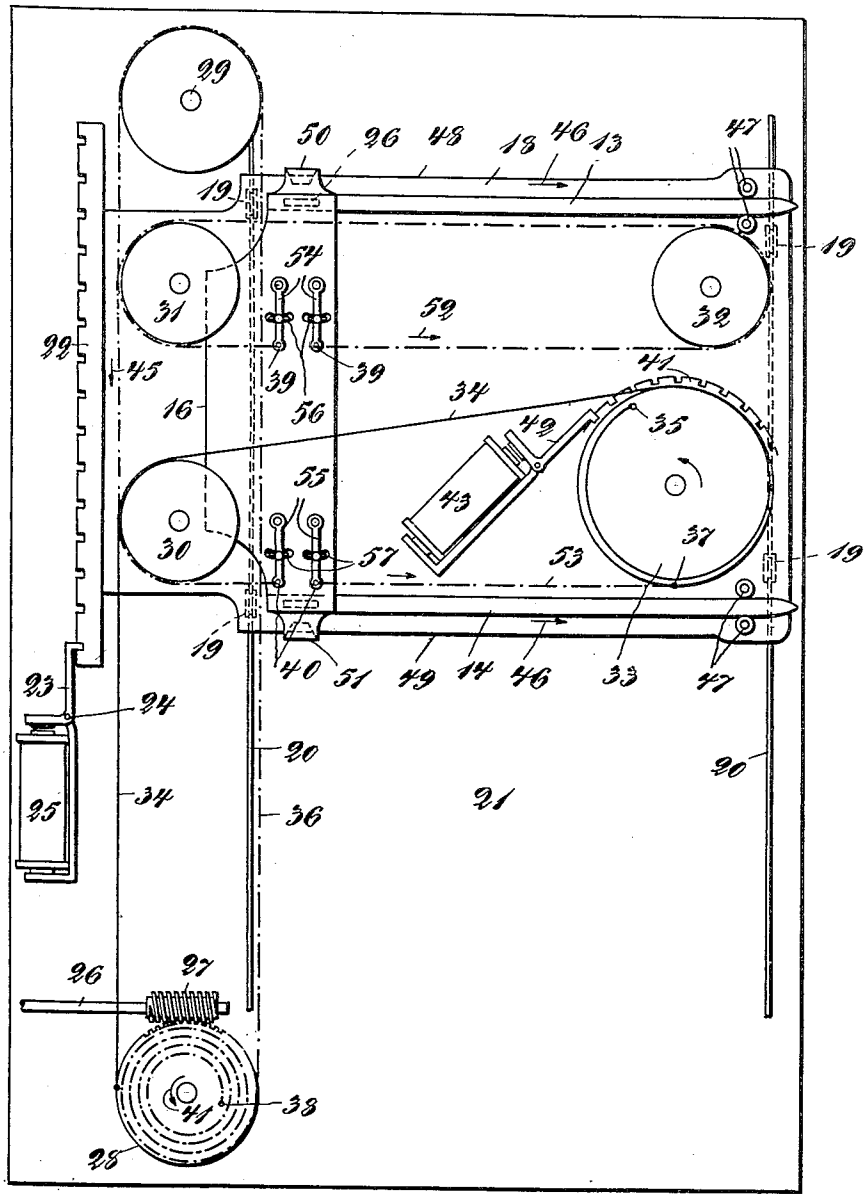
Fig.3.



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1,751,406

UNITED STATES PATENT OFFICE

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SELECTOR SWITCH FOR AUTOMATIC TELEPHONE SYSTEMS

Application filed August 3, 1927, Serial No. 210,382, and in Sweden April 11, 1922.

The invention relates to such selector switches for automatic telephone systems in which the movable switching member is adapted to be set in two different directions in the same plane said switching member having the form of an arm which is set in one of said directions by being moved in its longitudinal direction. The object of the invention is to increase the capacity of such selectors particularly with a view to increase the number of lines that can be reached by the movable contacts in the longitudinal direction of the switching arm. In switches of this kind heretofore known the number of such lines has been limited by the fact that the switching arm is supported only at one end its maximum length being as a consequence determined by its elasticity. Also from other practical reasons the switching arm must not be too long. According to the present invention this limitation is removed by providing the switching member with a plurality of sets of contact wipers adapted to move in separate rows of contacts in such a manner as to be capable of establishing connection in each setting position with one or the other of a plurality of lines.

The invention is particularly contemplated for selectors of the type referred to in which the fixed contacts are formed by wires, strips or the like extending through a group of selectors perpendicularly to the planes of movement of the switching arms. As applied to such switches the invention is particularly characterized by the contact rows corresponding to the different sets of contact wipers being formed by bundles of wires disposed in separate, parallel planes.

The invention will be more closely described with reference to the accompanying drawing in which Figures 1 and 2 illustrate schematically two embodiments of the invention, whereas Figure 3 shows a plan view of a selector mechanism of a selector according to Figure 1.

Figures 1 and 2 show only the switching member 1 and a section through the contact field. In both cases a selector is illustrated in which the fixed contacts are formed by bundles of parallel wires 2, 3, 4 extending through a group of selectors perpendicularly to the plane of movement of the switching member.

In the embodiment shown in Figure 1 the contact field is divided into two sections 5 and 6 each comprising bundles of wires arranged in parallel rows. The wires 2 and 3 may be connected to the speaking line branches of the telephone lines and the wires 4 may be the test wires. The switching member is provided with two sets of contact wipers 7, 8, 9 and 10, 11, 12 respectively mounted on or forming switching arms 13, 14 which are rigidly connected together and adapted to be set as a single switching member in two directions at right angles to one another. Both movements take place in the same plane in the following manner. At first the switching member is set in one direction (to the right in the drawing) to select a group of lines. This movement takes place outside the contact field. The switching member is then set in the other direction to establish connection with the particular contacts of a line of the group selected. The contact arms 13, 14 will then enter the corresponding rows of wires while making contacts successively with the wires 2, 3, 4 of the different lines. In each setting position the sets of contact wipers 7, 8, 9 and 10, 11, 12 respectively make contact simultaneously with two different lines of the group selected, the lines being tested in usual manner by means of the test wipers 9 and 12 and test relays connected thereto. After the switching member has been finally set the connection will be completed over one or the other set of contact wipers 7, 8, 9 or 10, 11, 12 respectively in any known manner. If for instance the selector operates as a searcher or line finder, the selector can be stopped and the connection completed by means of the test relays so that connection is established only with that one of the two lines which for the time being is disengaged or, if both are free, with one of them. Switching arrangements of this kind are known in the art.

It appears that all the wires of each line group selected are disposed so as to form two separate rows of wires located one in each

section 5 and 6 respectively and arranged in parallel planes perpendicular to the plane of movement of the switching arms. As a consequence of this arrangement the distance to be covered by the switching member in its second movement is only half the distance that would be necessary if all the wires of the same line group were arranged in a single row to be traversed by a single set of contact wipers. Considering now that the length of the switching arm is limited from constructive reasons it is evident that the arrangement described is a means for increasing the capacity of the selector or the number of lines in each group in a selector of this type. As a practical example it may be mentioned that selectors of this type having a single set of contact wipers and a capacity of five hundred lines, are known in which the line wires are arranged in twenty-five rows each comprising twenty lines. In using an arrangement according to Figure 1 the capacity of such a selector may be doubled without altering the number of lines in each row. By providing more switching arms and appertaining field sections in an analogous manner the capacity may, evidently be further increased.

In Figure 2 the contact wires are arranged so as to form a single contact field 15 the two rows of each group being placed close together at a distance equal to the normal distance between adjacent rows and the switching arms 13, 14 being similarly arranged close together. As a consequence, the distance between adjacent setting positions as well as the total length of the path of the switching member in its first setting movement will be twice as large as in Figure 1, but otherwise there is no difference in the operation of the selector.

Figure 3 illustrates the selector mechanism of a selector having two switching arms 13, 14 arranged as in Figure 1. Said arms consist of bars secured at their inner ends to a carriage 16 arranged to travel by means of rollers 17 on a second carriage 18. The carriage last mentioned is adapted to run by means of rollers 19 on tracks 20 secured to a base plate 21, and is arranged to be stopped and locked in the different setting positions by means of a toothed bar 22 and an electromagnetically operated pawl 23 pivoted at 24 and forming the armature of an electromagnet 25. The carriages are adapted to be driven by means of a system of wires and pulleys from the shaft 26 of a motor (not shown). Said shaft is coupled by means of a worm gear 27 to a driving pulley 28 mounted on the base plate 21. On the same plate there is mounted another pulley 29. Four other pulleys 30, 31, 32, 33 are mounted on the carriage 18. All pulleys are connected together by means of a driving wire comprising one section 34 fastened to the pulley 28 and carried over the pulley 30 to the pulley 33 around which it is wound one or more turns and to which it is fastened at 35, and a second section 36 which is fastened to the pulley 33 at 37, and carried over the pulleys 30, 31 and 32, a second time over the pulley 31 and over the pulley 29 to the pulley 28 to which it is fastened at 38. The second wire section is also fastened to the sides of the carriage 16 at 39 and 40 in a manner to be described hereinafter. The wire section 34 is drawn in full lines, whereas the section 36 is drawn in chain lines.

The pulley 33 is provided with a toothed segment 41 cooperating with a pawl 42 controlled by an electromagnet 43, to stop and hold the carriage 16 in each setting position.

To set the selector the motor is first started, while the magnet 25 is energized and the magnet 43 is deenergized. The carriage 18 is therefore free to move, whereas the carriage 16 is locked to the carriage 18. The pulley is rotated in the direction of the arrow 44 and the carriage 18 together with the carriage 16 is displaced in the direction of the arrow 45 the wire section 34 being then wound on to the pulley 28 whereas the section 36 is wound off said pulley. The wire transmission then operates as if there were only a single loop of wire extending between the pulleys 28 and 29 the pulleys 30, 31, 32 and 33 being not rotated at this instance. When the switching arms reach the position wanted the motor is stopped and the magnet 25 is deenergized to lock the carriage 18 in this position. The motor is then again started while the magnet 43 is energized, whereas the magnet 25 now remains de-energized, thereby holding the carriage 18 in the position set. The pulley 28 is rotated in the same direction as before. The wire section 34 is therefore now wound off the pulley 33, whereas the section 36 is wound on said pulley. As the wire section last mentioned is fastened to the carriage 16 at 39 and 40 said carriage will now move in the direction of the arrows 46 thereby driving the switching arms 13, 14 into the contact field. In this movement the switching arms are guided between rollers 47 on the carriage 18, whereas the carriage 16 is guided along the edges 48, 49 of the carriage 18 by means of extensions 50, 51 bent round said edges. The correct simultaneous motion of the opposite ends of the carriage 16 is safeguarded by the parts 52, 53 of the wire necessarily moving with the same speed being parts of the same wire section 36.

The means for fastening the driving wire to the carriage 16 is combined with means for adjusting and stretching the wire consisting of pivoted arms 54 and 55 fastened at their outer ends to the wire parts 52 and 53 respectively and provided with set screws 56, 57 extending through curve-shaped slots in the carriage 16 and by means of which said arms can be screwed fast in a suitable position to hold the wire stretched and the carriage 16

in the right position relatively to the carriage 18.

The contact wipers carried by the arms 13, 14 and which are not particularly shown in the drawing, are preferably provided on the sides of the arms near their pointed ends. The electrical circuits for controlling the movement of the selector form no part of the invention and are not shown as such circuit arrangements are well known in the art.

The invention is not limited to selector switches the switching member of which is movable in two directions at right angles to one another. It may for instance be applied with the same advantage also to such known selector switches in which the switching member is first rotated to select a line group and then displaced radially to establish connection with a particular line in the group selected.

I claim:

A selector arrangement comprising a group of selector switches each having a wiper carrier, a number of switch arms secured to said carrier, a plurality of sets of contact wipers carried by said switch arms, an incoming line, means for switching said incoming line onto one or the other of said sets of contact wipers, an operating mechanism for setting the wiper carrier in two different directions in the same plane and in one of said directions longitudinally of said switch arms, and a contact field consisting of rows of wires extending through a group of selectors perpendicularly to the plane of movement of the wiper carrier, said sets of contact wipers being arranged to be displaced along parallel paths and to make contact, in each setting position of the carrier, with a corresponding number of lines.

In testimony whereof I affix my signature.

CARL AXEL WILHELM HULTMAN.