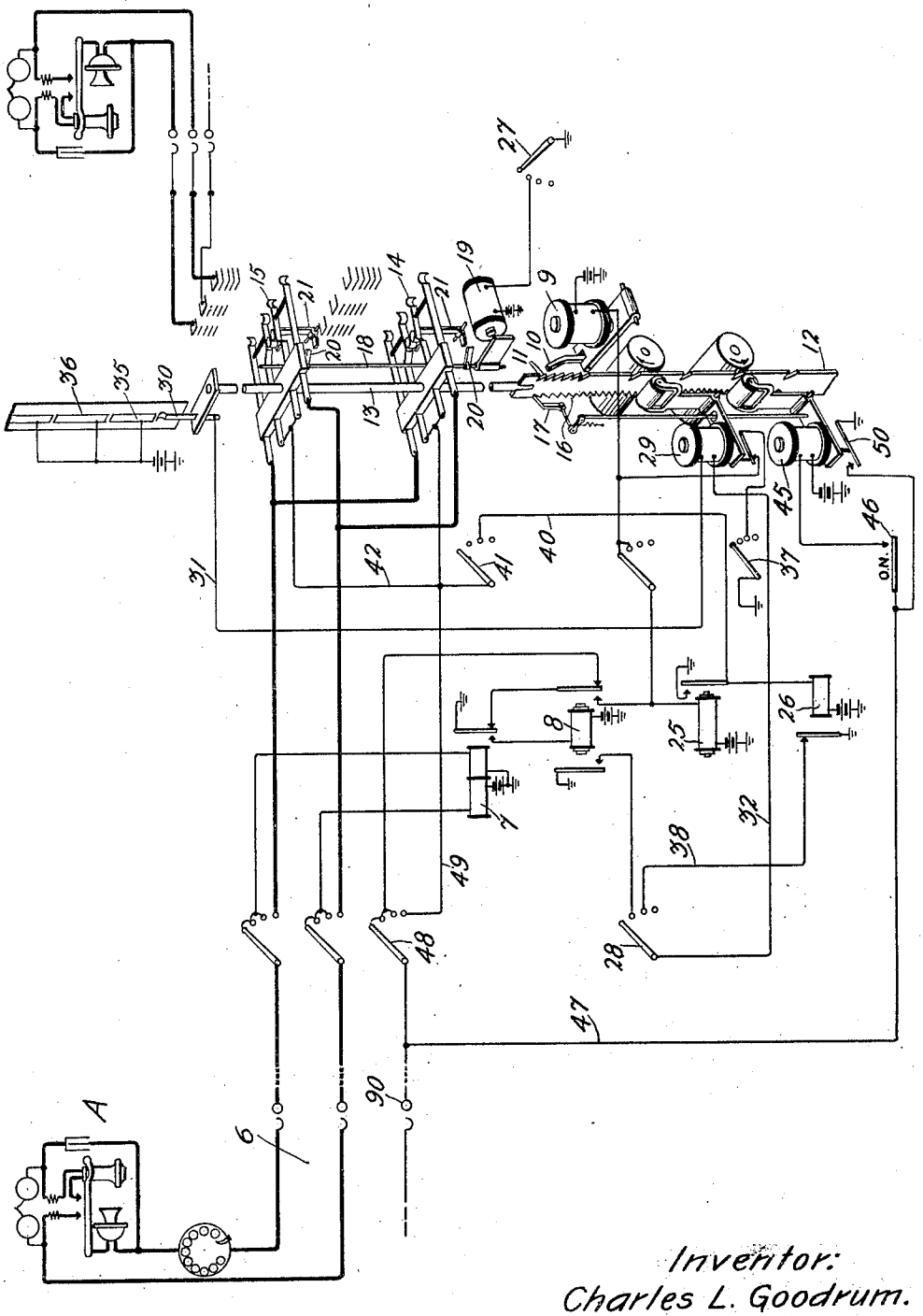
C. L. GOODRUM.

MACHINE SWITCHING DEVICE.

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1,375,692. Patented Apr. 26, 1921.



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UNITED STATES PATENT OFFICE.

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MACHINE-SWITCHING DEVICE.

1,375,692. Specification of Letters Patent. Patented Apr. 26, 1921.

Application filed February 24, 1919. Serial No. 278,927.

To all whom it may concern:

Be it known that I, CHARLES L. GOODRUM, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Machine-Switching Devices, of which the following is a full, clear, concise, and exact description.

This invention relates to automatic or semi-automatic telephone switching systems, and more particularly to switching systems employing selector switches of the power-driven panel-bank type.

The object of this invention is to provide an improved form of apparatus and organization of circuits, whereby the time for setting up a call between a calling and a called subscriber is reduced to a minimum.

In accordance with the general features of this invention, a selector switch for connecting the calling subscriber with the desired trunk line is adapted to be operated directly in response to impulses from the calling subscriber's station, to move from one group of trunk terminals to the next, and to be moved over the successive groups and into operative relation with the required group of terminals in response to the operation of the power-drive mechanism and under control of the impulse-sending mechanism.

In the preferred form of this invention, the step-by-step mechanism and the power-drive mechanism for controlling the movement of the brush shaft are made to operate upon the same member, namely, the tape or strip to which the brush shaft is connected, and the operation of this brush shaft in response to the step-by-step mechanism establishes conditions for continuing the operation of the brush shaft in response to the power-drive mechanism until the selected brushes have been moved across one group.

The drawing is a diagram of circuits and apparatus embodying the features of this invention.

Referring to the operation of this system, when the subscriber at A removes his receiver from the switch-hook for the purpose of making a call, the wires leading from this substation will be automatically connected with a trunk leading to the selector switch, through the agency of a line finder apparatus diagrammatically indicated at 6. Upon the connection of the subscriber's line with the trunk a relay 7 will be energized over the line wires, and in pulling up will complete a circuit for a slow release relay 8. Impulses from the calling station A, in response to the operation of the calling subscriber's dial, will cause the armature of relay 7 to vibrate, and with each retraction of this armature a circuit is completed for a brush selecting magnet 9 which, in operating, causes a pawl 10 to engage notches 11—11 in one edge of a tape 12 to raise a rod 13 carrying brush sets 14 and 15. Upon its opposite edge, the tape 12 is provided with a plurality of notches 16—16, adapted to be engaged by a holding pawl 17 to retain the brush shaft in a position to which it is moved by the brush-selecting magnet 9 and also by the power-drive mechanism.

The first set of impulses from the calling subscriber's dial selects the set of brushes which is to be tripped by means of a brush trip rod 18 controlled by a trip magnet 19. As shown, the brush trip rod 18 is provided with a plurality of angularly extending fingers 20—20, which are so spaced upon the rod 18 that each will engage a tripping arm 21 of a particular brush set in response to a different number of vertical impulses. That is to say, the lowermost set of brushes 14 may be set to be tripped in response to one impulse of the brush-selecting magnet, the next set 15 being set to be tripped in response to two steps of the brush-selecting magnet, and so on. The general arrangement of the contact bank, brush sets and tripping mechanism may be similar to that disclosed in Patent No. 1,123,696, issued January 5, 1915, to E. B. Craft and J. N. Reynolds.

At the end of the first series of impulses relay 7 remains energized, and a slow release relay 25 which is pulled up at the first retraction of the armature of relay 7 and holds an escape magnet 26 in energized position, now falls off and releases the magnet 26 to move the side switch arms into position 2. In position 2 side switch arm 27 completes a circuit for brush trip magnet 19 which swings the rod 18 into position for a finger

20 thereon, to trip the desired set of brushes upon the next upward movement of the brush shaft 13. When the side switch arm 28 goes into position 2 a circuit is completed for up-drive magnet 29 from battery, through a commutator brush 30 carried on the upper end of the brush shaft 13, over conductor 31, through up-drive magnet 29, over conductor 32, through side switch arm 28 in position 2, and left-hand front contact of relay 8, to ground.

The switch shaft 13 now moves upwardly until the commutator brush 30 passes from the first conducting segment 35 onto an insulating strip between the segment 35 and the next segment 36. As the brush shaft 13 starts upwardly, the desired set of brushes is tripped and is, at the end of the power-driven movement of the brush shaft 13, brought into position directly below the first row of contacts of the bank. The subscriber again operates his calling dial which completes a circuit for the brush-selecting magnet 9, which causes the commutator brush 30 to move onto the next conducting segment 36, whereupon the up-drive magnet 29 causes it to move over the first group of terminals and come to rest with the commutator brush 30 on the insulating segment between conducting segment 36 and the succeeding one above it. This movement is very rapid and takes place before the second impulse from the calling dial is received through the brush selecting magnet 9. The next impulse again operates the magnet 9 to move the brush 30 onto the next conducting segment, thereby again completing the circuit for the up-drive magnet 29, and this operation is repeated until the desired group of terminals has been selected.

At the termination of the second series of impulses from the subscriber's dial, the side switch magnet 26 which was energized upon the first retraction of the armature of 7 again falls off and moves the side switch arms into position 3. In position 3 the brush-selecting magnet 9 is again energized over a circuit from battery, through the winding of the magnet 9, through an armature and back contact of up-drive magnet 29 and side switch arm 37 in its third position. This moves the commutator brush 30 onto the next conducting segment, and trunk-hunting now takes place. During this hunting the up-drive magnet 29 is energized through a circuit which is completed from battery, through commutator brush 30, over conductor 31, over conductor 32, through side switch arm 28 in position 3, over conductor 38, to back contact and armature of the escape magnet 26. This magnet 26 acts also as a test relay and is operated through ground on the test contact of an idle trunk, which is applied thereto in a manner similar to the manner in which it is applied to the test contact 90 of the trunk leading to the selector shown in the drawing, that is, from ground to the back contact of the line relay and back contact of the first slow relay and side switch wiper 48 in its first position.

When the test brushes of a selected brush set engage the contacts of an idle trunk, that is, one on which ground is present, the escape magnet 26 pulls up over a circuit which is completed from battery, through the winding of escape magnet 26, over conductor 40, through side switch arm 41 in position 3, over conductor 42, and through the test brushes, to ground. This energization of the escape magnet causes the side switch arm to move into position 4 and completes the talking and release circuits of the selector. The operation of the side switch magnet, is so controlled that the first two steps of the side switch arms take place upon the de-energization of the escape magnet and the last step upon the energization.

The switch may be released by placing direct ground on the third contact of the succeeding switch in a manner well known, which completes the circuit from battery, through the down-drive magnet 45, which also controls the release of holding pawl 17 from tape 12. This circuit will be from battery, through the winding of down-drive magnet 45, through an off-normal contact 46, over conductor 47, through the side switch arm 48, over conductor 49 and conductor 42, to the test brushes of the set. When the down-drive magnet 45 pulls up, it closes a contact 50 which completes a locking circuit for the magnet 45 which is opened when the switch is completely restored to normal and the off-normal contact 46 is opened.

The general construction of the side switch is preferably similar to that disclosed in Patent No. 1,252,420, issued January 8, 1918, to O. F. Forsberg. The method of restoring the side switch in the present system may be similar to that employed in such patent.

The closely spaced notches upon the edge of the strip 12 to be engaged by the pawl 10 of the magnet 9 are spaced apart the distance between adjacent sets of stationary contacts. The remaining notches on strip 12 are spaced apart a distance equal to the space occupied by a group of contacts. The notches for the holding pawl 17 are spaced apart the distance between adjacent contact sets throughout the length of the strip 12.

What is claimed is:

1. In a telephone switching system, subscriber's impulse-sending mechanism, stationary contacts arranged in groups and sub-groups, a movable carriage, contacts mounted thereon, and step-by-step mechanism and power-drive mechanism operat-

ing directly upon said carriage in response to the operation of said impulse-sending mechanism to move said movable contacts into engagement with a desired set of stationary contacts in a desired group and sub-group.

2. In a telephone switching system, subscriber's impulse-sending mechanism, stationary contacts arranged in groups and sub-groups, movable contacts, a carriage for said movable contacts, step-by-step mechanism operating directly in response to the operation of the impulse-sending mechanism, and power-drive mechanism operating indirectly in response to the operation of said impulse-sending mechanism but simultaneously therewith to move said movable contacts into engagement with a desired set of stationary contacts in a desired group and sub-group, due to the mechanical coöperation of said step-by-step mechanism.

3. In a telephone switching system, a plurality of sets of stationary contacts divided into groups and sub-groups, movable contacts, a carriage for said movable contacts, step-by-step mechanism operating directly upon said carriage to move its contacts between adjacent sub-groups of stationary contacts, and power-drive mechanism operating upon said carriage to move its contacts across said sub-groups of stationary contacts to select a desired set of stationary contacts in a desired group and sub-group.

4. In a telephone switching system, subscriber's impulse-sending mechanism, a plurality of sets of stationary contacts divided into groups, movable contacts, a carriage for said movable contacts, step-by-step mechanism adapted to operate directly upon said carriage in response to the operation of the impulse-sending mechanism to move the movable contacts between adjacent groups of stationary contacts, and power-drive mechanism operated under control of said impulse-sending mechanism and simultaneously therewith to move the movable contacts across the groups of stationary contacts.

5. In a telephone switching system, subscriber's impulse-sending mechanism, stationary contacts arranged in groups and sub-groups, movable contacts, a carriage for said movable contacts including an operating member, and step-by-step and power-driving mechanism adapted to engage and drive said operating member in response to impulses from said impulse-sending mechanism and to move said movable contacts into engagement with a desired set of stationary contacts in a desired group and sub-group, simultaneously with the operation of said impulse-sending mechanism.

6. In a telephone switching system, subscriber's impulse-sending mechanism, stationary contacts, movable contacts, a carriage for said movable contacts including a flat-surfaced member having notches upon one edge thereof, step-by-step mechanism adapted to engage the notched edge of said flat-surfaced member to move said movable contacts directly in response to the operation of the impulse-sending mechanism, and power-drive mechanism adapted to engage the flat surface of said flat-surfaced member to move said carriage simultaneously with the operation of said impulse-sending mechanism.

7. In a telephone switching system, subscriber's impulse-sending mechanism, a plurality of sets of stationary contacts divided into groups, movable contacts, a carriage for said movable contacts, step-by-step operated mechanism directly responsive to said impulse-sending mechanism for moving said movable contacts between adjacent groups of stationary contacts, power-drive mechanism for said carriage, and an operating circuit for said power-drive mechanism established in the movement of said carriage in response to the step-by-step mechanism to move said movable contacts successively across the groups of contacts at each impulse of said impulse-sending mechanism.

8. In a telephone switching system, subscriber's impulse-sending mechanism, stationary contacts, movable contacts, a carriage for said movable contacts, step-by-step mechanism, power-drive mechanism for imparting motion to said brush carriage, a movable brush, a driving circuit for said power-drive mechanism extending through said movable brush, and means including said step-by-step mechanism to advance said brush in response to the operation of said impulse-sending mechanism.

9. In a telephone switching system, subscribers' impulse sending mechanism, stationary contacts arranged in a panel contact bank, a movable carriage, contacts mounted thereon, and a step-by-step mechanism and power drive mechanism operating directly upon said carriage in response to the operation of said impulse sending mechanism to move said movable contacts into engagement with a desired set of stationary contacts.

10. In a telephone switching system, a plurality of sets of stationary contacts divided into groups and mounted in a panel contact bank, movable contacts, a carriage for said movable contacts, and step-by-step mechanism operating directly upon said carriage to move said contacts between adjacent groups of stationary contacts, and a power drive mechanism operating upon said carriage to move its contacts across said groups of stationary contacts.

11. In a telephone switching system, subscribers' impulse sending mechanism, a multiple contact bank of the panel type, a

brush carriage, a plurality of normal inoperative brush sets mounted thereon, a step-by-step mechanism and power drive mechanism operating directly upon said brush carriage in response to the operation of said impulse sending mechanism, means to render operative a desired one of said brush sets under the control of said step-by-step mechanism, means to select a group of contacts under the joint control of said step-by-step mechanism and said power drive mechanism, and means to select a desired contact set in a selected group.

In witness whereof, I hereunto subscribe my name this 18th day of February A. D., 1919.

CHARLES L. GOODRUM.