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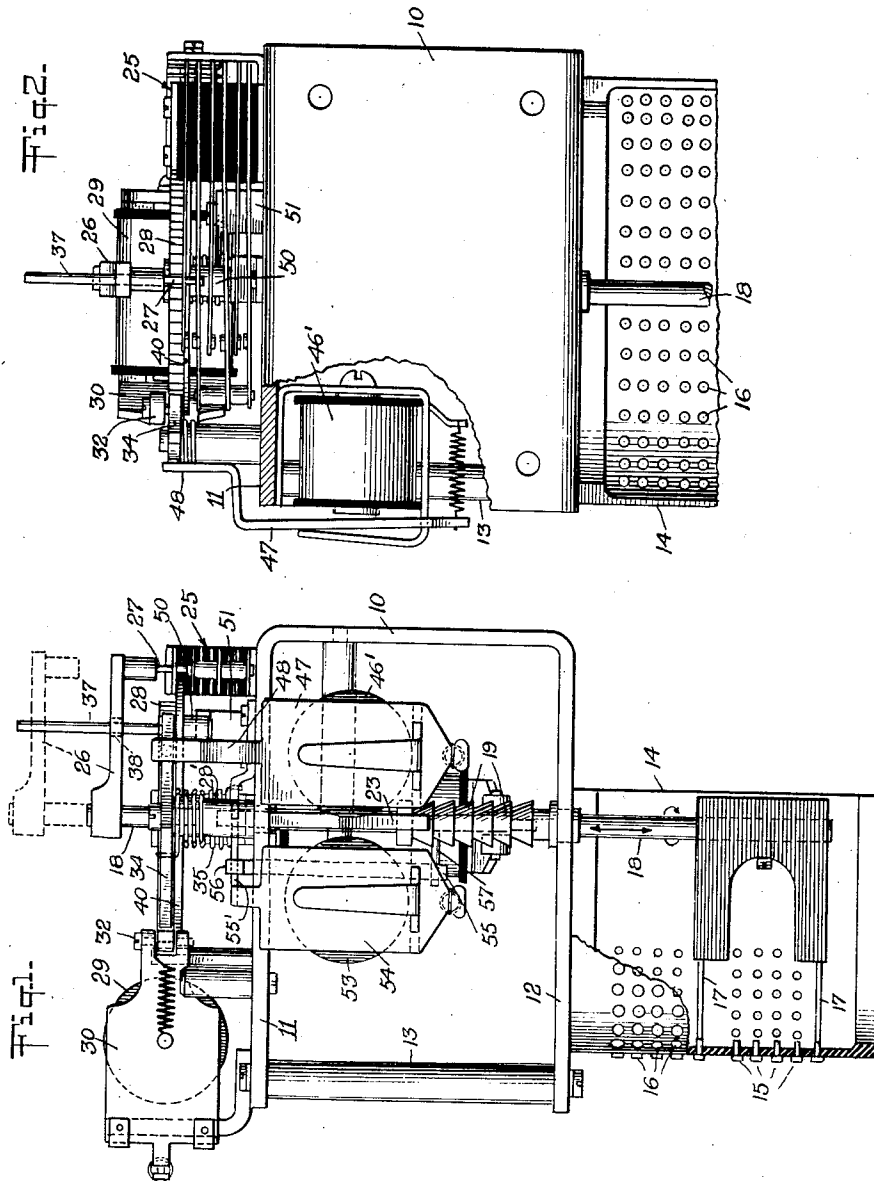
H. T. STENHAMMER

2,372,801

SELECTOR SWITCH

Filed June 15, 1943

2 Sheets-Sheet 1



INVENTOR

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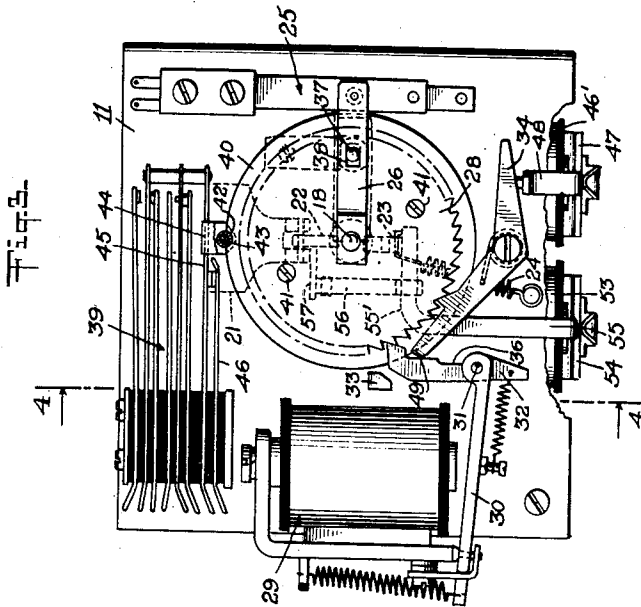
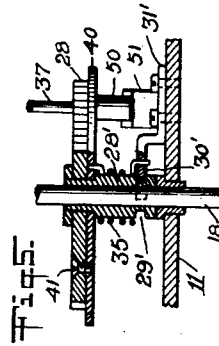
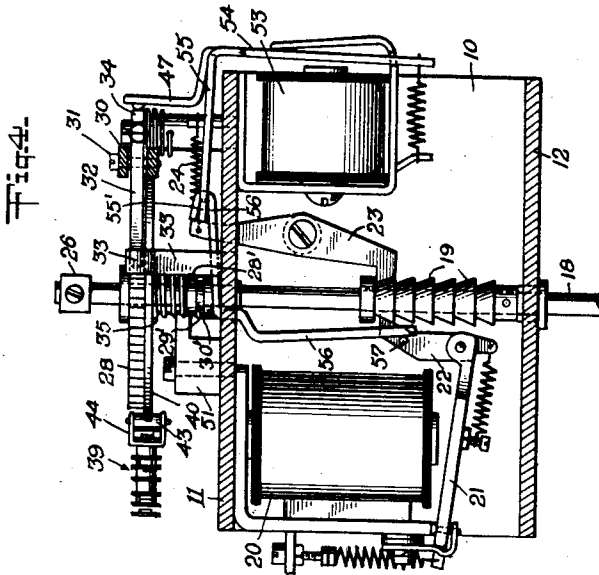
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SELECTOR SWITCH

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UNITED STATES PATENT OFFICE

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SELECTOR SWITCH

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Application June 15, 1943, Serial No. 490,843

6 Claims. (Cl. 179—27.52)

This invention relates to improvements in tele-
phone machine switching apparatus and has par-
ticular reference to a selector switch.

More especially, the switch of the present in-
vention is of the type, also known as a connector,
wherein a wiper shaft has both endwise and
rotary motions produced by impulses transmitted
to the switch in accordance with digits of a called
line. The wiper shaft of this well-known type of
switch has been commonly provided with vertical
and rotary ratchet teeth by means of which the
shaft is first stepped vertically and then rotated
by the successive operations of stepping mag-
nets, and, generally speaking, this equipment is
of expensive and complicated construction.

An object of the present invention is to pro-
vide an improved switch of the two-motion type
referred to which is of simple and practical con-
struction and economical to manufacture, and
which is positive in its operation.

Another and more specific object is to operate
the wiper shaft through its endwise or vertical
movement independently of and relative to a
ratchet, or its equivalent, which is utilized to
impart rotary movement to said shaft, and to
provide a driving connection between said ratchet
and shaft which, at the conclusion of the verti-
cal movement of the latter, will be controlled
by the movement of said ratchet to rotate said
shaft.

A further object is to utilize, in an improved
manner, the initial vertical movement of the
wiper shaft, which is independent of the ro-
tatable ratchet, to reverse the position of one
set of control contacts, and to similarly reverse
another set of such contacts by a means actu-
ated by the initial movement of said ratchet.

The inventive idea involved is capable of re-
ceiving a variety of mechanical expressions one
of which is shown in the accompanying draw-
ings; but it is to be expressly understood that
said drawings are utilized merely for the pur-
pose of describing the invention as a whole and
not to define the limits thereof, reference being
had to the appended claims for this purpose.

In the drawings—

Fig. 1 is a side elevation, partly broken away
and shown in section, of a selector switch con-
structed in accordance with the invention.

Fig. 2 is a similar view taken at right angles
to Fig. 1.

Fig. 3 is a top plan view.

Fig. 4 is a vertical section taken substantially
on the line 4—4 of Fig. 3, and

Fig. 5 is a fragmentary elevation, partly in sec-

tion, showing details of the mounting of the ro-
tary stepping magnet on the wiper shaft.

In its preferred form, the switch is shown as
comprising a supporting frame 10 of U-shape and
having its upper and lower plates 11 and 12 con-
nected by tie rods 13. Depending from the lower
plate 12 is a terminal bank 14 which may be
arcuate or circular and which has vertical and
horizontal rows of contacts 15 and 16 adapted to
be engaged by the wipers 17 carried by the lower
end of the wiper shaft 18. Said shaft extends
through and has bearings in the plates 11 and
12 of the supporting frame so as to have vertical
and rotary movements therein, and in an inter-
mediate portion of the shaft the same is provided
with the usual vertical ratchet teeth 19. Se-
cured to and depending from the under surface
of the upper plate 11 is the vertical stepping
magnet 20 operated, in any suitable circuit in re-
sponse to a series of impulses, to attract and re-
lease its armature 21 and thereby actuate the
stepping pawl 22 to move the shaft 18 upwardly,
from its normal position, one step for each ener-
gization of said magnet. A holding pawl 23 pre-
vents the return of the shaft by having its lower
end yieldably held in engagement with the teeth
19 by a coil spring 24 connected to the upper end
of said pawl, which latter end projects through
plate 11. As shaft 18 is moved vertically in re-
sponse to the operation of magnet 20, wipers 17
move likewise with respect to the vertical rows
of terminals 15 until the impulses which operate
said magnet cease, whereupon the wipers are then
associated with horizontal rows 16 in which a
set of terminals individual to a called line is to
be found, said terminals being engaged by the
wipers in response to the next series of impulses
transmitted to the switch.

The upward movement of the shaft 18 is also
utilized to control a set of spring contacts, gen-
erally indicated by numeral 25 and mounted on
the upper plate 11 for the purpose of accom-
plishing certain well-known switching operations
which need not be described in detail herein.
These contacts have both normal and off-normal
positions and are retained in the former posi-
tion, during the idle periods of the switch, by an
arm 26 secured to the shaft 18 at the upper end
thereof, the free end of said arm engaging and
depressing a pin 27 carried by one of said spring
contacts 25, as shown in Figs. 1 and 2. How-
ever, upon the initial upward movement of the
shaft 18, said arm 26 is raised, as indicated in
dotted lines in Fig. 1, and disengaged from the pin
27, and said spring contacts thereupon assume

their off-normal or closed positions and remain so until the shaft 18 is restored to normal.

The rotary movement of the shaft 18 and its wipers is accomplished through the medium of a disc ratchet 28 mounted on the upper frame plate 11 and having its axis of rotation coincident with that of said shaft which passes loosely through said ratchet so that the vertical or end-wise movement of the shaft is entirely independent of and relative to the ratchet, and the latter remains stationary during said vertical movement. In order to retain the ratchet against any possibility of vertical movement during a similar motion of the shaft 18, said ratchet is provided with a depending sleeve 28' (Fig. 5) having an annular groove 29' in which is engaged a bifurcated end 30' of a holding block 31' secured to the upper surface of the plate 11. The step-by-step rotation of the ratchet 28, which occurs at the termination of the vertical movement of shaft 18, is under control of the rotary stepping magnet 29 which is responsive to impulses in the energizing circuit thereof to attract and release its armature 30. Pivoted to said armature, at 31, is a spring-controlled stepping pawl 32 engageable, upon each attraction of said armature, with a tooth of said ratchet 28 to rotate it one step, there being a fixed cam 33 arranged in the path of said pawl, as the latter is advanced, to direct said pawl inwardly to thereby prevent any possible overthrow movement thereof, and consequently of said ratchet. A spring-controlled holding pawl 34 is pivoted to the frame plate 11 and engages the teeth of the ratchet to prevent return movement of the latter under the influence of its retractile spring 35 until the switch is ready to be restored to its normal condition. As the ratchet is stepped, the tooth of the pawl 34 rides over those of the ratchet and the free end of said pawl, when the high points of said teeth are engaged, enters a recess 36 of the advancing stepping pawl 32 so as to permit free movement of said holding pawl as it rides over said teeth and also prevent it from contacting the surface 49 of the pawl 32 and thereby disengaging the latter from the engaged tooth of said ratchet as said pawl 32 is being advanced.

The stepping of the ratchet 28 accomplishes the rotation of the shaft 18 and its wipers by a driving connection between said ratchet and shaft which, as shown, comprises a rod 37 extending upwardly from said ratchet adjacent its periphery and projecting through an opening 38 in the arm 26, the latter having a free sliding contact on said rod during the vertical movement of the shaft. However, when the ratchet is rotated through its step-by-step movement, or is returned to normal by its retractile springs 35, as will later appear, its rod 37 will cause the arm 26, and consequently the shaft 18, to rotate in one direction until the wipers 17 are properly positioned in accordance with the series of impulses transmitted to the rotary stepping magnet 29, or in the other direction under the influence of said spring 35.

The operation of the ratchet 28 is also utilized to control a set of spring contacts 39 mounted upon the upper plate 11 and having normal and off-normal positions similar to the set of contacts 25. This control is attained by means of a rotatable member such as a cam 40 secured, by fastening screws 41, to the under side of the ratchet 28 with the periphery of the cam extending outwardly beyond that of said ratchet. Said cam is provided in its edge with a cam recess 42 which,

in the normal position of the ratchet, receives a small roller 43 carried by a bracket 44 secured to the spring contact 45. In said normal position, the contact 45 and its associated contact 46, together with other contacts of the set 39, are closed while other groups of contacts of said set are opened. However, upon the first rotary movement of the ratchet 28, the cam 40 forces the roller 43 out of the recess 42 onto the high surface of the cam and, in so doing, reverses the positions of the contact groups in said set 39, to accomplish certain well-known functions, and they remain in such position until the ratchet and cam are restored to normal.

The release of the switch and restoration of its parts to normal occurs as follows. The rotary release magnet 46' is first energized and, in attracting its armature 47, causes an extension 48 on the latter to engage the adjacent end of the holding pawl 34 to rock the same about its pivot and thus disengage the tooth of said pawl from the ratchet. As said pawl is so operated, its end adjacent the stepping pawl 32 contacts the surface 49 of the latter pawl, since this pawl is not now advanced, and swings the same away from the teeth of the ratchet. With both pawls thus disengaged from said ratchet, the retractile spring 35 rotates the ratchet and its cam 40 counterclockwise, as viewed in Fig. 3, until a projection 50 on the under side of the cam engages a stop 51 on the plate 11, whereupon the ratchet is stopped in its normal position and the roller 43 is again engaged in the cam recess 42 to permit the switch contacts 39 to restore to normal. During the restoration of the ratchet, its rod 37 also rotates the wiper shaft 18 through the medium of the arm 26 and when said rotative movement has ceased the closure of the spring contacts 45, 46 of the set 39 is utilized, in any manner well-known in the art, to establish an operating circuit for the vertical release magnet 53 so that its armature 54 is attracted.

The operation of the release magnet effects the disengagement of the vertical holding pawl 23 from the teeth 19 of the shaft 18 and also removes the stepping pawl 22 to an inoperative position relative to said teeth, thereby permitting a free downward movement of said shaft to its normal or starting position. To accomplish these ends, an arm 55 on the armature 54 extends inwardly over the plate 11 and at its inner bent end 55' contacts the upper end of the holding pawl 23 so that upon attraction of said armature, the arm 55 rocks said pawl to disengage its lower end from the teeth 19. At the same time, said arm also depresses one end of an angular lever 56 fulcrumed in an opening in the plate 11, the other end of said lever extending downwardly through said plate with the lower extremity of said other end engaging a pin 57 projecting from the stepping pawl 22. Thus, when the upper end of said lever, which is bent around the end 55', is depressed and thereby rocked about its fulcrum by the arm 55, said lower end will swing the vertical stepping pawl out of operative association with the teeth 19 and the shaft 18 will then be free to drop to its normal position. When reaching said position, the free end of the arm 26 again engages and depresses the pin 27 to restore the contacts 25 to normal and the switch is again in position for another operation, the circuits (not shown) for the release magnets 46 and 53 being broken by the opening of contacts of the sets 39 and 25, respectively.

What is claimed is:

1. In a selector switch, a vertically movable and rotatable wiper shaft, means to move said shaft vertically, means to rotate said shaft including a rotatable member with respect to which said shaft has independent vertical movement, a driving connection between said shaft and rotatable member to rotate the former in unison with said member in response to said rotating means, two sets of spring contacts having normal and off-normal positions, means on said shaft forming a part of said driving connection for retaining one set of said contacts in normal position until said shaft is moved vertically, and means on said rotatable member to reverse the positions of the second set of contacts upon initial rotary movement of said member.

2. In a selector switch, a vertically movable and rotatable wiper shaft, means to move said shaft vertically, means to rotate said shaft including a ratchet through which said shaft extends for independent vertical movement relative thereto, a rod carried by said ratchet, an arm on said shaft having linear movement on said rod during the vertical movement of said shaft, said rod and arm thereafter combining to rotate said shaft in response to said rotating means, two sets of spring contacts each having normal and off-normal positions, one of said sets being retained in normal position by said arm prior to the initial vertical movement of said shaft, and means movable with said ratchet for switching the second set of contacts from normal to off-normal position upon initial movement of said ratchet.

3. In a selector switch, a vertically movable and rotatable wiper shaft, means to move said shaft vertically, means to rotate said shaft including a ratchet through which said shaft extends for independent vertical movement relative thereto, a rod carried by said ratchet, an arm on said shaft having linear movement on said rod during the vertical movement of said shaft, said rod and arm thereafter combining to rotate said shaft in response to said rotating means, two sets of spring contacts each having normal and off-normal positions, one of said sets being re-

tained in normal position by said arm prior to the initial vertical movement of said shaft, and a cam carried by said ratchet to shift the second set of spring contacts from normal to off-normal position when said ratchet is initially operated.

4. In a selector switch, a vertically movable and rotatable wiper shaft, means to move said shaft vertically, means to rotate said shaft including a rotatable member with respect to which said shaft has independent vertical movement, a driving connection between said shaft and rotatable member to rotate the former in unison with said member in response to said rotating means, a set of spring contacts having normal and off-normal positions, and means carried by said ratchet for shifting said contacts from normal to off-normal position upon initial operation of said rotating means.

5. In a selector switch, a vertically movable and rotatable wiper shaft, a ratchet loose on said shaft and having a driving connection therewith for rotating the same, means to move said shaft vertically relative to said ratchet, an electromagnetically operated stepping pawl for said ratchet, a holding pawl engageable with said ratchet, and ratchet releasing means for operating said holding pawl to disengage the same from said ratchet and to engage it with said stepping pawl to render the latter inoperative during the release of said ratchet.

6. In a selector switch, a vertically movable and rotatable wiper shaft, an electromagnetically operated stepping pawl engageable with said shaft to move the same vertically, a holding pawl also engageable with said shaft to retain the same in raised position, means including a ratchet through which said shaft has independent vertical movement for rotating said shaft at the termination of the latter movement, a vertical release magnet, a lever operable for rendering said stepping pawl inoperative during the vertical release of said shaft, and an extension on the armature of said release magnet for simultaneously releasing said holding pawl and operating said lever.

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