

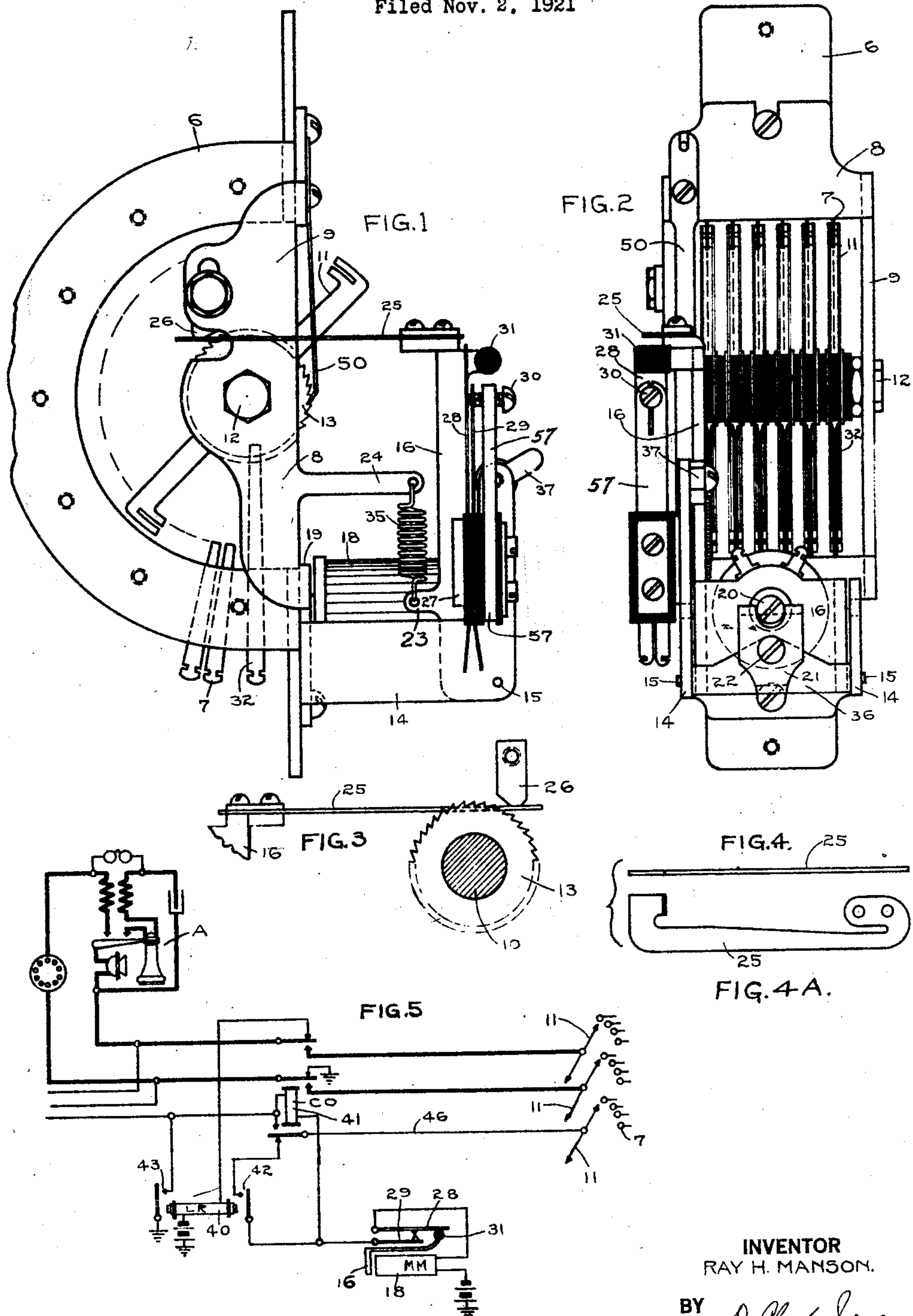
July 24, 1928.

1,678,069

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PAWL AND RATCHET MECHANISM

Filed Nov. 2, 1921



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PAWL-AND-RATCHET MECHANISM.

Application filed November 2, 1921. Serial No. 512,344.

This invention relates to a progressively movable step by step switch of the type employed in automatic telephone systems.

It is the purpose of this invention to provide such a step by step switch which will be rapid in operation and whose parts will be easily accessible for adjustment.

One of the novel features of this invention resides in the arrangement by which the power of the motor magnet is applied for rotating the brushes of said switch. Other features will appear from the detailed description and appended claims.

In the drawings, Fig. 1 represents a side view of the switch and its operating mechanism, a portion of the switch bank being broken away. Fig. 2 represents a front view of the switch showing particularly the arrangement of the brushes and the mounting of the armature of the motor magnet. Fig. 3 is a detailed view showing more clearly the arrangement of the pawl and the ratchet wheel actuated by it. Fig. 4 is a top and Fig. 4^A is a side view of the pawl. Fig. 5 represents telephone circuits employing such a switch.

Referring more in detail to the drawings; 6 designates an arcuate bracket to which rows of contacts such as 7 are clamped between strips of insulation in the well known manner. To this bracket there is secured a frame 8 of the motor mechanism of the switch, provided with two parallel side elements 9 which are apertured to receive the brush shaft 10. This shaft has a series of brushes such as 11 insulatedly mounted thereon and it is supported in the frame by pivot screws 12. Near one end of this shaft and secured thereon in any suitable manner is the ratchet wheel 13.

The lower portion of the frame 8 has two parallel extensions 14 which are apertured to serve as bearings for the non-magnetic pivot 15 of armature 16. This armature is actuated by the magnet 18 which is supported at one end by the downwardly extending portion 19 of the motor frame so that its other pole extends adjacent to the armature. A cast-iron screw 20 is provided on the armature to vary the air gap between the pole piece of the magnet and the armature, while a clamping member 21 with its screw 22, locks screw 20 in the position to

which it has been adjusted. A channel-shaped piece of non-magnetic material 36 is secured to the armature 16, by the clamping member 21 to prevent the armature from "freezing" or adhering to the motor frame when the magnet 18 is once energized.

It will be seen that the frame extensions 14 also serve as return pole pieces for concentrating the magnetic lines set up by the magnet winding 18 to complete the magnetic circuit through the armature 16. The sides of the armature 16 are turned back so as to present a flat surface of considerable area adjacent to the ends of the frame extensions 14 and thereby provide a lower resistance to the magnetic lines at the air gaps between the movable armature 16 and the stationary field extensions.

The motor frame is also provided with an arm 24 to receive one end of a spiral spring 35, the other end of which is attached to an extension 23 on the armature 16. At the upper end of a second extension of the armature 16, there is mounted a pawl 25 in such a position that it normally engages some one of the teeth of the ratchet gear 13. As shown in the top view of Figure 4, pawl 25 is straight throughout its length and is provided at one end with a hook and at its other end with screw holes by which it is mounted on an extension of the armature. The width of the pawl tapers from the hook to a point near the screw holes so that the hook portion of the pawl is substantially rigid while the restricted portion thereof is flexible. A stop 26 adjustably mounted on the side frame 9 prevents overthrow of the brushes 11 and holding dog 50 maintains these brushes in their advanced position. An extension 14 of the motor frame has an integral angular member 27 on which there are insulatedly mounted contact springs 28 and 29, while an adjusting screw 30 mounted in the upper portion of the arm 57 varies the separation between these contacts. At the upper portion of the armature 16 there is an insulated projection 31 which separates the contact springs 28 and 29 each time that the armature is fully attracted. An adjustable cam stop 37 on extension 14 limits the return movement of the armature. Connections between the pairs of brushes 11 and the circuits in which

they are employed is effected by means of feed wipers 32 which engage the pairs of brushes as best indicated in Fig. 2.

It will be noted by referring to Fig. 3 that when the armature 16 is attracted, the pawl 25 will move toward the right on the sliding face of one tooth and will drop into engagement with the next tooth of the ratchet wheel with substantially no upward movement of the portion of the pawl engaging the teeth.

It will also be noted that the pawl 25 does not engage the tooth at the highest portion of the ratchet wheel as is most clearly shown in Fig. 3 but instead engages a tooth whose upper surface is horizontal which permits the pawl 25 to engage the succeeding tooth of the ratchet wheel with substantially no upward movement of the tooth-engaging portion of the pawl.

In switches of the prior art it was customary to arrange the driving pawl so that it would engage the top-most teeth of the ratchet wheel and in this way it was necessary for the pawl to be elevated over each tooth as it engaged the next tooth on the wheel. This arrangement caused the switch to have more friction or to require more power to operate, and also necessitated that the pawl such as 25 should be arranged for a wide range of movement with the result that it was customary to pivot the pawl on the armature in order to give it sufficient movement to permit it to engage the teeth of the ratchet wheel. Such a pivot for mounting the pawl is especially susceptible of wear, rendering the switch inaccurate in operation and necessitating frequent adjustments and replacement of parts.

In the operation of the present switch when the magnet 18 is energized the armature 16 will be attracted toward the pole piece of the magnet causing the tensioning of the spiral spring 35. During this movement of the armature, the pawl 25 will be moved toward the left in Fig. 1 to engage a tooth of the ratchet wheel, at the same time the insulated projection 31 engages the spring 28 to break contact between the springs 28 and 29 and thereby interrupt the operating circuit of the motor magnet 18 so that this magnet will thereupon release its armature 16. The spiral spring 35 will, however, return the armature 16 to its normal position against the cam stop 37, but the pawl 25 as soon as it has advanced the sets of brushes 11 one step will be locked in this position between the stop 26 and a tooth of the ratchet wheel. To advance the sets of brushes still farther the cycle of operations just described will be repeated.

In the circuits of Fig. 5 it has been assumed that the switch of this disclosure is used as an individual line switch in an automatic telephone system. Under this assump-

tion when the subscriber whose substation is indicated at A, removes his receiver from its switch hook a circuit is closed for the line relay 40. This circuit may be traced from grounded battery winding of relay 40, uppermost armature and back contact of relay 41, over the upper side of the calling line and through its substation circuit in series, over the lower side of the calling line to ground at the innermost armature and back contact of the cut-off relay. The contacts 42 of the line relay are adjusted to close before the contacts 43, in order to prevent the false operation of the cut-off relay 41 before the idle trunk is located. However, when contact 43 is closed it applies a guarding potential to the test contacts of the calling line at the various connectors through which the calling line may be reached as a called line. As soon as contacts 42 are closed a circuit is completed from grounded battery, winding of the motor magnet 18, contact springs 28 and 29, armature and front contacts 42 of relay 40, lower armature and back contact of the cut-off relay, test brush such as 11 and test contacts such as 7 of busy trunk circuits to ground. As soon as the motor magnet 18 is energized it attracts its armature 16 and the insulated projection 31 causes the contact springs 28 and 29 to open its operating circuit. Magnet 18 retracts its armature and thereby advances the brushes 11 one step. As soon as a test brush of the switch such as 11 engages an idle test contact such as 7, the cut off relay 41 which has previously been short circuited by ground on busy test terminals is now operated in a circuit closed from grounded battery, winding of the motor magnet 18 contact springs 28 and 29, winding of the cut-off relay 41, contact 43 and armature of line relay 40 to ground. The cut-off relay is energized in this circuit and at its upper armature and back contact removes the line relay 40 from the control of the calling line. At the upper front contacts and armatures of the cut-off relay 41, the calling line is extended to the trunk just seized whereupon holding potential will be applied to the test-terminal of the selected trunk in the well known manner. This cut-off relay will be locked-operated in a circuit closed from grounded battery, winding of the motor magnet 18, contacts 28 and 29, winding of the cut-off relay 41, its lower front contact and armature, conductor 46 and test brush 11 to ground over the holding conductor of the selected trunk. On the release of the connection, ground potential will be removed from this holding conductor whereby the cut-off relay 41 will deenergize to disconnect the calling line from the brushes of the line switch so that the line switch can remain in engagement with the trunk line last used. In the cir-

cuits disclosed in Fig. 5 but three sets of brushes 11 are employed, in which case the switch may be assembled with this number of brushes instead of six sets as shown in Fig. 2.

What is claimed is:

1. In an article of the class described, a frame, a shaft rotatably supported in said frame, a ratchet wheel on said shaft, said ratchet wheel having teeth each of which is provided with a sliding face, a pivoted arm, and a pawl substantially straight throughout its length, rigidly mounted on said arm at right angles thereto, said pawl normally engaging the sliding face of a tooth of said wheel, said face lying in a plane extending at substantially right angles to said arm.

2. In an article of the class described, a rotatable ratchet wheel, a pivoted arm mounted adjacent said ratchet wheel, and a flexible pawl substantially straight throughout its length, rigidly mounted on said arm at right angles thereto, said pawl normally engaging the sliding face of a tooth of said wheel, said face lying in a plane extending at substantially right angles to said arm.

3. In a device of the class described, a frame, a shaft rotatable in said frame, a ratchet wheel on said shaft, a fixed stop on said frame adjacent said ratchet wheel, and a pawl straight throughout its length provided with a hook lying in the plane of said pawl mounted for reciprocating movement, said hook normally engaging said stop and the sliding face of a tooth of said wheel to lock said shaft against rotation.

4. In an article of the class described, a frame, a shaft rotatably supported in said frame, a ratchet wheel on said shaft, a pivoted arm mounted adjacent said ratchet wheel, and a pawl substantially straight throughout its length, rigidly mounted on said arm at right angles thereto and parallel to the plane of said ratchet wheel, said pawl engaging a tooth of said wheel while

resting on the sliding face of an adjacent tooth which lies in a plane parallel to said pawl.

5. In an article of the class described, a ratchet wheel mounted for rotation, a pivoted arm mounted adjacent said ratchet wheel, and a flat pawl rigidly secured to said arm and terminating in a hook to cooperate with said ratchet wheel, the width of said pawl being gradually reduced from the hook end to the end which is secured to said arm so as to cause a portion of the pawl adjacent to the hook end to be substantially rigid and the portion of said pawl adjacent to said arm to be flexible.

6. In a device of the class described, a ratchet wheel mounted for rotation, and a flat reciprocating pawl for driving said ratchet wheel, said pawl having a hook for engaging said ratchet wheel, said hook extending in the plane of said pawl and parallel to the long axis thereof, the other end of said pawl being provided with a mounting portion lying in the plane of said pawl and extending in a direction parallel to the long axis thereof.

7. In an article of the class described, a ratchet wheel mounted for rotation, a pivoted arm mounted adjacent said ratchet wheel, and a flat pawl provided with a hook at one end and with a mounting portion at its other end by which said pawl is rigidly mounted on said arm, said pawl tapering in width from said hook to said mounting portion, said hook lying in the same plane as and extending in a direction parallel to the greatest length of said pawl, said mounting portion lying in the plane of and extending in a direction parallel to the greatest length of said pawl.

In witness whereof, I hereunto subscribe my name this first day of November, A. D. 1921.

RAY H. MANSON.