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No. 865,536. PATENTED SEPT. 10, 1907.

C. E. SCRIBNER & C. D. ENOCHS.

SELECTOR FOR AUTOMATIC TELEPHONE EXCHANGES.

APPLICATION FILED APR. 10, 1905. RENEWED JULY 11, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

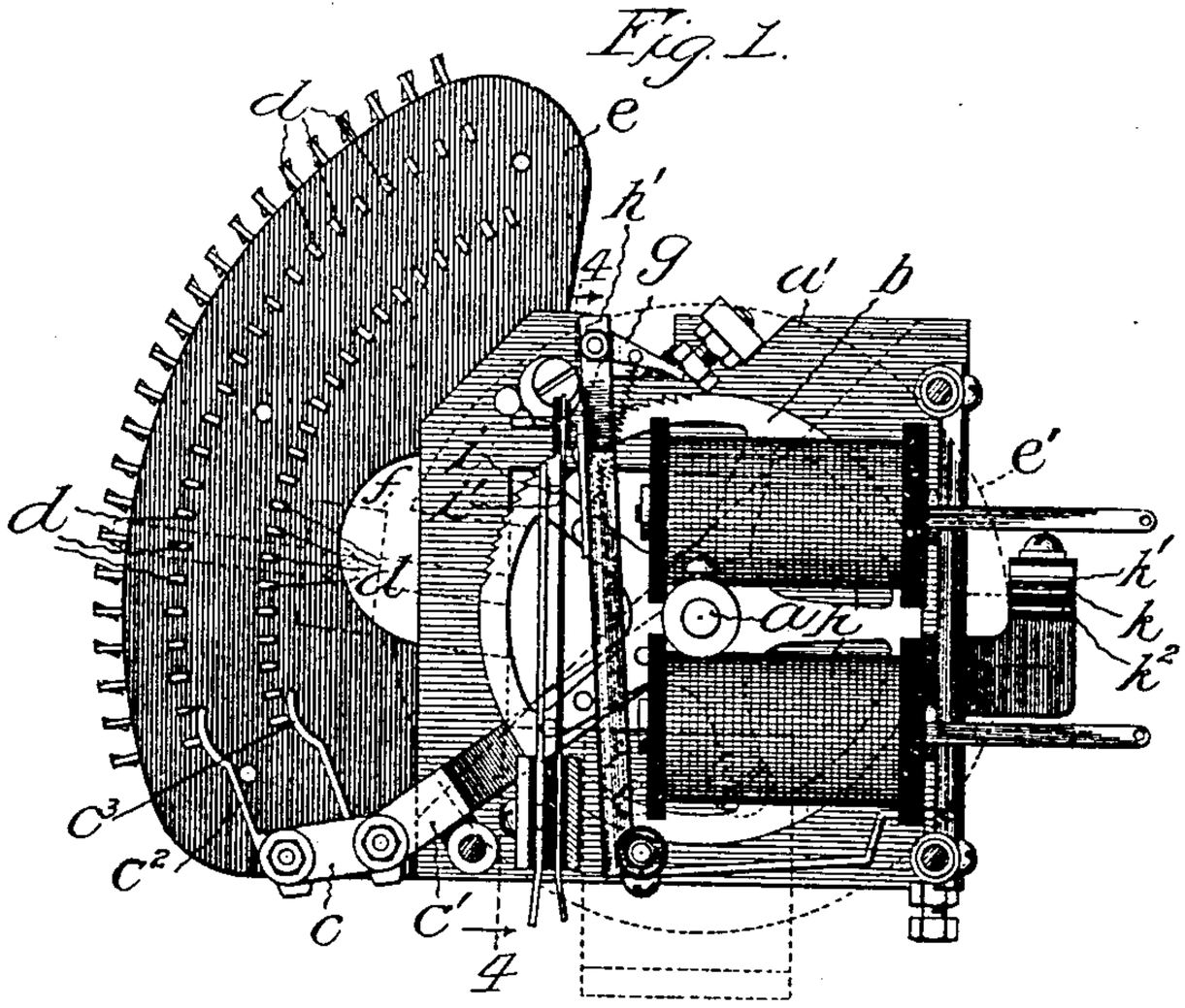
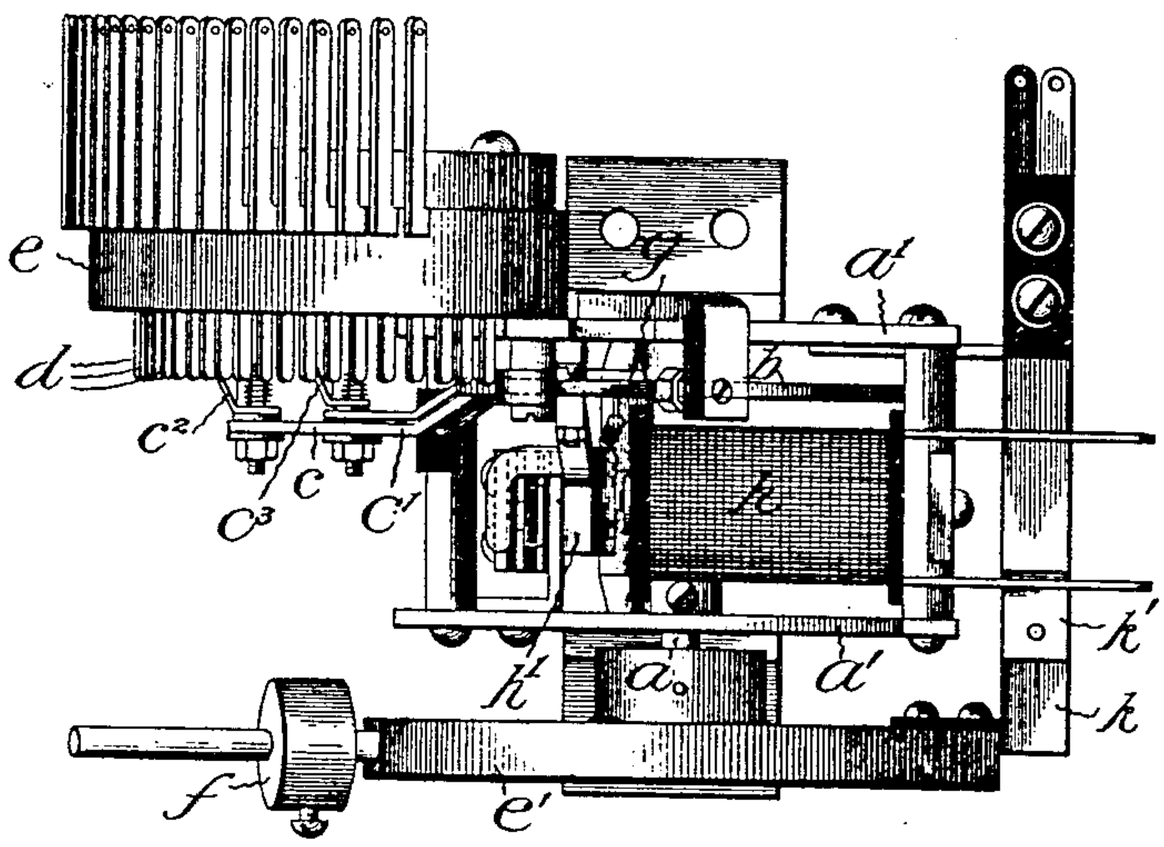


Fig. 2.



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Inventors:
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3 SHEETS—SHEET 2.

Fig. 3.

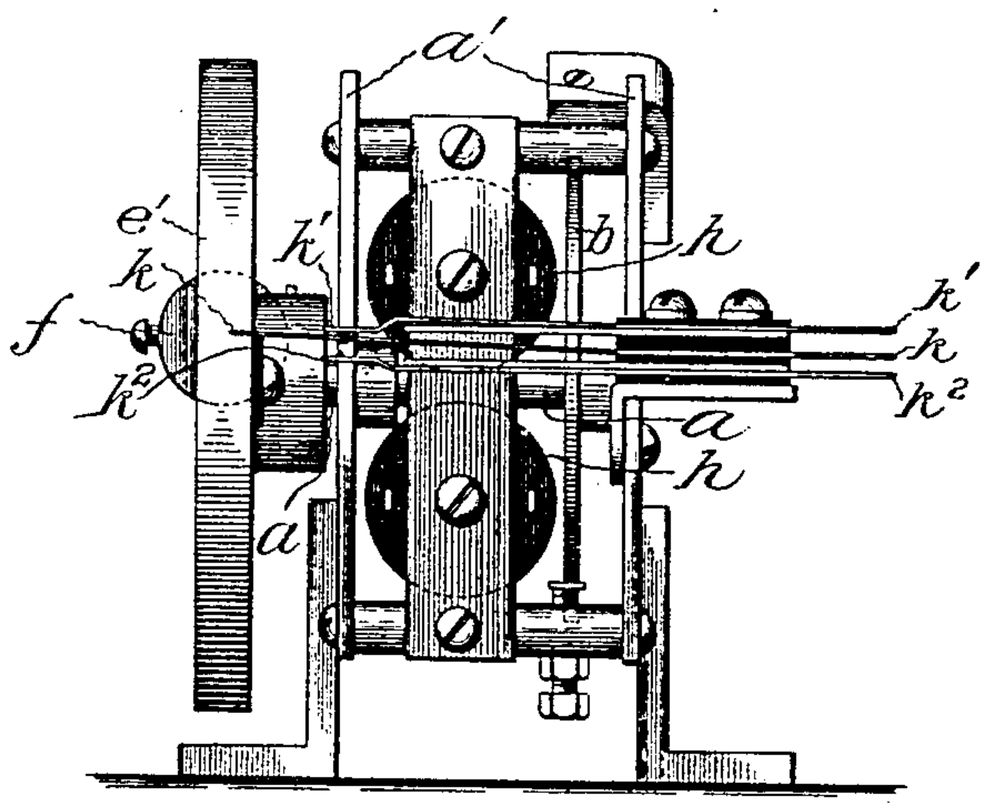
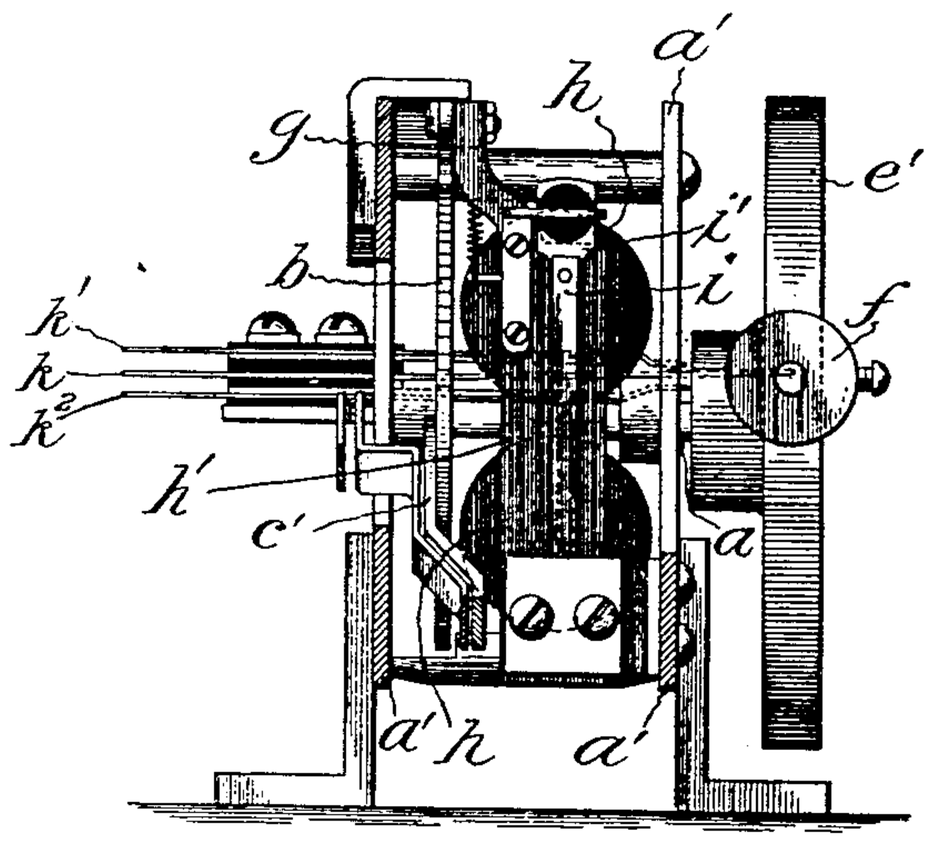


Fig. 4.



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3 SHEETS—SHEET 3.

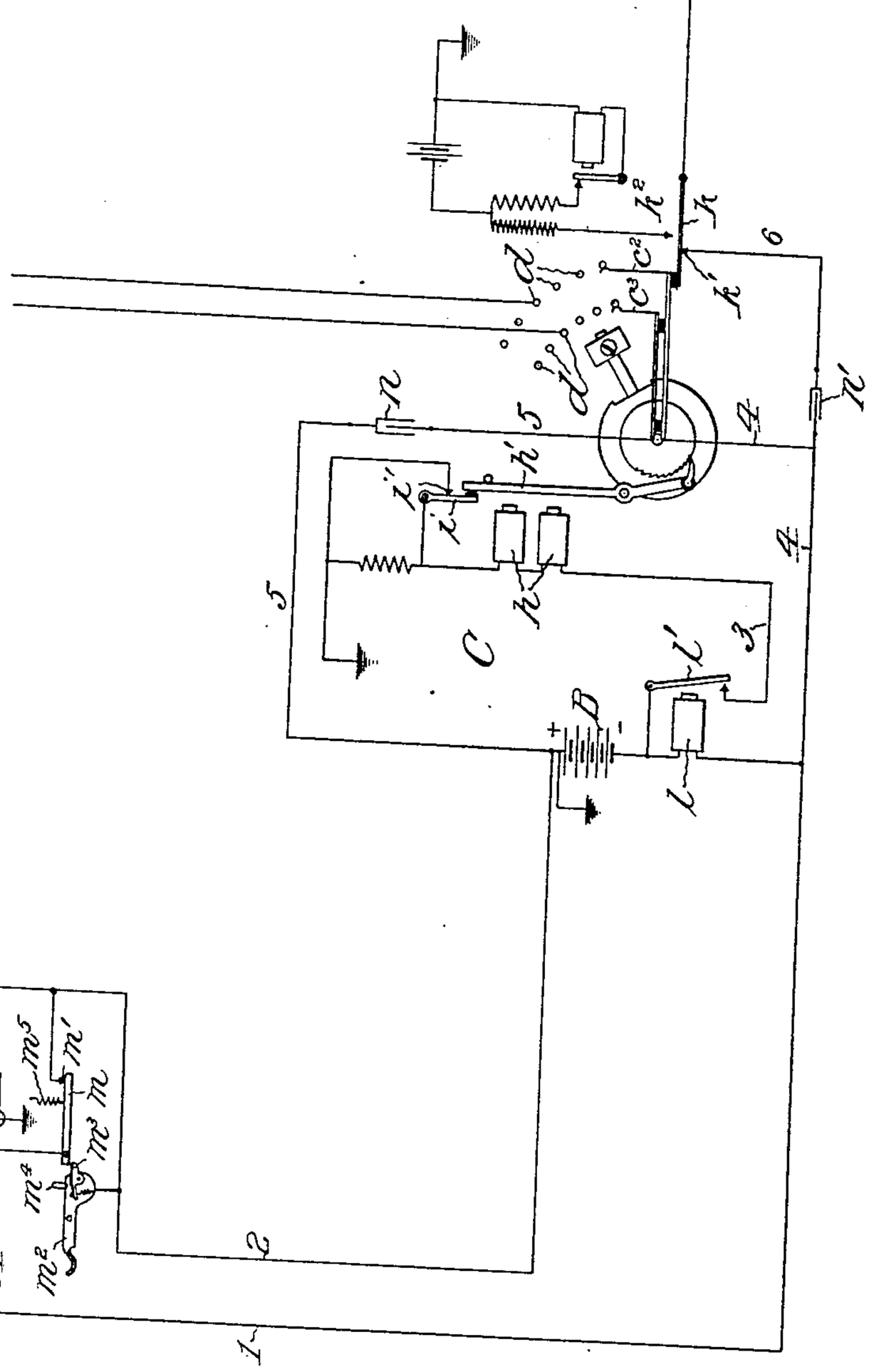

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF JERICHO, VERMONT, AND CLAUDE D. ENOCHS, OF CHICAGO, ILLINOIS, ASSIGNORS TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SELECTOR FOR AUTOMATIC TELEPHONE-EXCHANGES.

No. 865,536. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed April 10, 1905, Serial No. 254,762. Renewed July 11, 1906. Serial No. 325,615.

To all whom it may concern:

Be it known that we, CHARLES E. SCRIBNER, of Jericho, Chittenden county, Vermont, and CLAUDE D. ENOCHS, of Chicago, Cook county, Illinois, citizens of the United States, have invented a certain new and useful Improvement in Selectors for Automatic Telephone-Exchanges, of which the following is a full, clear, concise, and exact description.

My invention relates to electrical switching mechanism, and contemplates in general a ratchet wheel of considerable inertia, arranged in its operation to actuate a switch, a single pawl being provided for operating said ratchet under the control of said inertia. Such switching mechanism is capable of advantageous use, for example, as a line switching device or selector for telephone exchanges, and an object of our invention is to provide an improved structure for such use, adapted to be located at the central office of a telephone exchange to effect the interconnection of different lines terminating at such exchange.

Heretofore such selectors have been considerably complicated both in construction and electrical operation. Each selector has, of course, connection terminals thereon, and a ratchet wheel carrying a switch adapted to engage any one of said connection terminals according to the extent of advance movement of the ratchet wheel, such movement of the wheel being controlled by stepping and retaining pawls, governed in turn by suitable electro-magnets requiring particular and peculiar circuits and controlling apparatus.

In applying our invention to telephone exchange service, our aim has been to produce a simple and cheap selector which will require the minimum amount of circuits and working parts, and so obviate the liability of the selector becoming easily deranged.

An embodiment of our invention for automatic telephone exchange service contemplates a selector comprising a number of connection terminals with a movable switch adapted to be advanced by a ratchet wheel into engagement with any one of the connection terminals, such switch forming the incoming terminal of the individual line, which would, of course, be the calling line. The ratchet is arranged to have a certain amount of inertia, and a pawl is provided to coöperate with the ratchet, and is adapted after engaging one tooth thereof to be rapidly moved into engagement with the next tooth before the inertia of the ratchet can be overcome by gravity and cause the same to slip back to normal position, an electromagnet being provided for rapidly oscillating the pawl. With this arrangement, upon the rapid oscillation of the pawl, the ratchet will be advanced step by step to bring the switch into engagement with any desired connection terminal. When the switch reaches a desired terminal, the magnet may remain energized so as to hold the pawl in engagement with the proper tooth until the connection is no longer desired, when the magnet may be deënergized to release the pawl, whereupon the ratchet and switch return by their weight to their normal position.

In the preferred form of our invention, the ratchet is mounted upon a rotatable shaft, carrying a heavy disk which serves to impart inertia to the ratchet, and the disk carries a weight adjustable to regulate the effective amount of the inertia of the ratchet.

We will describe our invention more in detail by reference to the accompanying drawings, which illustrate an embodiment of our invention applied to automatic telephone exchange service, and the particular parts, improvements or combinations which we consider novel with us will be pointed out in the appended claims.

Figure 1 is a front elevation of the selector with the parts in normal position, and the inertia imparting disk and one of the supporting plates of the frame shown in dotted lines; Fig. 2 is a plan view of the selector; Fig. 3 is a side elevation of the selector with the connection terminals removed; Fig. 4 is a vertical sectional view taken on line 4—4 of Fig. 1; and Fig. 5 is a circuit diagram illustrating the selector employed in connection with an automatic telephone exchange system.

The same letters of reference are used to indicate the same parts wherever they are shown.

Referring first to Figs. 1 to 4, we will describe the mechanism of a selector embodying our invention. A shaft *a* is journaled in the frame *a'* of the selector and carries a ratchet wheel *b* adapted in its movement to advance a switch *c* into engagement with one of a number of sets of connection terminals *d*. The ratchet wheel preferably carries an arm *c'* upon which is mounted a switch, which may comprise two switch fingers c^2 c^3 insulated from each other, forming the terminals of the line with which the selector is associated. The connection terminals with which the switch fingers are adapted to coöperate are preferably mounted upon an insulating support *e* carried by the frame and arranged in a serial order.

The ratchet wheel is arranged to have a considerable amount of inertia, the shaft *a* preferably carrying a heavy disk *e'* which imparts the desired inertia to said wheel. The disk may carry an adjustable counter-weight *f* for the purpose of regulating the effective amount of inertia imparted to the ratchet wheel. This counter-weight may comprise an arm extending away from the disk and carrying an adjustable weighted collar. It will be apparent, of course, that the farther

the collar is removed from the periphery of the drum, the more effective will be the inertia imparted to the ratchet. A pawl g is adapted to engage the teeth of the ratchet wheel b, and is adapted after engaging one tooth, and thereby giving the ratchet a forward impulse or advance movement, to be brought into engagement with the next tooth in order to continue the movement of the ratchet, before the inertia of the wheel can be overcome by gravity to return it to its normal position,—that is, the wheel first gives the ratchet a forward impulse, and then before the forward movement due to such impulse is determined, the pawl is brought into engagement with the next tooth to continue the advance of the ratchet. An electro-magnet h is provided for rapidly oscillating the pawl through the agency of its armature h', to which the pawl is pivotally secured.

After the ratchet has been advanced to bring the switch fingers into engagement with any desired pair of connection terminals, the switch fingers will be maintained in such contact as long as the magnet remains energized, since the magnet so energized maintains the pawl in engagement with the proper tooth of the ratchet, but immediately upon the deënergization of the magnet, the ratchet wheel and its associated switch fingers return to normal position, due to their weight and that of the disk and its counterweight. The armature h' may be arranged to operate a pair of contacts i i' in each oscillation thereof. The disk may carry an insulating stud adapted in the normal position of the disk to maintain a contact spring k in engagement with an anvil k', said spring upon the forward movement of the disk, however, moving by its own resiliency into engagement with an alternative contact k^2.

Referring now to Fig. 5, we will describe an automatic telephone exchange system equipped with our improved selector. A telephone line is shown extending in two limbs 1, 2, from a substation A to a central station C, limb 1 being connected at the central office through the winding of a magnet l with the free pole of a battery B, while the limb 2 is connected at the central office directly with the grounded pole of said battery. The armature l' of relay l controls a local circuit 3, including the battery B and the winding of the selector magnet h.

The apparatus at the substation is of the usual character, with the exception that a selecting device is provided in association with the line for rapidly interrupting the circuit. This device forms no part of the present invention, but I will briefly describe the same. A pivoted contact arm m is electrically connected with the telephone hook, and provided with a normal resting contact m' connected with the limb 2 of the line, said contacts thus being serially included directly in the line circuit. A pivoted manually operated lever m^2 is provided carrying a pawl m^3 adapted upon the movement of the lever to engage the contact arm m and move the same away from its resting anvil m', at the same time closing a shunt about said separated contact points. As the hand lever continues its movement, the pawl is arranged to be suddenly withdrawn from engagement with the contact arm by means of a suitable stop finger m^4, thereby opening the shunt about the contact members and allowing the contact arm m to be moved into engagement with its anvil through the agency of a suitable spring m^5. The break in the circuit, it will be apparent, exists only during the return movement of the arm m. With this mechanism any desired number of rapid interruptions of the circuit containing the battery B and magnet l and in the circuit of the selector magnet h may be obtained, providing, of course, the telephone is first removed from its switch to close the line circuit.

Branch conductors 4, 5, lead from the line at the central station to the switch fingers c^2 c^3 of the individual line selector, upon which selector are mounted the connection terminals d of the remaining lines of the exchange, the branch 5 containing a condenser n. A branch 6 leads from conductor 4 to the multiple connection terminals representing the line from station A upon the other selectors in the exchange, said branch including a condenser n' and the contacts k k' normally closed by the weighted disk, the alternative contact k^2 of the spring k leading to a source of busy tone current, which upon the advance of the ratchet of the individual selector, is applied to the connection terminals upon the remaining selectors in the exchange.

The armature h' of the selector magnet h is adapted when attracted to open the contacts i i' before referred to, thereby breaking a normally closed shunt about a resistance included in the circuit of the selector magnet, so as to decrease the current flowing through the magnet to such an extent as to facilitate the rapid retraction of the armature h'.

The operation of the system may be briefly outlined as follows: A subscriber at station A desiring connection with some other line in the exchange, removes his telephone from its hook, thereby completing the line circuit and energizing magnet l, which in turn completes the circuit 3 including the magnet. The selector magnet in drawing up its armature brings the pawl into engagement with the first tooth of the ratchet wheel b, and advances the ratchet wheel one step, which however, would simply bring the switch finger into contact with a "dead" terminal immediately preceding the terminal of line No. 1. The subscriber would then operate the selecting mechanism at his station a number of times corresponding to the number of the line with which he desires connection. The first interruption of the line and local circuits allows the armature h' of the selector magnet to retract, but the circuit being instantaneously completed, the pawl is brought into engagement with the next tooth of the wheel, giving the same an initial impulse, bringing the switch into engagement with the connection terminals of line No. 1; and upon the circuit being thereafter made and broken rapidly, the pawl is brought into engagement with the succeeding teeth of the wheel before the inertia of the wheel can be overcome by gravity. In this manner the ratchet wheel is advanced until the switch fingers rest upon the connection terminals of the desired line, and the magnet h remaining energized, holds the pawl in engagement with the ratchet and maintains the switch fingers in operative relation to the selected terminals. The disk after its movement from zero, effects the closure of contacts k k^2 and applies a busy test to the terminals representing the line from station A upon the other selectors of the system. At the termination of the

conversation, the subscriber in hanging up his telephone, opens the line and local circuits and effects the deënergization of the selector magnet *h*, whereupon the pawl is withdrawn from the ratchet wheel, allowing the same to return to its normal position.

We claim:

1. A selector comprising a number of connection terminals, a movable switch, a ratchet adapted in its movement to advance said switch into engagement with any one of said terminals, a rotatable shaft upon which said ratchet is mounted, a weight separate from the ratchet carried by the shaft to give said ratchet inertia, a pawl adapted to engage the teeth of said ratchet, and a magnet adapted to rapidly oscillate said pawl to move the same from tooth to tooth on said ratchet to advance the same before the inertia thereof is overcome to allow the ratchet to begin a return movement.

2. A selector comprising a number of connection terminals, a ratchet, an arm secured thereto carrying a switch adapted in the movement of said ratchet to engage said terminals, a rotatable shaft upon which said ratchet is mounted, a heavy disk upon said shaft to give the ratchet inertia, a pawl adapted to engage the teeth of said ratchet, an armature carrying said pawl, said armature when rapidly oscillated moving the pawl from tooth to tooth on said ratchet before the inertia of the ratchet can be overcome by gravity, and a magnet for oscillating said armature.

3. A selector comprising a series of connection terminals, a movable switch, a ratchet wheel adapted in its movement to advance said switch into engagement with any one of its terminals, a rotatable shaft upon which said wheel is mounted, a heavy disk carried by said shaft to impart inertia to said ratchet wheel, an adjustable counter-weight carried by said disk to regulate the effective amount of inertia imparted to said wheel, a pawl adapted to engage the teeth of said ratchet wheel to advance the same before the inertia of the wheel is overcome to allow it to begin a return movement, and a magnet adapted to rapidly oscillate said pawl.

4. A selector for automatic telephone exchanges, comprising a number of pairs of connection terminals arranged in series, a ratchet wheel, an arm carried thereby, insulated switch fingers upon said arm, said wheel in its rotation moving said arm to bring said fingers into engagement with any pair of connection terminals, a rotatable shaft for said ratchet wheel, a heavy disk upon said shaft to give the wheel inertia, a pawl adapted to engage the teeth of said ratchet to advance the same before the inertia of said ratchet is overcome, and a magnet adapted to rapidly oscillate said pawl.

In witness whereof, we hereunto subscribe our names at Chicago, Illinois, this 24th day of February, 1905.

CHARLES E. SCRIBNER.
CLAUDE D. ENOCHS.

Witnesses:
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F. P. MCINTOSH.