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N. E. NORSTROM.

TELEPHONE EXCHANGE.

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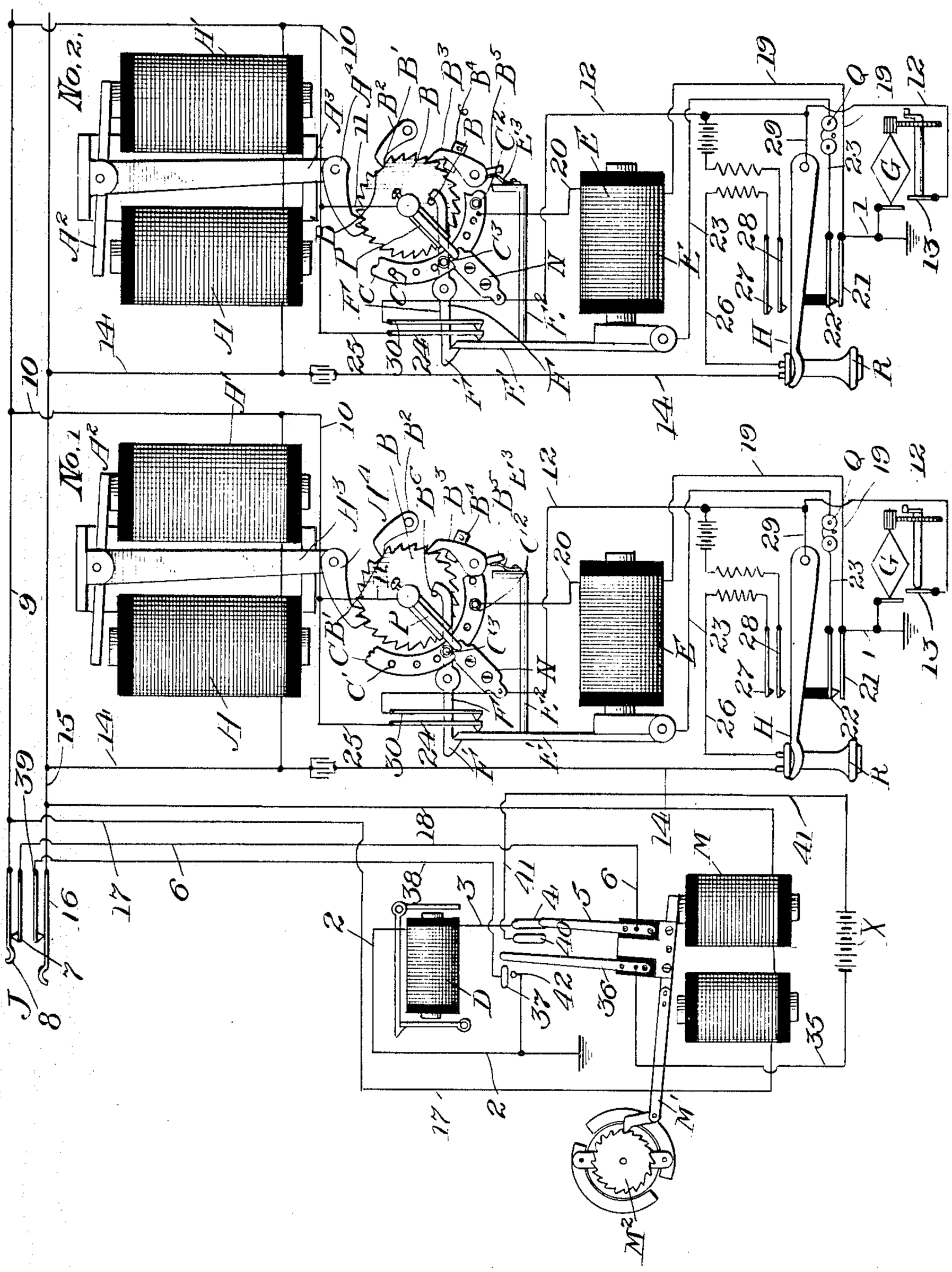

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TELEPHONE-EXCHANGE.

No. 871,520. Specification of Letters Patent. Patented Nov. 19, 1907.

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To all whom it may concern:

Be it known that I, NILS EMEL NORSTROM, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone-Exchanges, of which the following is a specification.

My invention relates to party line exchanges and has for its object improvement in the operation of such exchanges.

The accompanying drawing illustrates at the center and right, two stations on a party line; and at the left, a spring jack J and part of the devices used at the central office. The parts shown in the drawing are in their normal positions, that is, in the positions of rest with the exchange not in use.

At each local station there is a polarized magnet having spools A A^1, an armature A^2 having a lever A^3 attached thereto, and a double-toothed pawl A^4 on the end of the lever A^3. The pawl A^4 engages the teeth of a ratchet wheel B which is mounted upon a spindle in the ordinary way, but without any retractile spring or means for causing it to move backward after it has been moved forward. This ratchet wheel is of the ordinary kind except that it has one tooth removed as shown at B^1. There is a holding pawl B^2 of the ordinary kind, and a second holding pawl B^3 which is loose upon its pivot and without the ordinary spring to cause it to engage the ratchet wheel B. This second pawl B is engaged by a friction spring B^4, the office of which is to furnish friction which will hold the pawl B^3 at whatever point it may be placed. When the ratchet wheel B is advanced by the action of the driving pawl A^4 the pawl B^3 is pushed outward and does not again engage the teeth of the wheel until pushed inward, as will be hereinafterwards described.

Carried by each ratchet wheel B is a contact maker P which sweeps over a ring C having a series of holes C^1 therein. At each station on the line, the first hole beyond normal is a blank. At the first station the second hole C^1 carries a contact pin C^2 adapted to be engaged by the contact maker P. At the second station the pin C^2 is in the third hole, and so on. There is also a small pin C^3 at an intermediate position between the last position occupied by the contact maker just before it reaches its normal position in completing a revolution and its normal position. At its normal position the contact maker P engages a normal contact piece N which is not in electrical connection with the ring C.

At a convenient place is a magnet E which is provided with an electrical connection to the ring C. The armature lever E^1 of the magnet E is normally engaged by a hook F^1 on a pivoted lever F, and holds closed two contact springs 24 and 30. On the ratchet wheel B is a pin B^6 which, when the wheel is one step beyond its normal position, engages the other end of the lever F and lifts the hook F^1 clear of the armature E^1. When the wheel B has advanced one step more, the pin B^6 passes from the lever F and permits the hook F^1 to drop into a position preparatory to reëngaging the armature E^1 whenever the magnet E is actuated.

On the armature E^1 is an arm or projection E^2 provided with a spring E^3 which, when the magnet E is actuated, is adapted to engage a projection B^5 on the pawl B^3 and push said pawl into engagement with the teeth of the wheel B. When the magnet E is actuated the armature E^1 is caught by the hook F^1, and in this position the spring E^3 engages projection B^5 so as to act as a spring for the pawl B^3 and cause that pawl to act as an ordinary holding pawl. In this position the pawl B^3 engages the wheel B while permitting it to move. When the hook F^1 is released from the armature E^1, the spring E^3 moves away from the projection B^5 so that the pawl B^3 is pushed outward by a further advance of the wheel B, and stays at this position until the magnet E is again actuated. In normal position the pawl B^3 engages a tooth of the wheel B, and the pawl B^2 rests at the point where a tooth is removed from said wheel. When an impulse is sent through the spools A A^1 of the propelling magnet the pawl A^4 drives the wheel B forward so that the holding pawl B^2 will engage a tooth in the ordinary manner. In doing this, the pawl B^3 is pushed out by the movement of the wheel and does not again act as a holding pawl until the magnet E is again actuated. Repeated impulses through the propelling magnet continue to advance the wheel step by step, the double tooth on the driving pawl A^4 permitting it to drive past the part of the wheel where a tooth is cut out. This forward movement may continue until the contact maker rests adjacent to contact pin C^3 and the holding pawl B^2 is again at the beginning of the space left by

the removal of a tooth from the wheel B. As the pawl B^3 is not in engagement with the wheel, and as the pawl B^2 finds no tooth with which it can engage, further impulses will not advance the wheel until the pawl B^3 is pushed in by magnet E. As a consequence of this, any irregularity or skip in the movement of any switching may be compensated for by sending from the central office more impulses than are necessary to give the ratchet wheels a full rotation with the result that all will be stopped with their contact makers P adjacent to the contact points C^3. In addition to the parts so far described, there are at each local station, a receiver R, a hook H having adjacent contact springs, a bell-ringing device Q, a generator G, and electrical connections as shown.

At the central office there is a jack J connected to the party line and to which plug and cord connections may be made in the ordinary manner. Also at the central office are a drop D, a battery X, and a polarized magnet M which has an armature M^1 provided with a pawl for engaging a ratchet wheel M^2. The ratchet wheel M^2 is connected to a governing device the object of which is to furnish resistance enough to cause the magnet M to be sluggish in its movement. Anything which will accomplish this result may be substituted for the ratchet wheel M^2 and its connections. On the armature M^1 are insulated contact makers which coöperate with adjacent contact points as will be hereinafter described. The drawing shows these parts in their normal position.

The two local stations illustrated are marked No. 1 and No. 2, and it will be assumed that the subscriber at station No. 1 wishes to talk to the subscriber at station No. 2. The subscriber at station No. 1 turns the crank of his generator G, when a current flows:—G—1—ground to central office—2—D—3—4—5—6—7—8—9—10 of station No 1—11—P—N—12—13—G. This operates the drop D and calls the operator who inserts a plug in the jack J and communicates with the calling subscriber in the ordinary way. Inserting a plug into jack J breaks the connection between 7 and 8 so that no other station on the line can operate the drop D by turning the crank of his generator G. Upon being informed that station No. 1 wants station No. 2, the operator sends a series of alternating impulses over the line. These impulses are assumed to be sent by a calling device arranged for the purpose, though they may be sent by manually operated keys connected to the battery X, or to some other battery. This series of alternating impulses may be considered as made up of pairs, each pair consisting of one impulse in one direction followed by an impulse in the other direction. One of these impulses causes the armature levers A^3 to move in one direction and the other causes them to move in the opposite direction, the two together causing one forward step of the ratchet wheels B. Considering only that part of the circuit which extends out from the jack J, the course of the first impulse is:—8—9—A^1—A—14—15—16. This retracts the pawl A^4 preparatory to a driving operation by said pawl when an impulse flows over the same course in an opposite direction. There is a branch of this circuit as follows:—8—9—17—M—18—15—16. This operates the magnet M throwing its armature M^1 in the opposite direction. The result of this is to shift 5 from 4 to 40, and 36 to 37 and over and past 42. When the reverse impulse comes it operates the propelling magnets so as to advance the ratchet wheels one step. This advance causes the pins B^6 to tilt the levers F of all stations on the line so as to release the hooks F^1 from armatures E^1 and permit springs 24 and 30 to separate. It also operates the magnet M, but such operation is without effect because the circuit from the battery X is open at 7 and 8 when a plug is in the jack J. At the second forward step the contact maker P of station No. 1 is on its contact pin C^2, and as this is one of the stations to be placed in telephonic connection with the line, the operator closes a second connection to ground when a current flows through ground to station No. 1. 1—19—E—20—C—C^2—P—11—10—9—8— and through the inserted plug to the contact made. This operates magnet E to attract its armature and close spring 24 to spring 30, the said armature being caught by hook F^1 so as to hold this connection. This operation of the magnet E also forces the pawl B^3 into engagement with the teeth of the wheel B, but as pawl B^2 is at the time in operative connection, this movement of pawl B^3 is immaterial. The operator also makes a similar connection when station No. 2 has its contact maker P on its contact point C^2 with the result that the magnet E of that station is also operated. She then continues the alternating impulses until she has sent enough to cause all contact makers to rest adjacent to their contact points C^3. The operator then sends a ringing impulse through ground to the called station No. 2—1—21—22—23—Q—E^1—24—25—10—9—8. There are branches of this circuit through magnets E of uncalled stations, but as this ringing current is not strong enough to operate these magnets it is without effect. With both receivers removed, and beginning at the calling station the talking circuit is:—R—14—15—14 of station No. 2—R—26—27—28—H—29—12—30—24—25—10—9—10 of station No. 1—25—24—30—12—29—H—28—27—26—R. When through talking the subscriber rings off and the oper-

ator removes the plug from the jack J. This permits the springs of the jack to return to their normal connections whereupon a current flows:—X—35—36—37—38—39—16—15—18—M—17—9—8—7—6—5—40—41—X. A branch of this flows from 15 to 14 of each station A—A^1—10—9 etc. This current actuates M to return it to its normal position and also actuates the magnets A, A^1 of all local stations to advance their contact makers one more step to their normal positions. In making these movements the contact maker 36 at central sweeps over a contact point 42 and the contact makers P at the local stations sweep over their contact points C^3. When this occurs a current flows:—X—35—36—42—2—ground to all local stations,—1—19—E—20—C—C^3—P—11—10—9—8—7—6—5—40—41—X. This actuates the magnets E of all stations and causes their armatures E^1 to be caught and held by the catches F^1. It also causes the pawls B^3 to be again forced into engagement with the ratchet wheels so that their contact makers P are retained in their normal positions.

Should it happen that for any reason one of the switching mechanisms should get out of step with the others, they may all be again brought into step by means of the toothless part of the ratchet wheel. To do this, the operator without sending an impulse through any of the magnets E, sends a series of impulses greater than enough to carry the contact makers a complete revolution. By failing to send an impulse through the magnets E the pawl B^3 of no station is in engagement with the ratchet wheel B, and, as a consequence, all wheels stop as soon as their toothless portion comes to the pawl B^2. Then by withdrawing the plug from the jack all switching mechanisms are moved to their normal position as before described.

What I claim is:—

1. The combination with a party line terminating in a jack adapted to receive a plug, and a series of local stations connected to the party line, of a switching mechanism at each station, means by which impulses sent over said line will cause the simultaneous advance of all switching mechanisms, and means by which the removal of a plug from said jack will send an extra impulse over the line and cause the switching mechanisms to make one extra advance step.

2. The combination with a ratchet wheel having one tooth removed, a driving pawl, and a holding pawl, of a special pawl, and a magnet for causing said special pawl to engage said wheel so that the driving pawl can drive the toothless part of said wheel past the holding pawl.

3. The combination with a series of ratchet wheels each having one tooth removed, and a driving and a holding pawl for each wheel, of a special pawl for each wheel, a magnet for each special pawl, and means for sending an impulse simultaneously through all of said magnets.

4. The combination with a series of ratchet wheels, means for advancing them, and a holding device for each wheel, each of said wheels having one tooth removed so that the toothless part cannot normally pass the holding device, of a secondary holding device and an actuating magnet therefor for each wheel, each of said secondary holding devices serving when actuated to permit the associated wheel to be moved so as to carry the toothless part beyond the first mentioned holding device, and means for sending an impulse simultaneously through said actuating magnets.

5. In the local station mechanism of a party line exchange a telephonic connection, a magnet for closing said connection, a catch for holding the connection in a closed condition, a ratchet wheel having a normal position of rest, and means by which upon advancing said wheel from its normal position it will release said catch so as to permit the telephonic connection to open.

6. The combination with a series of telephone stations, a telephonic connection for each station normally held in a closed condition by a catch, switching mechanisms at the different stations connected together by a party line, and means by which an impulse sent over the party line will cause said switching mechanisms to release the catches so as to permit the telephonic connections of all stations to be simultaneously broken.

7. The combination with a central office and a series of local stations connected by a party line, of switching mechanisms at the different stations simultaneously movable from their normal positions by impulses sent over the party line, and a separate switching mechanism located at the central office operated by a magnet thereat and provided with connections for controlling the return of the switching mechanisms of the local stations to their normal positions.

8. The combination with a central office and the switching mechanisms of a series of local stations, of a magnet, a battery and a jack located at the central office and provided with connections to each other, means by which the removal of a plug from said jack will cause an operation of said magnet, and a contact closed by said magnet and provided with connections so as to cause an automatic operation of said switching mechanisms.

9. The combination with a series of rotatable contact makers at a series of local stations and means for advancing them step by step from their normal positions, of auto-

matically operating means for causing said contact maker to stop at one step short of a complete rotation, and a magnet at a central office provided with connections for causing said contact makers to be advanced the additional step necessary to bring them to normal position.

Signed at Chicago, Ill., this 15th day of August 1905.

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Witnesses:
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