A. F. DIXON.

SELECTOR MECHANISM.

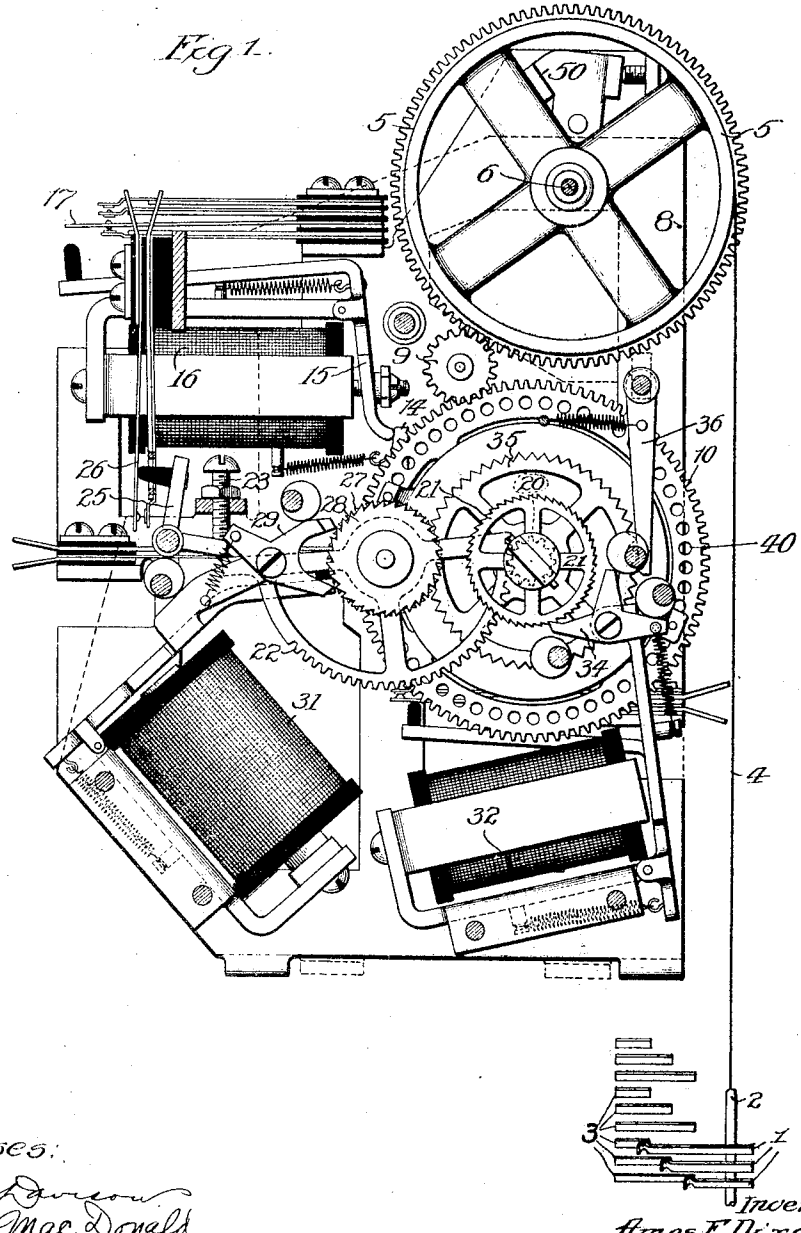
APPLICATION FILED JAN. 20, 1908.

989,133.

Patented Apr. 11, 1911.

4 SHEETS—SHEET 1.

Fig 1.



Witnesses:

Geo. C. Dawson

Irving MacDonald

Inventor

Amos F. Dixon

By Barton, Fanner & Folk,

Attys.

A. F. DIXON.

SELECTOR MECHANISM.

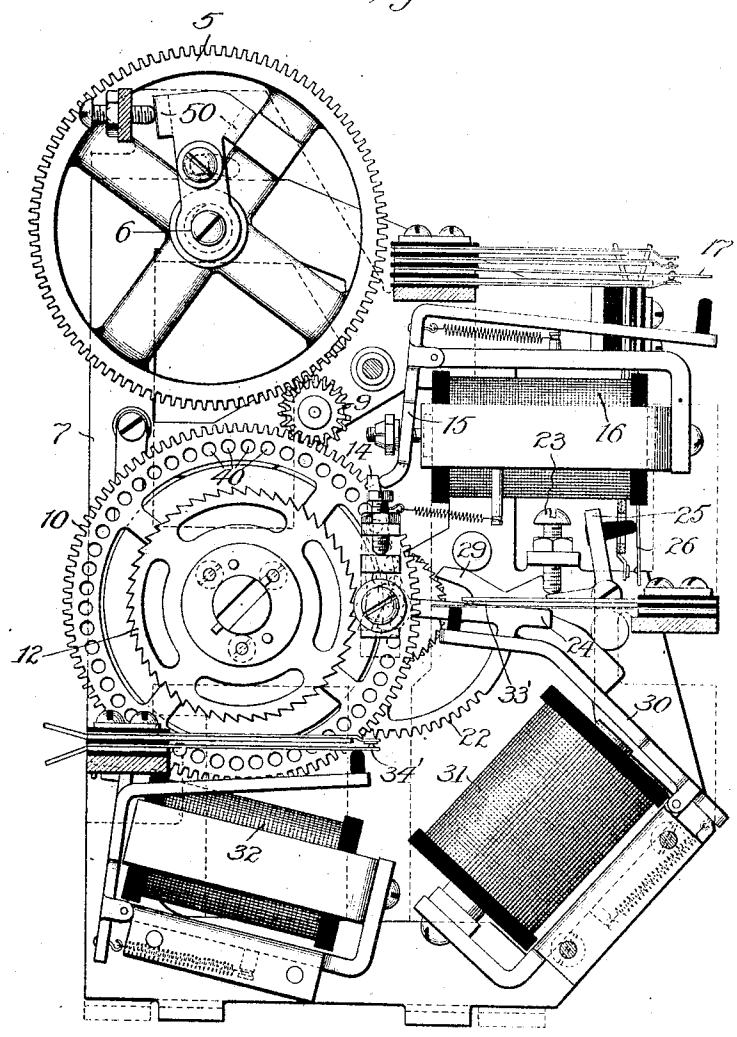
APPLICATION FILED JAN. 20, 1908.

989,133.

Patented Apr. 11, 1911.

4 SHEETS—SHEET 2.

Fig 2.



Witnesses:

Geo. C. Dyrion

Irving MacDonald

Inventor:

Amos F. Dixon

By Barton, Tanner & Folk,

Attys.

A. F. DIXON.

SELECTOR MECHANISM.

APPLICATION FILED JAN. 20, 1908.

989,133.

Patented Apr. 11, 1911.

4 SHEETS—SHEET 3.

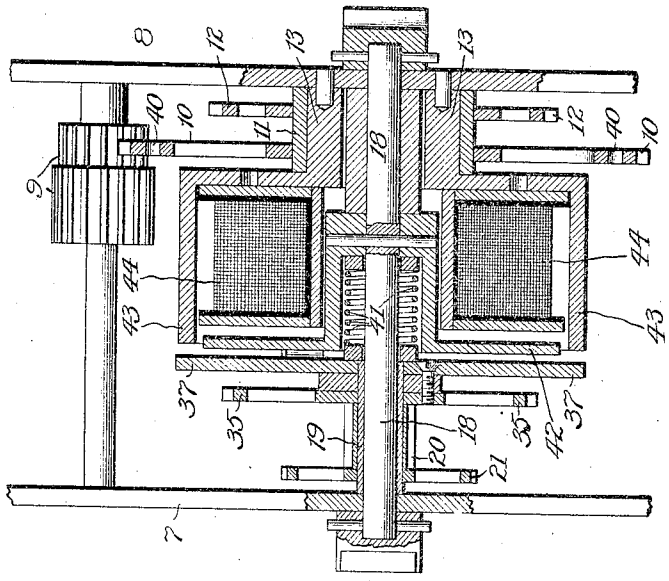


Fig 4

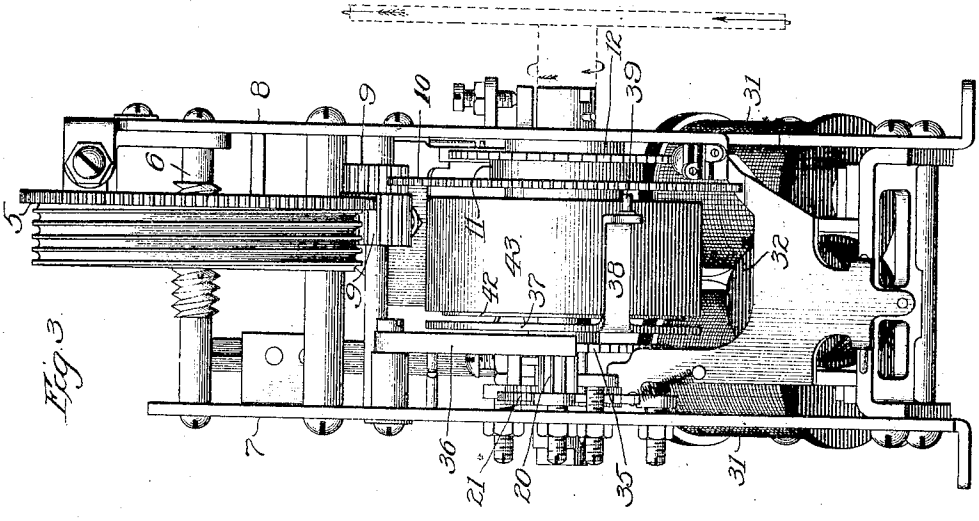


Fig 3

Witnesses:
Fred. C. Dennis
Irving MacDonald

Inventor:
Amos F. Dixon,
By Barton, Banner & Folk,
Attys.

A. F. DIXON.

SELECTOR MECHANISM.

APPLICATION FILED JAN. 20, 1908.

989,133.

Patented Apr. 11, 1911.

4 SHEETS—SHEET 4.

Fig 6.

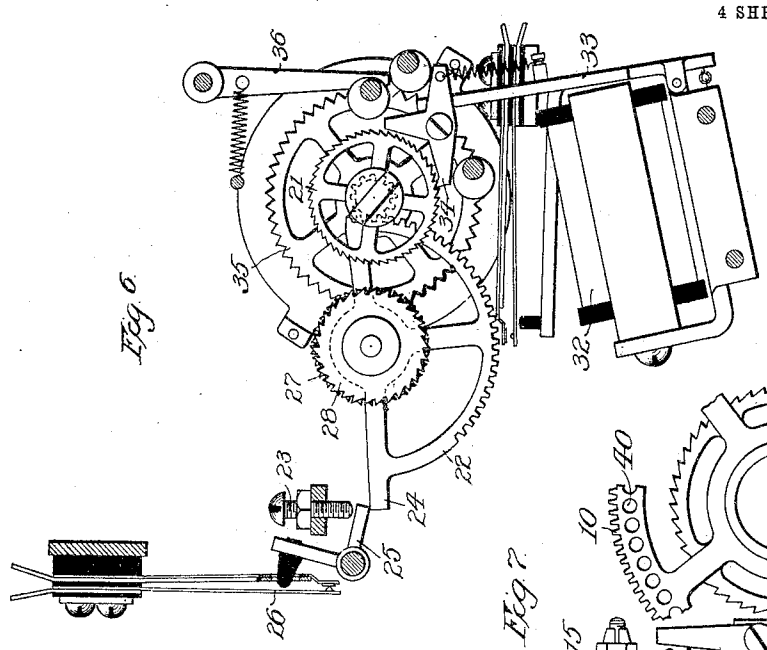


Fig 7.

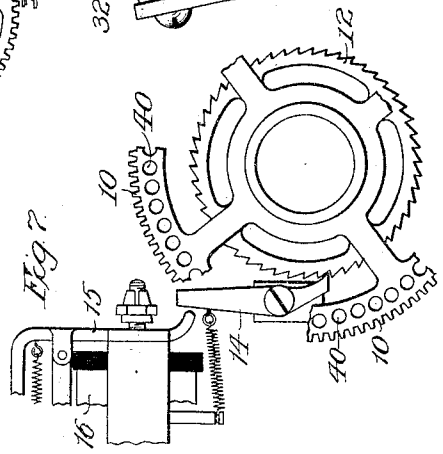
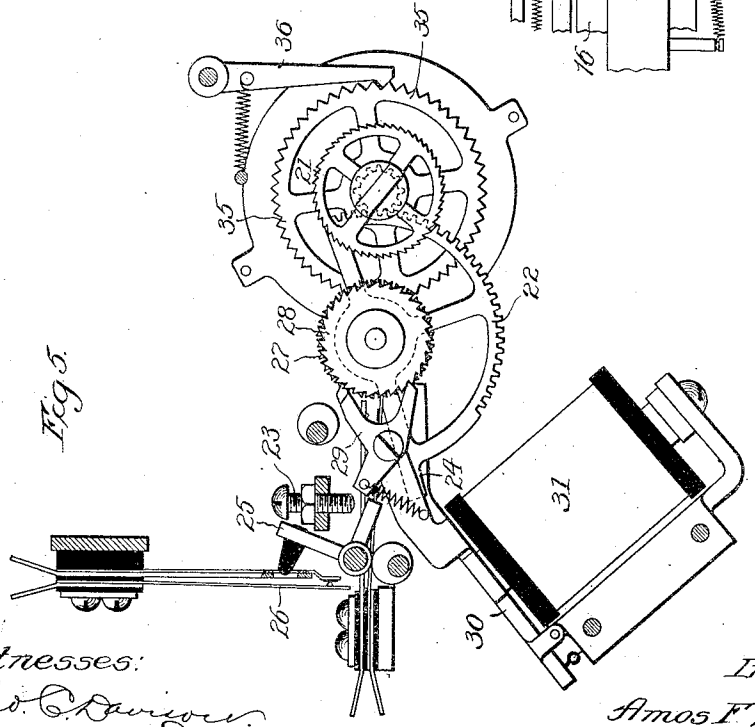


Fig 5.



Witnesses:
Geo. C. Dawson
Irving MacDonald

Inventor:
Amos F. Dixon
By Barton, Dannen & Folk,
Attys.

UNITED STATES PATENT OFFICE.

AMOS F. DIXON, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SELECTOR MECHANISM.

989,133. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed January 20, 1908. Serial No. 411,551.

To all whom it may concern:

Be it known that I, AMOS F. DIXON, citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Selector Mechanism, of which the following is a full, clear, concise, and exact description.

My invention relates to selector mechanism, and is particularly adapted for use in an automatic or semi-automatic telephone exchange system. Its object is to provide improved means by which a carrier for a brush or similar connector is driven a predetermined distance to move the connector in position to make a desired connection.

My invention consists in a combined selecting and driving mechanism, in which the selecting member thereof is moved, preferably step-by-step, from its normal or initial position, and, after being thus moved and connected with the source of power which also operates the driving mechanism, is carried back, preferably by a single movement, to its initial position, the extent of its return movement determining the distance which the driving mechanism moves the carrier. In accordance with my invention, instead of the traveling brush being moved step-by-step to the desired point by the direct action of a magnet or magnets which respond to the selecting impulses, such magnets merely act to advance comparatively light mechanism, the extent of movement of which determines the distance of travel of the brush, whereupon power is applied from another source to move the brush directly to the predetermined point. Thus but little mechanical work is required of the magnets which respond to the selecting impulses.

The several features of my invention may be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a section just within one of the supporting side frames, the position of such frame being indicated in dotted lines, and the operating mechanism being shown in side elevation; Fig. 2 is a similar view of the opposite side of the mechanism; Fig. 3 is an end elevation; Fig. 4 is a vertical section through the clutch mechanism; Figs. 5, 6 and 7 are detail views of different parts of the mechanism.

Fig. 1 indicates diagrammatically the movable switch member which may comprise contact brushes 1 mounted upon a vertically movable slide rod or carrier 2, so as to travel over and make engagement with stationary contact terminals 3. The rod 2 is secured to a cord 4 which passes over a pulley 5. Said pulley is threaded upon a shaft 6, mounted at its ends in the side frames 7, 8. (See Fig. 3.) Said pulley normally rests against a stop 50, and, by threading on shaft 6, said pulley is, by its rotation in winding up the cord 4, moved a slight distance longitudinally of the shaft away from engagement with the stop 50. The pulley 5 is provided with teeth which mesh with a pinion 9, which in turn meshes with the teeth of a gear wheel 10, carried upon a collar 11, (see Figs. 3 and 4) said collar also carrying a ratchet wheel 12. The collar 11 is loosely mounted, preferably on a hub 13 forming part of a clutch magnet, which is adapted to connect the gear wheel 10 with a rotating shaft 18, as will be hereinafter described. It will be observed that the weight of the carrier 2 normally returns it to its lowered position, and hence a holding pawl 14 (Fig. 7) is provided, which cooperates with the ratchet 12 to retain the carrier in its operated position. The pawl 14 is normally held out of engagement with the teeth of the ratchet 12 by the armature 15 of a holding magnet 16, mounted in any suitable manner upon the upper part of the frame 8. When the armature 15 is attracted, the holding pawl 14 is thrown into engagement with the ratchet 12. (See Fig. 7). The armature 15 may also control a group of contact springs 17, in the usual manner.

Mounted loosely on the shaft 18 is a hollow shaft or collar 19 which carries a pinion 20 and a ratchet wheel 21, by means of which said collar is adapted to be rotated. The teeth of a reciprocatory rack, (Figs. 5 and 6) preferably in the form of a pivotally mounted segmental rack 22, mesh with the pinion 20. A stop 23 serves to bring the rack 22 to rest in its initial or normal position. Said segmental rack is preferably provided with a radial extension 24, which in its initial position moves a bell-crank lever 25 against the stop 23, in which position said bell-crank lever engages a contact spring 26 and holds open the contacts controlled thereby.

The segmental rack 22 is rotatably mount-

ed on the frame 7, and the hub of said rack carries a pair of ratchet wheels 27, 28, the teeth of which extend in opposite directions. Coöperating with said ratchet wheels is a compound pawl 29, pivotally carried on an arm or extension of the armature 30 of long step magnet 31. In its normal position the pawl 29 rests against a stop and is held out of engagement with said ratchet wheels. When the armature is attracted, as shown in Fig. 5, one branch of the compound pawl 29 engages with the ratchet 28 and steps it one tooth, at the end of which movement the other branch of the pawl engages the ratchet 27 and prevents further movement of the parts for said operation of the armature. An impulse of current in the magnet 31 thus serves by the system of gears just described to advance the gear 22 by a comparatively long step. The rack 22 may also be advanced by an impulse of current in the short step magnet 32, the armature 33 of which carries a pawl 34, adapted, when the armature is actuated, to engage the ratchet wheel 21 and step it forward one tooth, and, through the pinion 20, give a short step to the rack 22. It will be noted that the magnets 31 and 32 step the rack or selecting member 22 in the same direction, the connection being such that the former produces a "long step" and the latter a "short step", as, for example, ten of the short steps may be equal to one of the long steps. The long and the short step of the member 22 would then correspond or be proportional to the distance of travel of the brush carrier over ten, and over one, respectively, of the line terminals. The armatures of the magnets 31, 32, may control the opening and closing of contact springs 33′, 34′, in case this be found necessary.

The collar 19 is preferably provided with a drag wheel 35 having teeth on its periphery with which a spring pressed drag 36 engages and thereby prevents a too free rotation of said collar.

Secured on the collar 19 to rotate therewith is a disk 37, forming the armature or movable member of a magnetic clutch. Said disk is provided with one or more extensions or lugs 38, Fig. 3, extending perpendicularly to the disk from the circumference thereof. The free end of said lug is provided with a pin 39 projecting in front of a series of holes 40 near the rim of the wheel 10. The collar 19 is capable of a slight longitudinal movement on the shaft 18, but is normally held by the thrust of the spring 41, (Fig. 4) in such position that the pins 39 do not normally enter the holes 40.

A friction disk 42, preferably of brass or other non-magnetic material is mounted to rotate with the shaft 18. Said disk is mounted before the pole faces of a magnet inclosed in a casing 43. It will be understood that the spring 26 serves as a clutch release device, since it may be arranged to open the circuit through the coils 44 of the magnetic clutch. When the magnetic clutch is actuated the armature disk 37 is drawn into frictional engagement with the friction disk 42, thus causing the collar 19 and the pinion 20 carried thereby to rotate with the shaft 18. The attraction of the disk 37 causes the pins 39 on the end of the lugs 38 to enter the holes 40 in the gear wheel 10, thus coupling said gear wheel to the shaft 18 through the frictionally engaging disks 37, 42. The shaft 18 rotates in a direction to wind the cord 4 on the pulley 5 and thus elevate the carrier or rod 2. Therefore by the energization of the coils 44 of the electromagnet clutch, the cord 4 is wound on the pulley 5, while the direction of rotation of the pinion 20 by the shaft 18 is such that the segmental rack 22 is returned to its initial position. When said segmental rack reaches its initial position it operates the clutch release spring 26 and thus opens the contacts controlled by the spring 26. Since, as hereinbefore stated, said contacts are designed to control, by any suitable arrangement of circuits, the energization of coils 44, it is obvious that the return of the rack 22 to its position against its stop will throw open the magnetic clutch, disconnecting the pinion 20 and the gear 10 from rotary movement with the shaft 18. It is apparent, therefore, that the distance the carrier 2 is moved is dependent upon the distance the segmental rack 22 is stepped from its initial position. As before stated, a holding pawl 14 prevents the weight of the carrier returning the same to its normal position until said pawl has been removed from engagement with the ratchet 12 by the deënergization of the holding magnet 16, such deënergization being controlled in any suitable manner.

Briefly stated, the operation of the mechanism will in general be as follows: The holding magnet 16 will first be energized to attract its armature 15, allowing the pawl 14 to engage the ratchet 12 and by the actuation of the contact spring 17, establishing, if desired, such circuit conditions as may be necessary to the further operation of the other parts. The stepping magnet 31 will now be energized and through the agency of pawl 29 and ratchet 28 will advance the segmental rack 22 by a long step for each impulse of current corresponding to a distance of travel over ten terminals by the carrier 2. The stepping magnet 32 may next be operated, and through the agency of the pawl 34, ratchet 21 and pinion 20 further advance the rack 22 by a short step for each impulse of current, corresponding to a distance of travel over one terminal by the carrier 2. The rack consti-

tuting the selecting mechanism being thus set, the clutch magnet may then be excited, whereby the constantly rotating shaft 18 is coupled to drive the pulley 5 to raise the carrier rod 2 to a predetermined point. At the same time the shaft 18 returns the rack 22 to its initial position, whereupon said rack operates the clutch release spring 26, which may be arranged to open the circuit of the magnetic clutch. The traveling brush 1 has thus been removed to the required point and stopped. When it is desired to restore the brush carrying rod 2 to its normal position, the holding magnet 16 is deënergized, whereupon the holding pawl 14 is withdrawn, and the weight of said rod causes the cord 4 to unwind from the pulley 5, said pulley being operatively connected with the loosely mounted gear wheel 10.

I claim:

1. In a selector switch, the combination with a movable switch member, of a selecting member, selectively controlled electrical means for advancing said selecting member, and driving mechanism arranged to return said selecting member to its initial position and to drive said movable switch member a distance predetermined by the extent of movement of said selecting member.

2. In a selector, the combination with a movable selecting member, of a brush carrier arranged to travel over line terminals, means for advancing said selecting member a distance from its normal position corresponding to the desired travel of the brush carrier over said line terminals, and motor mechanism arranged to return said selecting member to its normal position and to advance said brush carrier a distance corresponding to the distance of return travel of the movable selecting member.

3. In a selector, the combination with a movable selecting member, of a brush carrier arranged to travel over line terminals, means for advancing said selecting member a distance from normal corresponding to the distance of travel of the brush carrier over ten of said line terminals, means for advancing the movable member a distance from normal corresponding to the distance of travel of the brush carrier over one terminal, and motor mechanism for returning said selecting member to normal and for advancing the brush carrier a distance corresponding to the distance of travel of the movable selecting member from its advanced to its normal position.

4. In a selector, the combination with a movable selecting member, of a brush carrier arranged to travel over line terminals, electrically controlled means for advancing said selecting member step-by-step a distance from its normal position corresponding to the desired travel of said brush carrier over said line terminals, motor mechanism arranged to return said selecting member to its normal position and to advance said brush carrier, means for operatively connecting said motor mechanism to said selecting member and to said brush carrier, and means operated by said selecting member upon its return to its initial position to disconnect said selecting member and said brush carrier from the motor mechanism, whereby the distance of advance travel of said brush carrier corresponds to the distance of the return travel of the selecting member.

5. A selector switch comprising electrical means adapted to respond to selecting impulses, a step-by-step selecting member actuated by said means, a movable brush carrier, motor mechanism adapted to move said brush carrier and to return said selecting member to its initial position, means for simultaneously bringing said motor mechanism into operative relation with said carrier and said selecting member, and means operated by said selecting member upon its return to its initial position to arrest the movement of said brush carrier at the point predetermined by the extent of the return movement of said selecting member.

6. In a selector switch, the combination with a movable switch member, of a step-by-step selecting member, an electromagnet arranged in its response to selecting impulses to advance said selecting member by long steps, a second electromagnet for advancing said selecting member by short steps, motor mechanism adapted to drive said movable switch member and to return said selecting member to its initial position, means for simultaneously bringing said motor mechanism into operative relation with said carrier and said selecting member, and a switch arranged to be operated by said selecting member when the latter is in its initial position, for disconnecting said motor mechanism from said carrier and said selecting member.

7. In a selector, the combination with a movable switch member, of step-by-step selecting mechanism, electromagnetic means for advancing said selecting mechanism, continuously-acting motor mechanism, a magnetic clutch, means actuated by said clutch for operatively connecting said motor mechanism to said switch member to drive the same, means actuated by said clutch for operatively connecting said motor mechanism to said selecting mechanism to restore said selecting mechanism to its initial position, and means operated by said selecting mechanism in its initial position for deënergizing said magnetic clutch.

8. In a selector switch, the combination with a movable switch member, of a rack, a pinion coöperating therewith, selectively

controlled electromagnetic means for advancing said rack, and driving mechanism arranged to operate said pinion to return said rack to its initial position and to drive said movable switch member a distance predetermined by the extent of the return movement of said rack.

9. In a selector switch, the combination with a movable switch member, of a rack, a pinion coöperating therewith, an electromagnet adapted to respond to selecting impulses, mechanism operated by said electromagnet for advancing said rack step-by-step, motor mechanism adapted to move said brush carrier and to operate said pinion to restore said rack to its initial position, means for simultaneously bringing said motor mechanism into operative relation with said carrier and said pinion, and means operated by said rack upon its return to its initial position to arrest the movement of said movable switch member at the point predetermined by the extent of the return movement of said rack.

10. In a selector switch, the combination with a movable switch member, of a rack, a pinion coöperating therewith, an electromagnet arranged in response to selecting impulses to advance said rack by long steps, a second electromagnet for similarly advancing said rack by short steps, motor mechanism adapted to move said brush carrier and to operate said pinion to restore said rack to its initial position, means for simultaneously bringing said motor mechanism into operative relation with said carrier and said pinion, and means operated by said rack upon its return to its initial position to arrest the movement of said movable switch member at the point predetermined by the extent of the return movement of said rack.

11. In a selector, the combination with a movable switch member, of a rack, a pinion coöperating therewith, electromagnetic means for advancing said rack a predetermined distance, continuously-acting motor mechanism, a magnetic clutch, means actuated by said clutch for operatively connecting said motor mechanism to said pinion to restore said rack to its initial position, means actuated by the connection of said pinion with said motor mechanism to operatively connect said motor mechanism to said switch member to drive the same, and means operated by said rack in its initial position for deënergizing said magnetic clutch.

12. In a selector, the combination with a movable switch member, of a constantly rotating shaft, driving gear adapted to be operated by said shaft to move said switch member, a pivotally mounted segmental rack, a pinion coöperating therewith, said pinion being loosely mounted on said rotating shaft, an electromagnet, pawl and ratchet mechanism operated thereby for advancing said rack by long steps, a second electromagnet, pawl and ratchet mechanism operated thereby for advancing said rack by short steps, said rack in its advance rotating said pinion in a direction reverse to the direction of rotation of said shaft, an electromagnetic clutch for coupling said pinion and said driving gear to said rotating shaft, and a clutch releasing switch arranged to be operated by said rack upon its return to its initial position.

13. In a selector, the combination with a movable switch member, of a rotating shaft, driving gear adapted to be operated by said shaft to drive said switch member, selecting mechanism for determining the travel of said switch member, electromagnetic means for setting said selecting mechanism, restoring gear adapted to be operated by said shaft to return said selecting mechanism to its initial position, clutch mechanism for connecting said driving gear and said restoring gear to said rotating shaft, and clutch releasing mechanism operated by said selecting mechanism upon its return to its initial position.

14. In a selector, the combination with a movable switch member, of a constantly rotating shaft, driving gear adapted to be operated by said shaft to drive said switch member, step-by-step selecting mechanism, electromagnetic means for stepping said selecting mechanism, restoring gear adapted to return said selecting mechanism to its initial position, an electromagnetic clutch for connecting said driving gear and said restoring gear to said rotating shaft, and a clutch releasing switch arranged to be opened by said selecting mechanism upon its return to its initial position.

15. In a selector, the combination with a movable switch member, of a constantly rotating shaft, driving gear adapted to be operated by said shaft to move said switch member, reciprocally mounted selecting mechanism, an electromagnet, pawl and ratchet mechanism operated thereby for advancing said selecting mechanism by long steps, a second electromagnet, pawl and ratchet mechanism operated thereby for advancing said selecting mechanism by short steps, restoring gear engaging with said selecting mechanism and adapted by its actuation to return said selecting mechanism to its initial position, an electromagnetic clutch for connecting said driving gear and said restoring gear to said constantly rotating shaft, a clutch releasing switch arranged to be operated by said selecting mechanism upon its return to its initial position, a holding magnet, and a holding pawl controlled thereby for maintaining said movable switch member in the position to which it is moved by said driving gear.

16. In a selector, the combination with a

movable switch member, of selective mechanism, selectively controlled electromagnetic means for advancing said selecting mechanism, a constantly rotating shaft, a loosely mounted driving gear for moving said switch member, restoring gear loosely mounted on said shaft for returning said selecting mechanism to its initial position, clutch mechanism for simultaneously connecting said loosely mounted gears with said rotating shaft, and a clutch release member arranged to be operated upon the return of said selecting mechanism to its initial position.

17. In a selector, the combination with a movable switch member, of selecting mechanism, selectively controlled electromagnetic means for advancing said selecting mechanism, a constantly rotating shaft, a loosely mounted driving gear for moving said switch member, restoring gear loosely mounted on said shaft for returning said selecting mechanism to its initial position, an electromagnetic clutch adapted when energized to secure one of said gears to said rotating shaft, a connecting member adapted when said clutch is energized to operatively connect said gears, and a clutch release member arranged to be operated upon the return of said selecting mechanism to its initial position.

18. In a selector, the combination with a movable switch member, of a constantly rotating shaft, a loosely mounted driving gear adapted to be operated by said shaft to move said switch member, reciprocating selecting mechanism, electromagnetic means for advancing said selecting mechanism, restoring gear loosely mounted on said shaft and adapted to be connected with said shaft to return said selecting mechanism to its initial position, an electromagnetic clutch adapted when energized to couple said restoring gear to said rotating shaft, means operated when said restoring gear is coupled to said shaft to also couple said driving gear to said shaft, and a clutch releasing switch arranged to be opened by said selecting mechanism upon its return to its initial position.

19. In a selector, the combination with a movable switch member, of a constantly rotating shaft, a loosely mounted driving gear arranged to be operatively connected to said shaft to move said switch member, a pinion loosely mounted on said shaft, a rack cooperating with said pinion, selectively controlled electromagnetic means for stepping said rack and pinion, said pinion being rotated thereby in a direction reverse to the rotation of said shaft, clutch mechanism adapted when operated to simultaneously connect said pinion and said driving gear to said rotating shaft, and a clutch release member arranged to be operated upon the return of said rack to its initial position.

20. In a selector, the combination with a movable switch member, of a constantly rotating shaft, a loosely mounted driving gear arranged to be operatively connected to said shaft to move said switch member, a pinion loosely mounted on said shaft, a rack cooperating with said pinion, selectively controlled electromagnetic means for stepping said rack and pinion, said pinion being rotated thereby in a direction reverse to the rotation of the shaft, an electromagnetic clutch adapted when energized to secure said pinion to said rotating shaft, means operated in the engagement of said pinion with said shaft for operatively connecting said driving gear to said shaft, and a clutch releasing switch arranged to be opened by said rack upon its return to its initial position.

21. In a selector, the combination with a movable switch member, of a constantly rotating shaft, a loosely mounted driving gear arranged to be operatively connected to said shaft to move said switch member, a pinion loosely mounted on said shaft, a rack cooperating with said pinion, selectively controlled electromagnetic means for stepping said rack and pinion, said pinion being rotated thereby in a direction reverse to the rotation of said shaft, a disk carried by said pinion, an electromagnetic clutch for coupling said pinion to said shaft, said disk forming the armature of said electromagnetic clutch, an extension of said disk adapted when said clutch is energized to engage said driving gear and operatively connect it to said pinion and thereby to said shaft, and a clutch releasing switch arranged to be opened by said rack upon its return to its initial position.

22. In a selector, the combination with a movable switch member, of a constantly rotating shaft, driving gear adapted to be operated by said shaft to move said switch member, a pivotally mounted segmental rack, a pinion coöperating therewith, said pinion being loosely mounted on said rotating shaft, an electromagnet, pawl and ratchet mechanism operated thereby for advancing said rack by long steps, a second electromagnet, pawl and ratchet mechanism operated thereby for advancing said rack by short steps, said rack in its advance rotating said pinion in a direction reverse to the direction of rotation of said shaft, a disk carried by said pinion, an electromagnetic clutch for coupling said pinion to said shaft, said disk forming the armature of said electromagnetic clutch, an extension of said disk adapted when said clutch is energized to engage said driving gear and operatively connect it to said pinion and thereby to said shaft, and a clutch releasing switch

arranged to be opened by said rack upon its return to its initial position.

23. In a selector, the combination with a rotating shaft, of a gear loosely mounted on said shaft, a driving wheel, a switch member driven thereby, an electromagnetic clutch for coupling said gear to said shaft, means controlled by said clutch for operatively connecting said driving wheel to said shaft to move said switch member, and means for releasing said clutch upon the movement of said gear a predetermined distance.

24. The combination with a rotating shaft, of a pinion, a rack coöperating therewith, selective mechanism for advancing said rack a predetermined distance, a driving gear, a member driven thereby, a clutch for coupling said pinion to said shaft, said pinion being driven thereby in a direction to return said rack to its initial position, means operated when said pinion is coupled to said shaft for operatively connecting said driving gear to said rotating shaft, and clutch release mechanism operated by said rack upon its return to its initial position.

25. In a selector the combination with a movable switch member, of a continuously rotating power shaft, a switch operating shaft in alinement with said power shaft, juxtaposed friction disks carried by the respective shafts, one of said disks being of magnetic material, a cylindrical electromagnet mounted concentric with the axis of said shafts, said magnet having an annular pole piece adapted to attract said disk of magnetic material and draw it into engagement with the other disk to cause the switch operating shaft to be driven from said power shaft, and means controlled by said switch operating shaft controlling the de-energization of said electromagnet.

26. In a selector, the combination with a movable selecting member, of a movable switch member, means for advancing said selecting member a distance from its normal position corresponding to the desired travel of said switch member, a continuously rotating power shaft, a longitudinally slidable switch-operating shaft in alinement with said power shaft, a disk of magnetic material carried by said slidable shaft, a juxtaposed friction disk carried by said power shaft, a cylindrical electromagnet mounted concentric with the axis of said shafts, said magnet having an annular pole piece adapted to attract said disk of magnetic material and draw it into engagement with the other disk to cause the switch operating shaft to be driven from said power shaft, gear driven by said switch operating shaft for returning said selecting member to its initial position, and a clutch releasing switch arranged to be operated by said selecting member upon its return to its initial position; whereby the movable switch member is advanced during the excitation of said magnet a distance predetermined by said selecting member.

In witness whereof, I hereunto subscribe my name this fifteenth day of January, A. D., 1908.

AMOS F. DIXON.

Witnesses:
JOHN J. LYNG,
E. STEWART MCLANE.