Oct. 20, 1936. C. D. LAKE ET AL 2,057,686

RELAY

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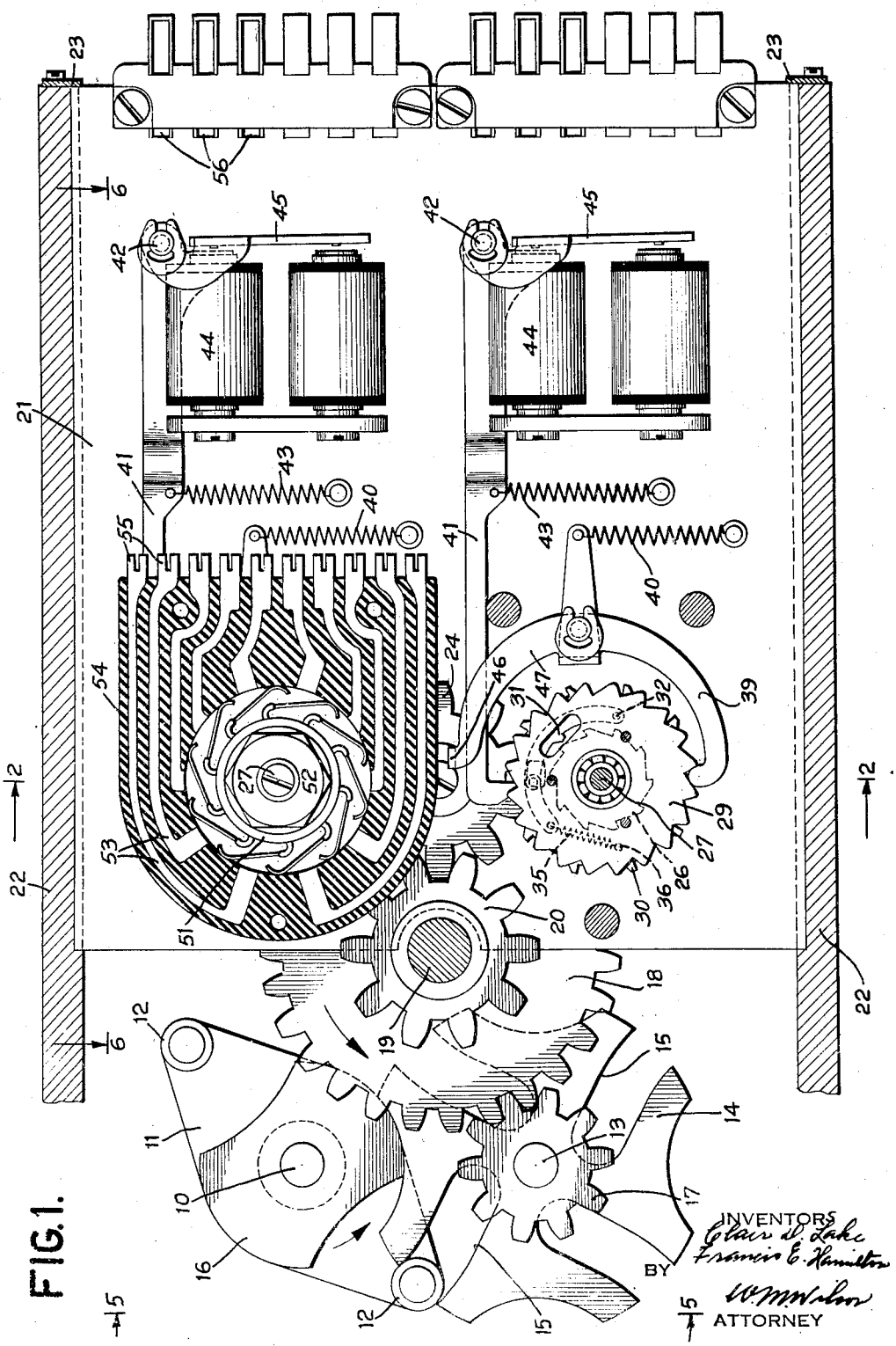


FIG. 1.

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FIG. 2.

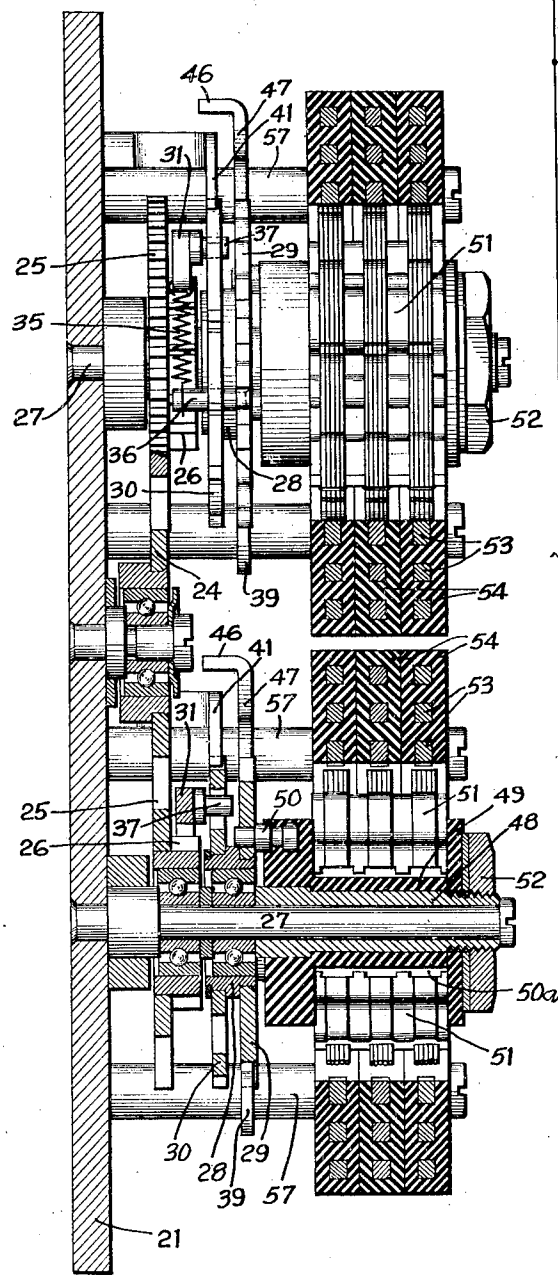


FIG. 3.

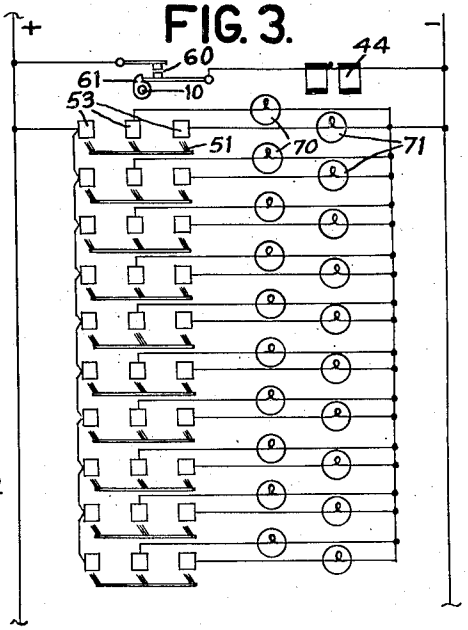
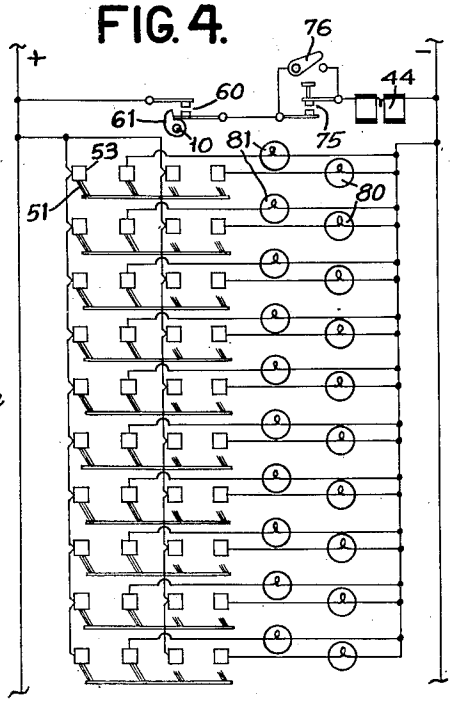


FIG. 4.



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FIG. 5.

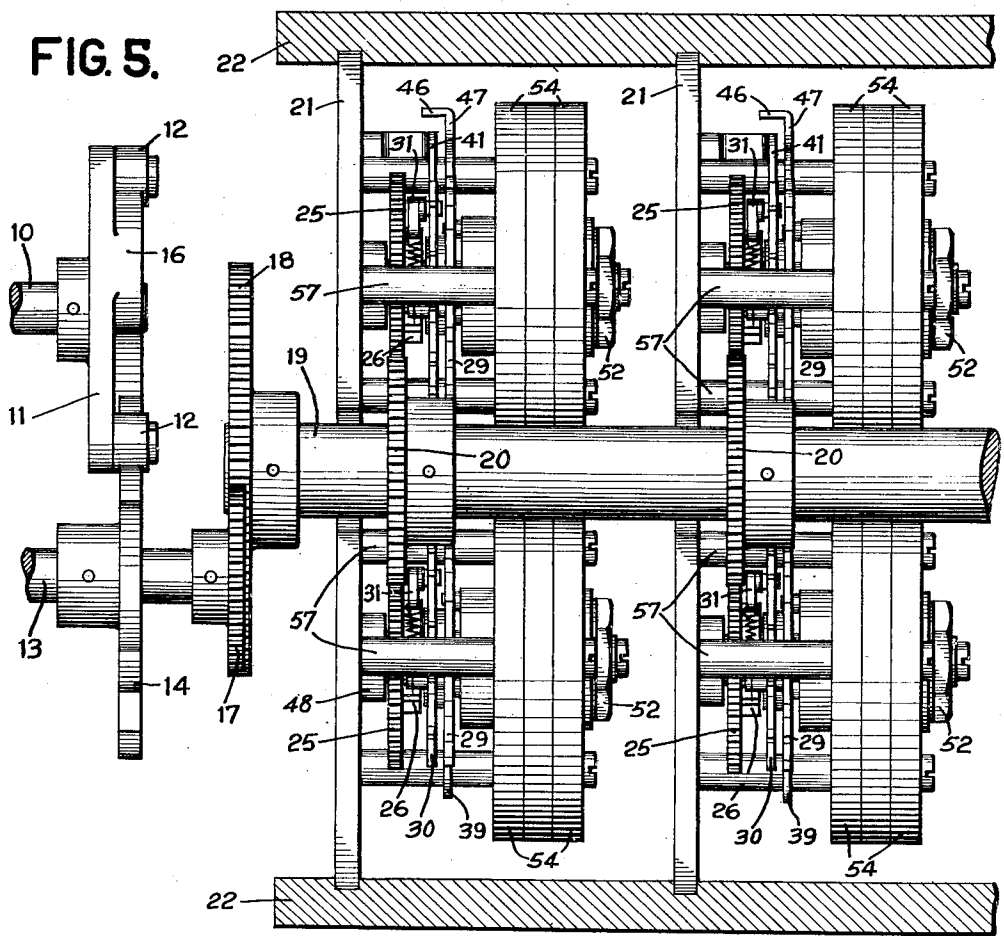
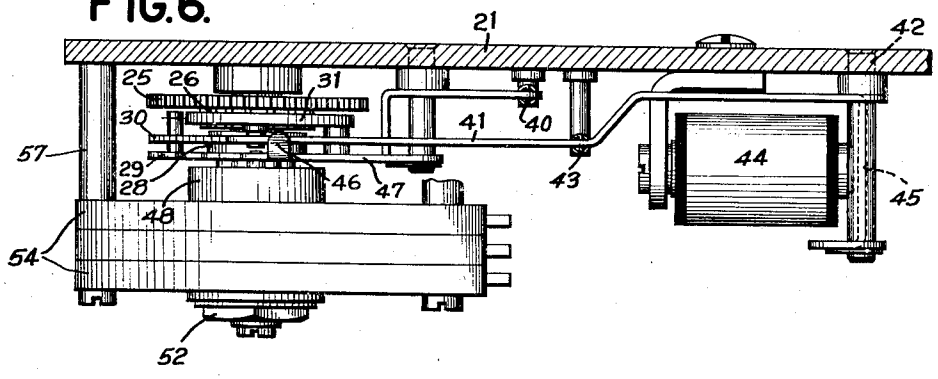


FIG. 6.



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FIG. 7.

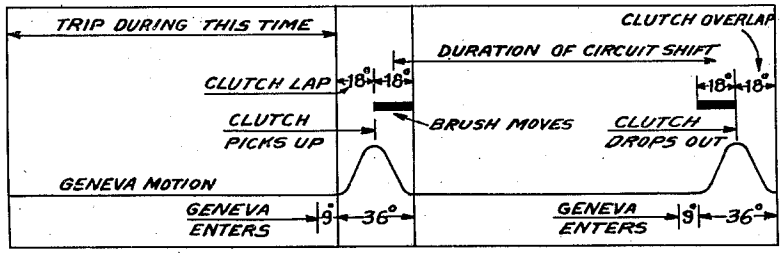


FIG. 8.

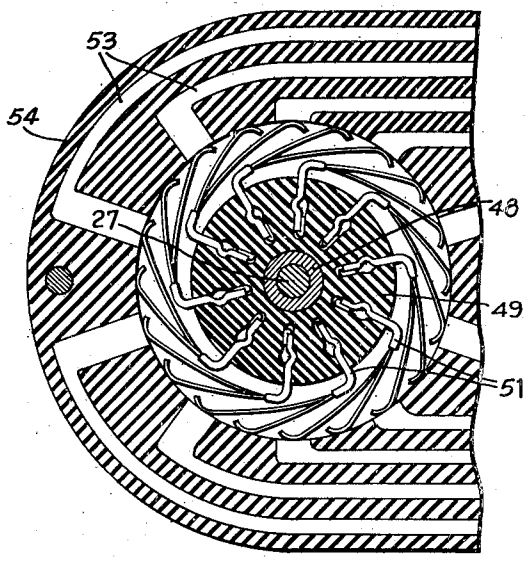


FIG. 9.

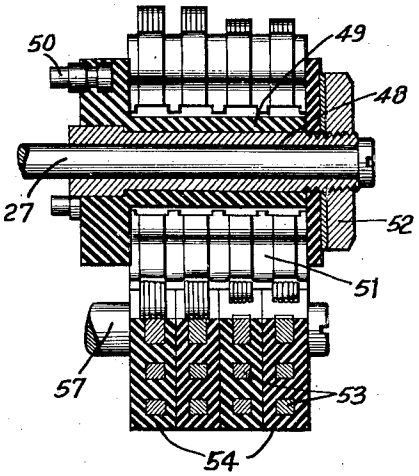
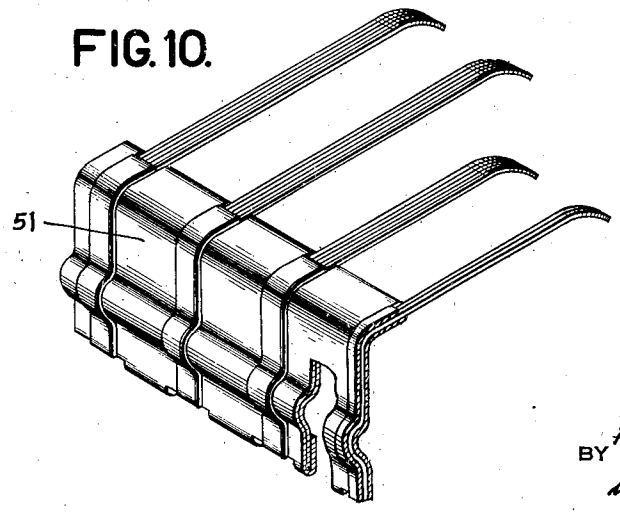


FIG. 10.



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FIG. 11.

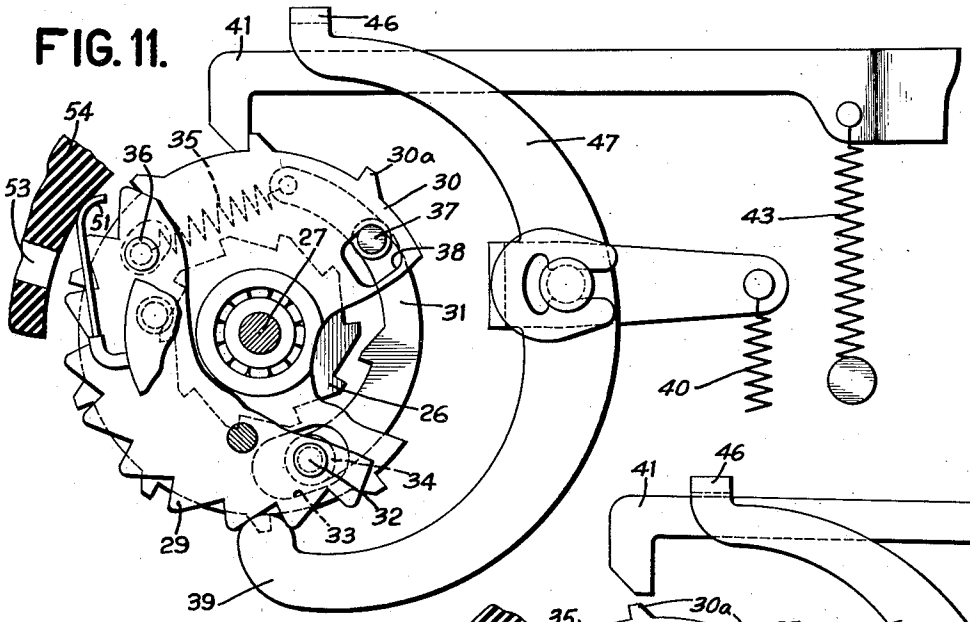


FIG. 12.

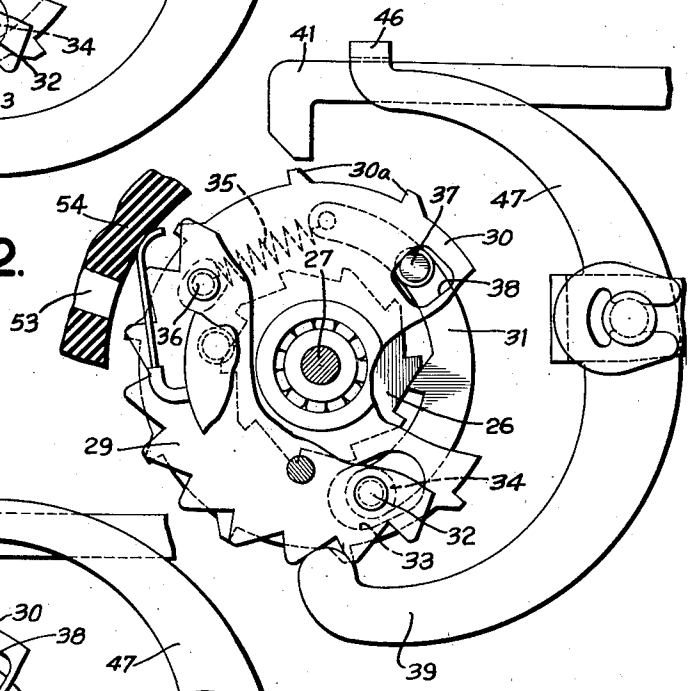
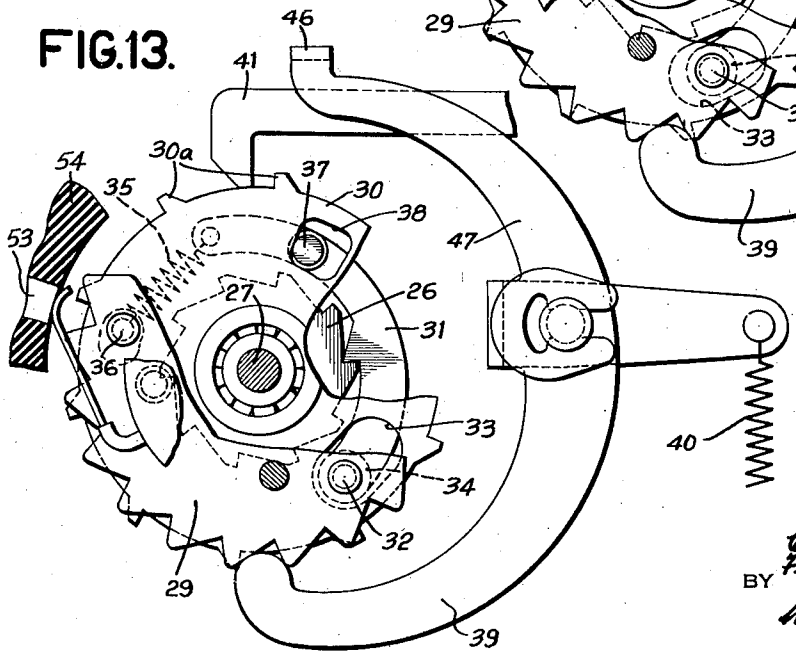


FIG. 13.



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RELAY

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Application June 1, 1936, Serial No. 82,910

8 Claims. (Cl. 200—26)

This invention relates to a circuit changing mechanism and more particularly to a power driven mechanism for automatically effecting the shifting of circuit connections in a rapid and positive manner.

The invention consists in providing a rotatable contact brush structure adapted to be advanced step by step so that the brushes contact with fixed commutator segments to make and break circuit connections as the brush structure is rotated. The mechanism for rotating the structure comprises a clutch driving member, which, by means of a modified form of Geneva mechanism, moves with an intermittent motion. Electromagnetically controlled mechanism effects a clutching action between the brush structure and the driving mechanism whereupon the brush is coupled to the driving mechanism and rotates therewith in accordance with the motion imparted by the Geneva drive. Associated with the brush structure is a de-clutching arrangement to effect de-clutching of the parts after the brush structure has advanced a step.

Various other objects and advantages of the invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and useful features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a view showing the general arrangement of the circuit changing mechanism and the Geneva drive thereto.

Fig. 2 is a section taken along lines 2—2 of Fig. 1.

Figs. 3 and 4 represent examples of circuit connections which may be controlled by the device.

Fig. 5 is a view looking in the direction of the lines 5—5 of Fig. 1.

Fig. 6 is a view taken along lines 6—6 of Fig. 1.

Fig. 7 is a diagram showing the timing of certain parts of the mechanism.

Fig. 8 is a view showing a modified form of contact brush structure.

Fig. 9 is a cross sectional view of the brush structure shown in Fig. 8.

Fig. 10 is a view in isometric of one of the separate brushes shown in Fig. 8.

Figs. 11, 12, and 13 show the clutching mechanism in various operative positions.

Referring to Fig. 1, 10 represents a driving shaft which may be in constant rotation and which carries a double-armed member 11 with cam rollers 12 on opposite ends thereof. Below shaft 10 is a shaft 13 which has secured thereto the Geneva member 14 provided with four slots 15 for cooperation with the rollers 12 and also arranged for suitable cooperation with the locking portion 16 of member 11. Each of the slots 15 is configured at its outer end to permit a slight dwell of member 14 after roller 12 has entered the slot. This is brought about by making the ends of the slots concentric with the shaft 10. In Fig. 7 is shown the timing of the Geneva drive for one complete revolution of shaft 10. In this figure it is seen that there is a nine degree dwell after the first roller 12 enters the slot, after which the member 14 is given a quarter turn during thirty-six degrees motion of shaft 10 and the driven part then rests until the second roller cooperates wtih the next slot 15 and causes a repetition of the movement.

Mounted on shaft 13 is a gear 17 which drives a gear 18 secured to a cross shaft 19 (see also Fig. 5). The ratio between gears 17 and 18 is 1:2½ so that for each quarter turn, shaft 19 makes a movement of thirty-six degrees, or a tenth of a revolution. Shaft 19 has secured along its length the gears 20 which serve to drive the circuit changing devices in unison and as many gears 20 are provided as there are devices to be driven.

Each circuit changing device comprises a plate 21 slidable in suitable grooves in the frame structure 22, as shown, and may be locked in position as by strips 23 (Fig. 1). Pivoted to each plate 21 is a gear 24 (see also Fig. 2) which, when the plate is slid horizontally into the grooved frame 22, will mesh with the driving gear 20 on shaft 19. By removing the strips 23 the entire plate 21 may be removed with facility. Each plate 21 carries two separate and independent sets of circuit shifting brushes and commutators, and their dual mounting is for the purpose of convenience. In Fig. 1, the upper part of the plate shows the brush and commutator arrangement of the upper device and in the lower part of the plate the brush and commutator are removed to show some of the clutch mechanism in the rear.

Referring now to Figs. 2 and 11, the gear 24 meshes with a gear 25 which has integral therewith a driving ratchet 26 with a suitable ball bearing mounting on a stud 27. From the above description of the Geneva drive it will be seen that the gear 25 and ratchet 26 are moved a tenth of a revolution for each engagement of a roller 12 with a slot 15 and the resulting intermittent motion will effect a step-by-step advance of the ratchet.

Also mounted on stud 27 and supported on a ball bearing is a collar 28 which has rigidly secured thereto a notched disk 29. The collar 28 also carries a ratchet 30 which is mounted for rotation upon the collar.

The disk 29 carries a clutch pawl 31 which is pivoted to the disk at 32. As viewed in Figs. 2 and 6, the pawl 31 lies in the plane of driving ratchet 26. The ratchet 30 lies between the pawl 31 and its supporting disk 29. The ratchet 30

is provided with an opening 33 through which the spacing sleeve 34 and its supporting pin extend. A spring 35, connected to the upper end of the pawl 31, has connection with a pin 36 carried by the disk 29. This pin also extends through a suitable opening in the ratchet 30.

Secured on pawl 31 is a pin 37 which engages a camming surface 38 in the ratchet 30. The normal relationship of the parts is shown in Fig. 11 where the pawl 31 is held out of engagement with the ratchet 26 due to the action of camming surface 38 against the pin 37. If the ratchet 30 is permitted to move counterclockwise with respect to the pivot point of pawl 31, the camming surface 38 will move away from the pin 37 and will permit the spring 35 of the pawl to rock the latter into engagement with the ratchet 26 so that the parts assume the positions shown in Fig. 12.

The disk 29 is normally held by a detenting arm 39 whose free end is urged by spring 40 into engagement with the notched periphery of the disk. With the disk 29 thus restrained against movement, the tension of spring 35 tends to cause the pin 37 to act against the camming surface 38 and urge the ratchet 30 in a counterclockwise direction.

The ratchet 30 is provided with teeth 30*a* which may be engaged by a latching arm 41 pivoted at 42 (see Fig. 1) and urged in a counterclockwise direction by spring 43. If the arm 41 is rocked clockwise so that its free end is raised out of engagement with the tooth 30*a*, the ratchet 30 may then rock counterclockwise to permit the pawl 31 to move from the position of Fig. 11 to that of Fig. 12, thereby engaging the driving ratchet 26, and the disk 29 will accordingly be advanced until the pawl is again disengaged from the driving ratchet. This disengagement is brought about by lowering the arm 41 into the path of one of the teeth 30*a*, thus holding the ratchet 30 and causing its camming surface 38 to cam the pawl 31 out of engagement with the driving ratchet.

The initial clockwise rocking of arm 41 is controlled by a pair of magnets 44 whose armature 45 is integral with the arm 41 so that energization of the magnets will effect clockwise rocking of the arm. Counterclockwise rocking of the arm is brought about by an extension 46 of an arm 47, which arm is co-extensive with the detenting arm 39. Thus, after clutching has been effected and disk 29 rotates, the notched periphery will cause counterclockwise rocking of arms 39, 47 and the extension 46 will accordingly insure the counterclockwise rocking of arm 41 into position to engage the next following tooth 30*a* of the ratchet 30. This position of the parts is shown in Fig. 13 where the disk is shown after it has been moved a twentieth of a revolution or eighteen degrees from its starting position.

Referring to Fig. 2, the stud 27 has rotatably mounted thereon a sleeve 48 which carries a contact brush holder 49 provided with pins 50 which extend into suitable openings in the disk 29, whereby the brush holder and sleeve are rotated with the disk. The holder 49 is provided with ten slots 50*a* parallel to the axis of the holder into each of which a brush holder 51*a* may be inserted and locked into position by a nut 52. The brushes are configured as shown in Fig. 1 and cooperate with commutator segments 53 molded in a supporting block 54. The segments extend outside of the holder as shown at 55, from which point suitable wire or cable connection may be made to binding posts 56. In Fig. 2, the brushes 51 are shown as cooperating with three sets of segments 53 which are placed side by side and suitably mounted on studs 57. In Fig. 8 is shown a modified form of brush structure, in which the brushes themselves vary in length so that while one brush is in engagement with a segment 53, another of the brushes on the same holder is in contact with the insulating portion between segments. This modified form of contact brush is shown in isometric in Fig. 10 where two brushes are of a different length than the other two. It will be understood, of course, that with this type of brush, four commutator segments 54 are provided, as indicated in Fig. 9.

Referring now to Fig. 11, in the normal positions of the parts when the driving ratchet 26 is at rest, the driving tooth of pawl 31 lies eighteen degrees ahead of the next tooth of ratchet 26 so that when the pawl is tripped into engagement with the ratchet as shown in Fig. 12, the pawl and its supporting disk 29 will not be rotated until the ratchet has moved through the eighteen degree period of lag.

Since, as explained above, the Geneva mechanism only drives the ratchet through thirty-six degrees, the net effective movement of the pawl 31 will only be eighteen degrees. This is the amount of movement necessary to move the brush 51 from the position of Figs. 11 and 12 to that of Fig. 13. In moving to this position, the arm 39 will have been rocked by a disk 29 and arm 41 will have been lowered into position to intercept the next tooth 30*a* of the ratchet 30. This movement of the parts is diagrammatically represented in Fig. 7 which indicates the time at which the clutch picks up, which is substantially at the center of the period of movement of the driven part of the Geneva, and consequently the movement of the brush takes place in the following eighteen degrees as indicated. The parts accordingly remain in the position shown in Fig. 13 with the brush in engagement with the commutator segment until the second arm of the Geneva engages the next slot 15. This will cause the disk 29 to be picked up and during the eighteen degree period indicated, brush 51 will be moved out of engagement with the commutator segment and disengagement will occur at the point indicated. The ratchet 26 will, however, advance a further eighteen degrees to its rest position.

Tripping of the clutch through energization of magnets 44 may take place during the period of the cycle as indicated and may be brought about by means of a cam controlled pair of contacts 60 which may be operated by a suitable contact closing cam 61 carried on shaft 10. Thus, with such arrangement, magnets 44 will be energized once each revolution of shaft 10 and following such tripping, the brushes will be shifted during the eighteen degree period as indicated to effect any desired circuit change.

This circuit change will be maintained throughout the period indicated as "duration of circuit shift," at the end of which time, the circuits will be changed back to normal again and the process repeated with the disk 29 and the associated brush structure being advanced a tenth of a revolution for each revolution of the main shaft 10.

Fig. 3 shows schematically a simple form of circuit with which the device may be employed. In this figure, one set of commutator segments is wired together and to positive side of a source of current supply, while the central set is individually connected to a set of lamps 70, and the right hand set is connected to a set of lamps 71

which have connection to the negative side of line. With the brushes 51 normally in position intermediate sections 53, no circuits are completed. Upon energization of magnet 44, however, all of the brushes 51 will shift to make connection between a left hand segment 53 and the other two segments to cause the completion of circuits through all of the lamps. The subsequent automatic shifting of the brushes will thereafter break all the circuits again and the lamps will become extinguished.

In Fig. 4 is shown the modified form of brush structure with brushes of different length employed to control a set of lamps 80 and a set of lamps 81. In this arrangement, the two left hand sets of segments 53 are normally engaged by the longer pair of brushes 51 and complete circuits through the lamps 81. Upon energization of magnet 44, the brushes 51 will shift to disconnect the aforesaid circuit and bridge the pairs of segments 53 with the two right hand sets, thus completing circuits through the lamps 80 and extinguishing the circuits through lamps 81.

With this arrangement, the sets of circuits are alternately completed. In Fig. 4 is also shown a key controlled pair of contacts 75 and a switch 76 which, when the latter is open, permits energization of magnet 44 only when the key 75 is depressed so that a shifting of the circuits and their automatic restoration will only take place when the contacts 75 are closed. If switch 76 is closed, the operation will, of course, take place automatically and repeatedly.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. A circuit changing mechanism comprising a constantly rotating shaft, a clutch driving element, driving connections between said element and said shaft to cause intermittent movement of said element, a driven clutch element, clutching mechanism between said elements, a stationary commutator having conducting segments, brushes carried by said driven element and arranged to cooperate with said segments and normally out of contact therewith, magnetically controlled means to cause clutching of said elements to rotate said brushes into engagement with said segments, means controlled by said driven element to effect unclutching after contact is made and further means controlled by said driven element to effect re-clutching of said elements.

2. In a circuit changing mechanism, a rotatable driving ratchet, means for intermittently driving said ratchet, a rotatable contact brush structure, a stationary commutator cooperating therewith, coupling mechanism for connecting said brush structure to said ratchet, electro-magnetic means for effecting operation of said coupling mechanism and means connected with said brush structure for effecting uncoupling after a predetermined movement of said brush structure.

3. In a circuit changing mechanism, a rotatable driving ratchet, means for causing step-by-step rotation of said ratchet, a rotatable contact brush structure and a stationary commutator cooperating therewith, electromagnetic means for causing coupling between said structure and said ratchet during each alternate step of rotation of said ratchet, and means carried by said structure for effecting uncoupling after a predetermined movement of said structure.

4. In a circuit changing mechanism, a rotatable driving ratchet, means for causing step-by-step rotation of said ratchet, a driven mechanism including a contact brush structure, a pawl carried by said mechanism, a disk coaxial with said mechanism and engaging said pawl to hold the same out of engagement with said ratchet, means for causing said disk to release said pawl for engagement with said driving ratchet and means controlled by said driven mechanism after a predetermined movement thereof for causing disengagement of said pawl and ratchet.

5. In a device of the class described, a rotatable driving ratchet, means for causing step-by-step rotation of said ratchet, a driven mechanism including a contact brush structure, a pawl carried by said mechanism, a disk coaxial with said mechanism and engaging said pawl to hold the same out of engagement with said ratchet, means for normally holding said mechanism and disk against rotation, means for effecting relative rotation of said mechanism and disk and means effective upon said rotation for causing said pawl to engage said ratchet to rotate said mechanism.

6. In a device of the class described, a rotatable driving ratchet, means for causing step-by-step rotation of said ratchet, a driven mechanism including a contact brush structure, a pawl carried by said mechanism, a disk coaxial with said mechanism and having a camming surface engaging said pawl to hold the latter out of engagement with said ratchet, means for normally holding said mechanism and disk against rotation, means including said camming surface for causing relative rotation of said mechanism and disk and means effective upon said relative rotation for causing said pawl to engage said ratchet to rotate said mechanism.

7. In a device of the class described, a rotatable driving ratchet, means for causing step-by-step rotation of said ratchet, a rotatable contact brush structure, clutching mechanism between said ratchet and brush structure, a magnet for controlling clutching action, means for causing said magnet to effect clutching during each alternate step of rotation of said ratchet, and means controlled by the brush structure for effecting unclutching after each step of movement.

8. In a device of the class described, a rotatable driving ratchet, a Geneva drive mechanism for effecting step-by-step movement of said ratchet and arranged to effect a complete revolution of said ratchet in a predetermined number of steps, a rotatable contact brush structure, means for clutching said structure to said ratchet means for effecting unclutching and means for controlling the operations of clutching and unclutching to cause said structure to be advanced step by step so as to make a half revolution for each complete revolution of said ratchet.

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