Jan. 29, 1935. W. C. McWHIRTER 1,989,522

TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

Filed Feb. 23, 1934 4 Sheets-Sheet 1

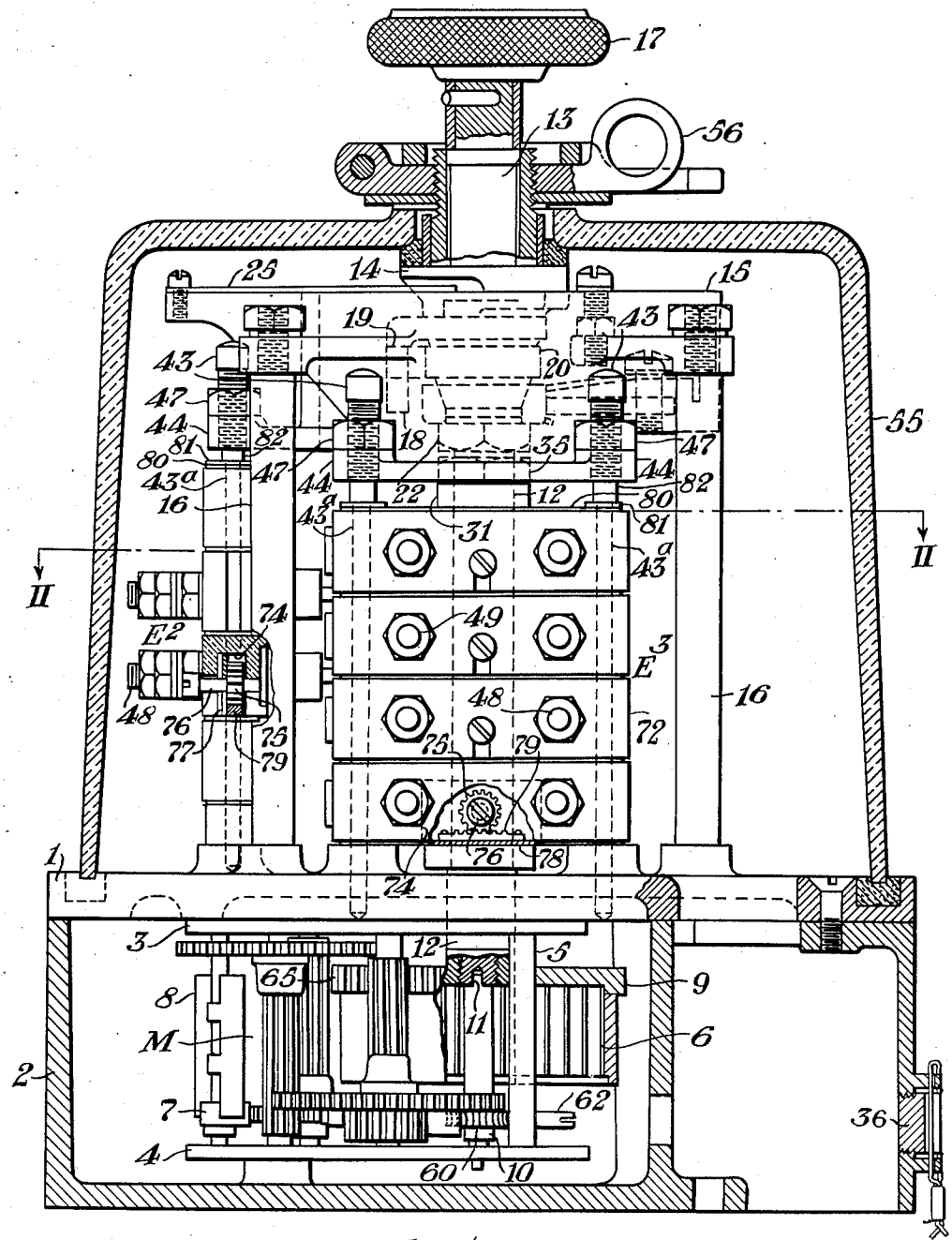

Fig. 1.

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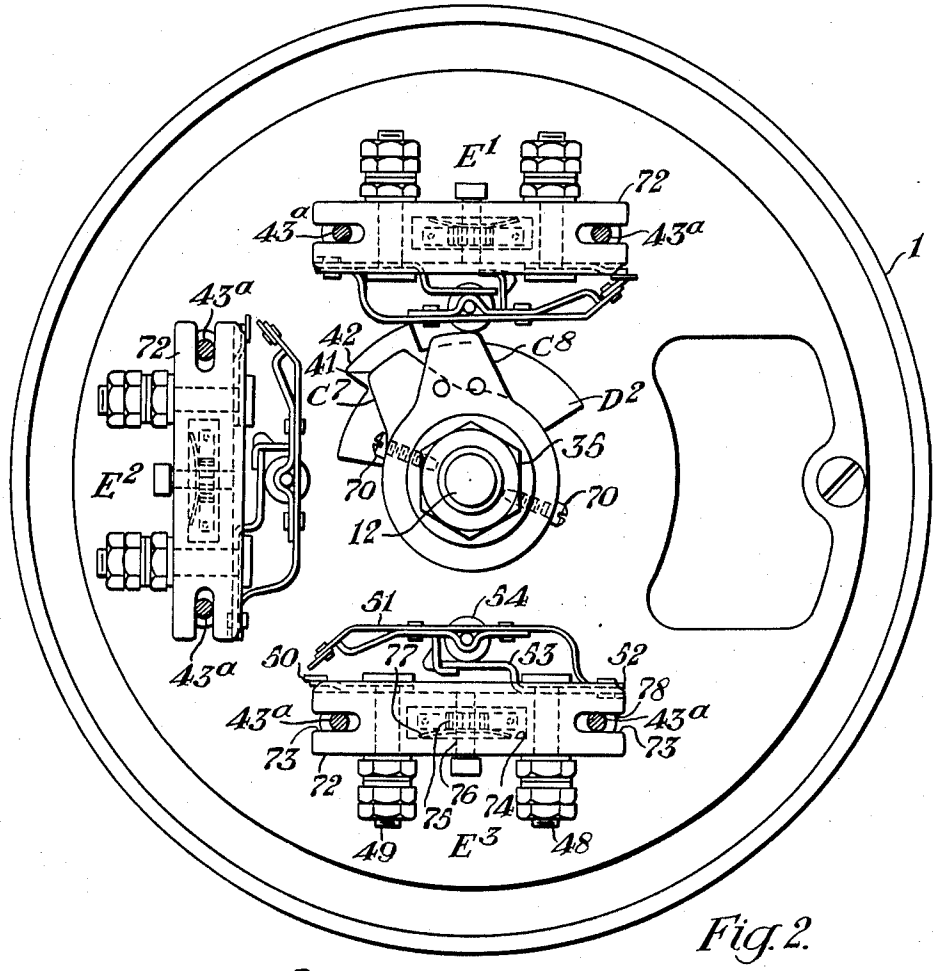

Fig. 2.

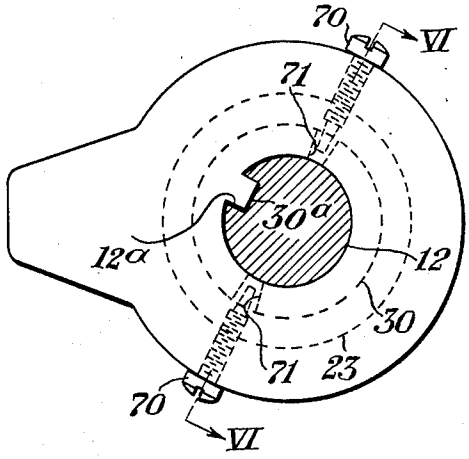

Fig. 5.

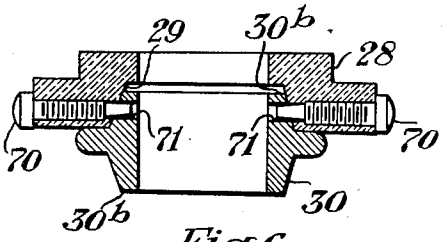

Fig. 6.

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TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

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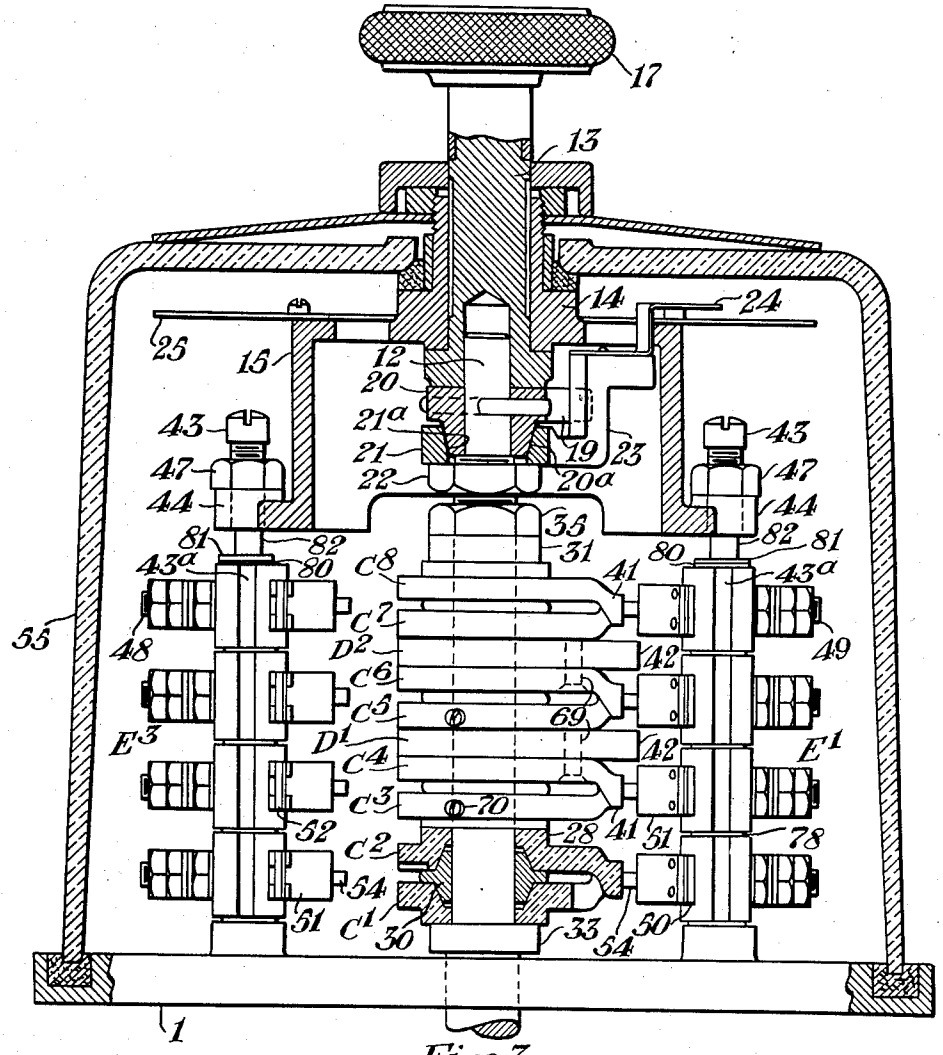

Fig. 3.

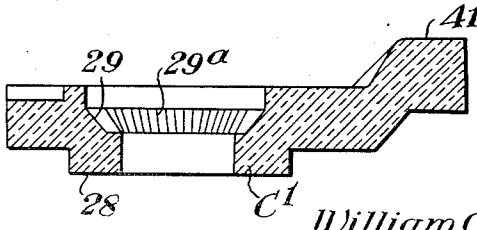

Fig. 4.

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TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

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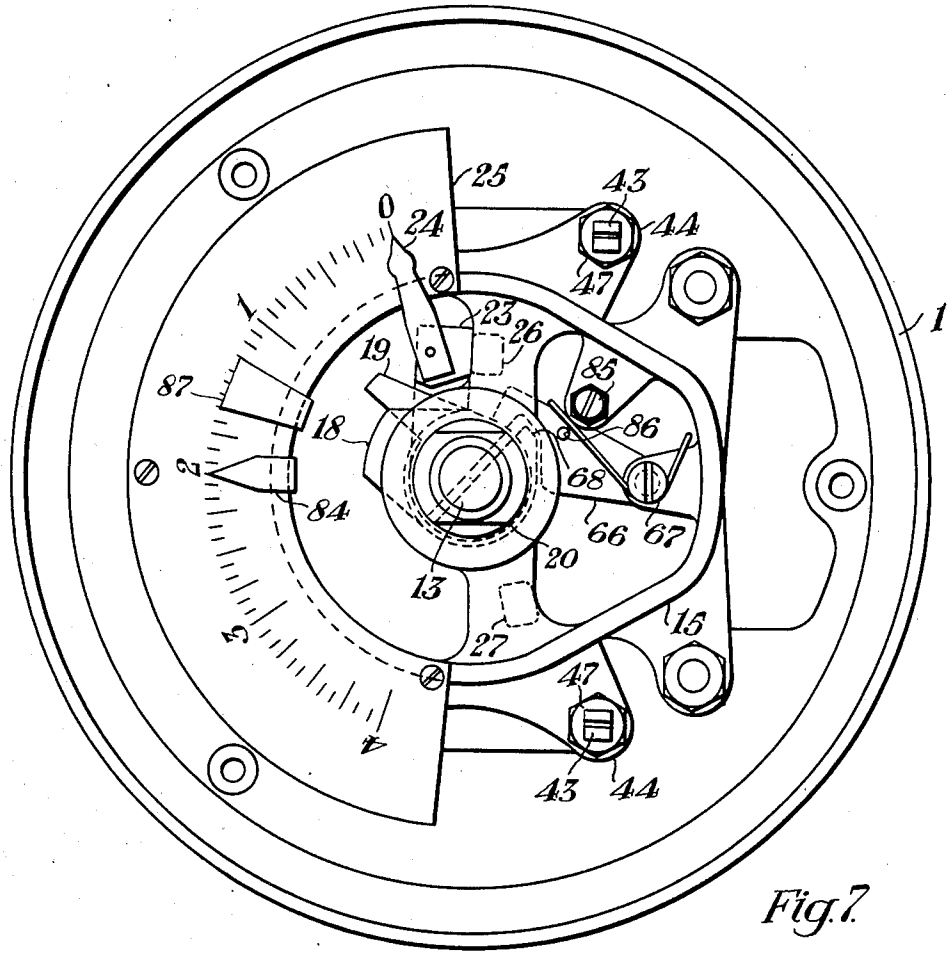

Fig. 7.

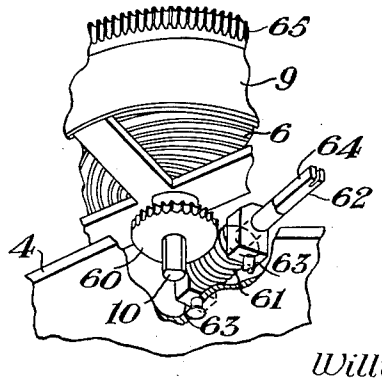

Fig. 8.

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UNITED STATES PATENT OFFICE

1,989,522

TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

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Application February 23, 1934, Serial No. 712,567

12 Claims. (Cl. 200—38)

My invention relates to time governed circuit controlling mechanisms, and particularly to improvements in mechanisms of the type shown and described in the Letters Patent of the United States No. 1,916,485, granted to Kurt Manrodt, on July 4, 1933.

One object of my invention is to provide, in circuit controlling mechanisms of the type referred to, an improved adjustment for the individual contacts. A second object of my invention is the provision for such mechanisms of an improved adjustable circuit controlling cam structure wherewith certain operating cams are fixed against rotation with respect to the camshaft. A still further object of my invention is to provide in such mechanisms an improved structure for readily adjusting the normal tension of the operating spring. Other objects of my invention will appear as the specification progresses.

In the accompanying drawings, Fig. 1 is a view, partly in side elevation and partly in section, showing one form of mechanism embodying my invention. Fig. 2 is a sectional view taken on the line II—II of Fig. 1. Fig. 3 is a view, partly in section and partly in elevation, showing the circuit controlling cams and the connection of the operating shaft with the winding device. Fig. 4 is an enlarged vertical longitudinal sectional view of one of the cams of Fig. 3. Fig. 5 is an enlarged plan view of a cam fixed against rotation with respect to the camshaft. Fig. 6 is a sectional view on the line VI—VI of Fig. 5. Fig. 7 is a plan view of the mechanism of Fig. 1 with certain of the parts omitted. Fig. 8 is a detail view, partly in section, of the adjusting device for the main spring of the clockwork mechanism of Fig. 1.

Similar reference characters refer to similar parts in each of the views.

Referring first to Fig. 1, the reference character 1 designates a supporting plate which is secured to a base 2 and upon which the various parts are mounted. Suspended from the supporting plate 1 within the base 2 is a framework consisting of two plates 3 and 4 supported by spacing studs 5, and mounted in the framework is a clockwork mechanism M. This clockwork mechanism M is similar to the clockwork mechanism shown and described in the patent to Kurt Manrodt referred to hereinbefore, except that it is provided with an adjusting device to be described later for varying the normal tension of the operating spring. This clockwork mechanism comprises a train of gears actuated by a main spring 6 and driving an escapement pawl 7 to which is secured a fan 8 for the purpose of regulating the rundown time of the mechanism. The main spring 6 is enclosed in a spring cage 9, the inner end of the spring being secured to a shaft 10, and the outer end to the inside of the spring cage 9. One end of the shaft 10 is journalled in the plate 4, and the other end is journalled in a recess 11 formed in the lower end of a camshaft 12 which, in turn, is securably fastened to the spring cage 9 and is journalled adjacent its lower end in the supporting plate 1.

A worm gear 60 is pinned to the shaft 10 adjacent the end of the shaft journalled in the plate 4 and meshes with a worm 61 (see Fig. 8) made integral on a shaft 62 having bearings in blocks 63 secured to the plate 4. This worm gear 60 and worm 61 secure the shaft 10 against rotation and yet permit it to be manually rotated and the spring 6 to be wound up a certain amount or released as is desired. In other words, when the apparatus is originally set up, the main spring 9 is given an initial tension necessary for operation of the mechanism in accordance with time interval requirements by operation of shaft 62 and gear 60. Adjustment of the tension in the spring from a predetermined amount can be made by operating worm shaft 62 through the medium of the screw driver slot in the end of shaft 62, or by a suitable key adapted to fit the square end 64 of the shaft 62. The spring cage 9 is operatively connected with the gear train of the clockwork mechanism by means of an integral gear 65 cut on the outer face of the cage. With this construction, when the camshaft 12 is rotated in a clockwise direction, it winds the main spring 6, and if the shaft is then released, the spring will drive the camshaft in a counter-clockwise direction at a constant speed, as will be readily understood from the foregoing description and from an inspection of the drawings. The speed of the camshaft 12 in the counter-clockwise direction will depend upon the proportioning of the parts and the tension of the main spring. After the apparatus is set up, the tension of the spring 6 can be adjusted through the medium of the worm gear 60, as pointed out above, and a more accurate adjustment of the speed of the camshaft 12 at a desired value can be established. Furthermore, variations above or below such desired value of the rundown speed, caused by change of frictional resistance in the mechanism because of wear of and decrease of lubrication in the bearings in service can be readily and conveniently compensated for by varying the tension of the

main spring by screw driver operation of the worm gear 60, without dismantling the clockwork mechanism, the screw driver being inserted through a hole in the case 2 upon removal of a plug 36 under seal. In actual installations of mechanisms of the type here involved, it has been found that the speed of the mechanism during the rundown period may materially vary from the desired value of speed at which it is originally adjusted. In the practice of my invention such variations of the rundown speed can readily and quickly be compensated for by increasing or decreasing the tension of the operating spring.

Referring now to Figs. 1, 3 and 7, the upper end of the camshaft 12 is journalled in the lower end of a winding member 13 which, in turn, is mounted to rotate in a bearing 14 formed in a bracket 15 which is secured to the supporting plate 1 by means of spacing studs 16. A knob 17 is fixed to the upper end of the winding member 13 to facilitate manual operation of that member, and the lower end of the winding member is provided with a depending lug 18. When the winding member 13 is rotated in a clockwise direction, the lug 18 engages a radial arm 19 formed on a collar 20 which is rigidly mounted to the camshaft 12 directly below the winding member 13, and causes the camshaft to rotate with the winding member, thus winding up the main spring 6. The collar 20 also serves to maintain the winding member 13 in its proper vertical position in the bearing 14. Clamped against the lower side of the collar 20 by means of a jam nut 22 is a sleeve 21 having a conical portion 21^a which receives a corresponding portion 20^a formed on the collar 20. By this arrangement the angular position of the sleeve 21 with respect to the camshaft 12 may be conveniently and quickly adjusted by merely loosening the jam nut 22, rotating the sleeve to the desired position, and again tightening the jam nut 22. Projecting from the side of the sleeve 21 is a substantially L-shaped arm 23 having fixed thereto a pointer 24 which, when the camshaft 12 is rotated, moves over a graduated dial 25. The arm 23 also cooperates with a depending stop 26 formed on the bracket 15 to limit the extreme position to which the shaft 12 may be rotated in the clockwise direction. The extreme position to which the camshaft 12 may be rotated in the counter-clockwise direction is limited by a depending stop 27 formed on the bracket 15 and which is adapted to engage the radial arm 19 on the collar 20. A latch dog 66 pivotally mounted in the bracket 15 by a pin 67 is adapted to engage a latch 68 formed on the sleeve 21. With this construction, the mechanism is latched in the wound up or normal position, that is, the position illustrated in the drawings. The lug 18 on the winding member 13 is adapted to engage the outer end of the latch dog 66 when the winding member is rotated counter-clockwise, to unlatch the mechanism and permit it to be operated counter-clockwise under the influence of the operating spring 6 until the arm 19 encounters the stop 27 which is the reverse or rundown position for the mechanism. Turning the knob 17 clockwise, the lug 18 engages the arm 19 and rotates the mechanism until the arm 23 encounters the stop 26 at which point the latch dog 66 engages the latch 68 and retains the mechanism in this wound-up position. In this position the pointer 24 registers at the zero position on the dial 25.

Mounted on an intermediate portion of the camshaft 12 (see Fig. 3) are a plurality of similar cams C designated specifically by the reference characters C^1, C^2, C^3, C^4, C^5, C^6, C^7 and C^8. As will appear hereinafter, it is desirable that the angular position of certain of these cams with respect to the camshaft 12 may be quickly and conveniently adjusted. It is also desirable that certain other of these cams may be fixed in position with respect to the camshaft and yet so constructed that their position may at times be varied. To this end I propose to provide for fastening of these cams to the camshaft in the following manner. Each cam C is provided on one face (see Figs. 4 and 6) with an outstanding boss 28 and in the other face with a tapered central recess 29 having serrations or teeth 29^a. The cams are loosely mounted on the shaft 12 and are assembled with alternate cams facing in one direction and the remaining cams facing in the other direction, whereby each pair of adjacent cams provides either a bearing formed by a pair of confronting bosses 28 or a socket formed by a pair of recesses 29. A cam adjusting collar 30, having a feather key 30^a (see Fig. 5), which is of the proper size to fit slidably in the keyway 12^a formed lengthwise on the shaft 12, is disposed in the socket formed by each adjacent pair of recesses 29. Each of these collars is provided with two opposing hubs 30^b. Each of the hubs is tapered to fit the recess 29 in the adjacent cam and is provided on its periphery with teeth which match with the teeth on the circumference of the socket of the cooperating cam. These cams C and adjusting collars 30 are clamped together on the camshaft 12 between a shoulder 33 against which the boss 28 of the lower cam C^1 abuts, and the collar 31 which engages the upper side of the boss 28 of the cam C^8, by means of the nut 35 which is screwed onto the shaft 12 above the collar 31. With the cams fastened to the camshaft in this manner it will be apparent that in order to adjust the angular position of any of the cams C with respect to the camshaft, it is only necessary to back off the nut 35 a sufficient distance so that the teeth on the circumference of the socket of the recess of such cam may be disengaged from the teeth on the cooperating adjusting collar, turn the cam to the desired position and again tighten the nut 35. Projecting from each cam C is a cam lobe 41 which operates a particular circuit controlling contact as will be more fully described hereinafter.

Certain of the cams C are preferably fixed against rotation in position with respect of the camshaft. As here shown, cams C^3 and C^5 are each adapted to be fixed against rotation with respect to the shaft 12 but yet permit the cams to slide longitudinally on the shaft as may be necessary when one of the other cams is to be adjusted in the manner described hereinbefore. Screws 70 (see Figs. 2, 5 and 6) are threaded through the hub of the cam which it is desired to fix against rotation and engage in drilled holes 71 in the cam adjusting collar 30. It follows that with the screws 70 run down and their ends projecting into the holes 71, the cam will be securely locked against rotation with respect to the shaft 12 since the collar 30 is keyed to the shaft, and yet the cam and collar as a unit will be free to slide longitudinally along the shaft 12 when the nut 35 is backed off to loosen the cams as explained above. If it is desired to change the position of one of these fixed cams, it is only necessary to remove the respective screws 70 thereby permitting disengaging of the cam from its adjusting collar 30 when the nut 35 is backed off and after which adjusting of the angular posi-

tion of the cam may be made in the usual manner.

Intermediate cams D^1 and D^2 are mounted on the confronting bosses 28 of certain of the cams C and each of which is held rigidly fastened to the cooperating cam C by means of screws 69. These intermediate cams D are each provided with a cam lobe 42 which is adapted to cooperate in a manner to be made clear presently with a particular contact of the mechanism which contacts I will now describe.

The contacts of the mechanism are mounted on a plurality of similar terminal assemblies here shown as three in number and designated by the reference characters E^1, E^2 and E^3, respectively. These terminal assemblies are disposed about the camshaft 12 on three sides of a square as best seen in Fig. 2 and are each held in place by means of two clamping screws 43, the upper ends of which are screwed through threaded lugs 44 projecting from the sides of the bracket 15 as shown in Figs. 1 and 3. The lower end of each screw 43 is formed with a rod-like projection 43^a which passes into a boss formed on the supporting plate 1, the screw 43 being locked in place by a lock nut 47.

Each contact assembly comprises a plurality of individual terminal blocks which form a feature of my invention. These terminal blocks are all alike in construction and hence a description of one will suffice for a description of all. Referring to Figs. 1, 2, and 3, 72 is a molded block of any suitable insulating material. The ends of the block 72 are constructed with slots 73 for slidably mounting the block on the rods 43^a. Each terminal block 72 is formed with a recess 74 in which is mounted a small adjusting pinion 75 formed integral on a shaft 76, both ends of which are journalled in the terminal block and the one end is extended and slotted for screw driver operation. The pinion 75 is held in place in the recess by a friction spring washer 77. Adjacent each terminal block 72, a flat plate 78 having a rack 79 riveted to it, is mounted on and non-slidable with respect to the supporting rods 43^a, the rack 79 extending into the recess 74 and meshing with the pinion 75. A flat leaf spring 80 which is similar to the rack plate 78, except that it is preferably made of lighter material, is mounted on the rods 43^a at the top of the terminal assembly. A washer 81 is spaced on each rod 43^a above the spring plate 80 and engages a shoulder 82 formed on the rods. It is clear that when the screws 43 are drawn down to compress the spring plate 80, and apply force against terminal blocks 72 all blocks are securely clamped together with the respective pinion 75 in mesh with the rack 79 of the respective plate 78, the lock nuts 47 holding the screws 43 securely in place.

Each terminal block 72 carries two contacts which are operated by a particular cam. As shown in Fig. 2, a fixed contact member 50 is fastened in the terminal block 72 by means of a terminal post 49 of the usual construction. A flexible contact finger 51 is fastened at one end to the outer end of a contact member 52 which, in turn, is fastened to the terminal block by means of another terminal post 48. The manner of operating the contact finger 51 by a corresponding cam C or D may take different forms and preferably is that disclosed in the aforementioned Manrodt patent. It is deemed sufficient for this description to point out that the contact finger 51 is bowed away from the terminal block and a roller 54 is mounted thereon, the construction being such that the roller 54 is adapted to be engaged with a cam lobe 41 or 42 as the case may be. The parts are so arranged and proportioned that when the mating cam lobe engages the roller 54, the contact finger 51 is forced into engagement with the contact member 50 and connection between the two terminal posts 48 and 49 is completed, and when the cam lobe moves out from engagement with the roller 54, the contact finger 51 springs away from the contact member 50 and the connection between the two terminal posts is open, the movement of the contact finger to the open position being limited by a suitable stop 53. It is clear from the foregoing description that the cams C and D can be set to cause the cam lobes 41 and 42, respectively, to engage a corresponding contact roller 54 at any desired point in the movement of the mechanism. In a preferred embodiment of my invention certain of the cams C, for example, cams C^2, C^4, C^6 and C^8, are adapted to operatively engage a contact of the terminal assembly E^1 closing the respective contact in the normal or wound-up position of the mechanism, and the remaining C cams are adapted to operatively engage a contact of the terminal assembly E^3 to close the contact in the run-down or reverse position of the mechanism, while the intermediate cams D are each adapted to operatively engage a contact of the assembly E^2 to close the contact spring during some portion of the movement of the mechanism from the normal to the reverse position. It will be understood, of course, that my invention is not limited to this arrangement of the contacts and this arrangement is given by way of illustration only. As a matter of fact, the latch member 66 may be held out of position through the medium of a screw 85 engaging a hole 86 on the latch member 66 and in which event the normal position of the mechanism becomes the run-down condition of the spring 6 and the reverse position the wound-up condition of the spring.

To adjust any of the individual terminal blocks 72 the proper lock nuts 47 are loosened and the screws 43 are backed off a few turns relieving the clamp pressure of the screws but yet allowing pressure of the spring plate 80 on the terminal blocks to retain mesh of pinion 75 and rack 76 and permitting the blocks 72 to slide endwise. A screw driver may now be inserted in the slotted end of the pinion shaft 76 of the block which it is desired to move and endwise motion will be transmitted to the block as the pinion 75 is rotated, the pinion moving along the rack 79 of the corresponding plate 78 which plate, it will be recalled, is held in position with respect to the rods 43^a. The position of the operating roller 54 of that terminal block with respect to the operating cam lobe is, therefore, changed and the time of the contact operation is advanced if the block is moved in one direction or it is retarded if the block is moved in the opposite direction. It will be noted that in the adjustment of any block 72 no friction action is present tending to disturb the adjustment of the adjacent block due to the intervening fixed plate 78. The time interval for operating any individual contact may, therefore, be adjusted without disturbing the adjustment of the adjacent contacts, as the pressure of the spring plate 80 will serve to hold the blocks in place but they may be easily moved through the medium of the pinion 75. After the desired adjustments have been made, the screws 43 will be tightened and locked in place by the respective lock nuts.

The entire mechanism is protected from improper operation and from dirt by a glass cover 55 which may be locked in place by means of a padlock through the staple 56.

The operation of the apparatus as a whole is as follows: As shown in the drawings, the mechanism is in its normal or wound-up position, the latch dog 66 retaining it in this position by engaging the latch 68 on the sleeve 21. The contacts 50—51 of the terminal assembly E^1 are held closed by the cam lobes 41 of the corresponding C cams and the contacts of the remaining terminal assemblies are open. To start an operation the operator will rotate the knob 17 in the counter-clockwise direction until the lug 18 engages the latch dog 66 and lifts it out of the latch 68, permitting the spring 6 to start rotating the camshaft 12 in the counter-clockwise direction. At the very beginning of the counter-clockwise movement, the respective cam lobes 41 move out from operative engagement with the rollers 54 of the respective contacts of the terminal assembly E^1, thus permitting the contacts of that assembly to open. Upon further movement of the camshaft the cam lobes 42 of the intermediate cams D operatively engage the rollers 54 of the respective contacts of the assembly E^2 to close these contacts. These latter contacts only remain closed, however, for an interval of time required for the cam lobes 42 to pass under the rollers 54. That is, the contacts of the assembly E^2 are held closed only a predetermined interval in the operation of the mechanism, say for example, 20 seconds. Near the end of the counter-clockwise movement the lobes 41 of certain of the cams C engage the rollers 54 of the respective contacts of the assembly E^3 to close these contacts. At the end of the counter-clockwise movement the radial arm 19 encounters the stop 27 and further operation is arrested. To return the mechanism to its normal position the operator will rotate the knob 17 in the clockwise direction and the lug 18 will engage the arm 19 and rotate the camshaft 12 in the clockwise direction until the stop 26 is reached where the latch dog 66 engages the latch 68, holding the mechanism in the normal position.

It will be readily understood from the foregoing description that, for a given proportioning of the parts, the length of the time required for the parts to move from the normal position to the reverse position, depends upon the angular position of the sleeve 21 with respect to the camshaft 12. The angular position of the sleeve 21 with respect to the camshaft may be readily adjusted in the manner previously described, and it follows, therefore, that the release time may be regulated to any desired value within the limits of the device. As here shown, the parts are proportioned to provide the maximum release time which, in the accompanying drawings, is represented to be four minutes as indicated by the dial 25. The time which has elapsed since the parts have left the wound-up position may be read at any instant during its operation by the position of the pointer 24 on the dial 25. It will also be readily understood from the foregoing description that since the angular positions of the cams with respect to the camshaft are adjustable, the various contacts may be made to operate at any time during the operation of the mechanism. Furthermore, by providing the cam lobes 42 of the intermediate cams D with wider or shorter surface, the length of the time that the contacts of the assembly E^2 remain closed during the operation may be varied to any desired value. Again, it will be understood from the foregoing description that since the position of any individual contact of any of the contact assemblies may be adjusted without disturbing the position of any of the other contacts, the time which any particular contact will be operated can be conveniently and quickly advanced or retarded within limits of the adjustment.

As pointed out hereinbefore, in the manufacturing of such time governed circuit controlling mechanisms the operating spring is preferably given an original tension for establishing a desired speed of operation. Since the tension of the operating spring can readily and conveniently be adjusted after the mechanism is set up, the desired speed of operation of the mechanism can be more accurately established. Also, variations in the speed of operation caused by wearing in of the parts and changes in the frictional resistance can be compensated for by adjusting the tension of the operating spring without dismantling the mechanism.

It will be seen, therefore, that I have provided a time governed circuit controlling mechanism having a first set of contacts which are closed in the wound-up position of the mechanism, a second set of contacts which are closed in the run-down position of the mechanism, and a third set of contacts which are closed for a predetermined interval during the operation of the mechanism. That the time of operating the different sets of contacts can be readily varied, each individual contact can be adjusted to vary its time of operation, and the speed of operation may be adjusted to a predetermined value.

The time governed circuit controlling mechanism of the type here described is particularly suitable for, although in no way limited to, use in connection with railway signaling systems for controlling the lock circuit in certain forms of route locking schemes. When used for this purpose, the lock circuit is preferably controlled by contacts of the assembly E^2, and as a result the circuit is closed for a predetermined interval only (usually 20 seconds) during the total time of operation. This compels the operator to fix his attention to the work at hand and to make his unlock during the 20 seconds or be compelled to again operate the release. To provide the operator with an indication when the mechanism has reached this interval, a marker 87 may be frictionally fastened to the dial 25 at the position registered by the pointer 24 during the 20 seconds these contacts are closed. As set forth hereinbefore, the mechanism here disclosed is assumed to have a four minute operation from the normal to the release positions. If it is desired to complete the release of the route locking in a less time, say for example, two minutes, the cams will be set accordingly, and to indicate to the operator the point at which the release is completed, a marker 84 may be frictionally fastened to the dial 25.

Although I have herein shown and described only one form of time governed circuit controlling mechanism embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. A circuit controlling mechanism comprising a rotatable shaft provided with a keyway, a pair

of cams loosely mounted on said shaft and each having a tapered bore in one side provided on its circumference with teeth, said cams being assembled on said camshaft with the bores facing each other to form a socket, an adjusting collar on said shaft disposed in said socket and provided with a feather key of the proper size to fit slidably in the keyway in said shaft, said collar also provided with two oppositely disposed hubs each tapered to fit the bore of the associated cam and having teeth which match the teeth on the circumference of the cooperating bore, one of said hubs being further provided with a hole, means for clamping said cams and said collar together on said camshaft, a cam lobe on each of said cams, a pair of circuit controlling contacts one controlled by each of said cam lobes, a tapped hole located in the cam cooperating with the hub of the collar having the milled slot, said tapped hole registering with said slot, and an adjustment screw adapted to fit said tapped hole and having an end formed to fit said hole whereby said one cam is held fixed against rotation with respect to the shaft while said clamping means is loosened for adjusting the position of the other of said cams.

2. A circuit controlling mechanism comprising a rotatable shaft provided with a keyway, a cam loosely mounted on said shaft and having a tapered bore in one side provided on its circumference with teeth, an adjusting collar on said shaft disposed adjacent the tapered bore of said cam and provided with a feather key of the proper size to fit slidably in the keyway in said shaft, said collar also provided with a drilled hole and with teeth which match the teeth on the circumference of the cooperating bore, means for clamping said cam and collar together on said camshaft, a cam lobe on said cam, a circuit controlling contact controlled by said cam lobe, a tapped hole located in the cam to register with said hole in the collar, and an adjustment screw adapted to fit said tapped hole and having an end formed to fit said hole, whereby said cam is held fixed against rotation with respect to the shaft while said clamping means is loosened for sliding the collar along said shaft.

3. A circuit controlling mechanism comprising a terminal block provided with a pair of cooperating contact members, an operating member mounted on one of said contact members for closing said contacts, a pair of parallel supporting rods, slots formed in the ends of said block for slidably mounting said block on said rods, a pinion disposed in a central recess of the block and rigid with a shaft journalled in the block and having a protruding slotted end for manual operation, a plate disposed adjacent said block non-slidably mounted on said rods and provided with a rack adapted to engage said pinion, means for clamping said block and plate together, and a rotatable shaft disposed parallel with said rods and having mounted thereon a cam adapted to engage at times said operating member.

4. A circuit controlling mechanism comprising a rotatable shaft carrying a cam provided with a lobe, a motor for rotating the shaft in one direction, a pair of supporting rods disposed parallel with said shaft, a terminal block mounted on said rods, said block provided with slotted ends for slidably mounting the block on said rods, a pair of cooperating contact members mounted on said block, an operating member mounted on one of said contact members adapted to operatively engage said cam lobe for at times closing the contacts, a recess formed on one side of the block, a pinion disposed in the recess rigid with a shaft journalled in the block and having an exposed end formed for manual operation, a plate disposed adjacent the block non-slidably mounted on said rods and provided with a rack on the side adjacent the recess for engaging the pinion, and means for clamping said block and plate together whereby the operating member is normally held at a given position with respect to the cam and the time of closing the contacts may be advanced or retarded.

5. A circuit controlling mechanism comprising a plurality of terminal blocks each provided with a pair of cooperating contact members, a pair of parallel supporting rods, slots formed in opposite ends of each block for slidably mounting said blocks consecutively on said rods, a central recess formed in one side of each block, said block arranged that the recesses all face in the same direction, a pinion disposed in the recess of each block and rigid with a shaft having an exposed end formed for manual operation, a plate disposed between adjacent blocks non-slidably mounted on said rods and provided with a rack on the side cooperating with a recess for engaging the pinion, means for normally clamping said blocks and plates together, and a rotatable shaft disposed parallel with said rods carrying cams each provided with a lobe adapted to at times operatively engage a contact of a particular block for closing the contacts of that block.

6. A circuit controlling mechanism comprising a rotatable shaft carrying cams each provided with a lobe, a spring operated motor for rotating the shaft in one direction at a constant speed, means for manually rotating the shaft in the opposite direction for winding up said spring, a pair of supporting rods disposed parallel with said shaft, a plurality of terminal blocks consecutively mounted on said rods, said blocks each provided with slotted ends for sliding the block on said rods, a pair of cooperating contact members mounted on each block, an operating member mounted on one of said contact members adapted to operatively engage a particular cam lobe for at times closing the contacts, a recess formed on one side of each block with said blocks arranged that the recesses all face in the same direction, a pinion disposed in the recess of each block rigid with a shaft journalled in the block and having an exposed end formed for screw driver operation, a plate disposed between adjacent blocks non-slidably mounted on said rods and provided with a rack on the side cooperating with a recess for engaging the pinion, and means for clamping said blocks and plates together whereby the contacts are normally held at a given position with respect to the camshaft and each block is adapted to have its position with respect to the camshaft individually adjusted.

7. A circuit controlling mechanism comprising a plurality of terminal blocks each provided with a pair of cooperating contact members having an operating member mounted on one of said contact members for closing said contacts, a pair of parallel supporting rods, means for mounting said blocks consecutively on said rods, means for clamping said blocks together, a rotating shaft disposed parallel with said rods and having mounted thereon a plurality of cams each provided with a lobe adapted to engage the operating member of a particular block, means operative at times for rotating said shaft for closing

the contacts of said blocks, and means mounted on each block for varying the position of its operating member with respect to the cooperating cam lobe manually operative when said clamping means is released whereby the time of closing the contact of each block may be individually advanced or retarded.

8. A circuit controlling mechanism comprising a plurality of terminal blocks each provided with a pair of cooperating contact members having an operating roller mounted on one of said members for closing said contacts, a pair of parallel supporting rods, slots formed in the ends of each terminal block for slidably mounting said blocks consecutively on said rods, means for clamping said blocks together, a rotating shaft disposed parallel with said rods and having mounted thereon a plurality of cams each provided with a lobe adapted to engage the roller of a particular block, means operative at times for rotating said shaft for closing the contacts of said blocks, and means for each of said blocks for sliding the block on said rods manually operative when said clamping means is released whereby the position of the roller of the block with respect to its cooperating cam lobe may be individually advanced or retarded.

9. A circuit controlling mechanism comprising two oppositely arranged sets of contacts, each contact of a set mounted on an individual terminal block, means for clamping the terminal blocks of a set together, a rotatable shaft disposed between said sets of contacts carrying cams each having a lobe adapted to operate a particular contact, said cams arranged to normally occupy a position of operative engagement with the contacts of one set, a slow acting motor for rotating the shaft in one direction and thereby rotating the cams from operative engagement with said one set of contacts to operative engagement with the opposite set of contacts, and means for each terminal block for varying its position with respect to the camshaft manually operative when the clamping means is released whereby the time of operating the contact of the block may be individually advanced or retarded.

10. A circuit controlling mechanism comprising three separate contacts arranged on the three sides of a square respectively, each contact mounted on an individual terminal block, means for normally clamping each terminal block in place, a rotatable shaft disposed at the center of the square carrying cams each having a lobe adapted to operate a particular contact, said cams arranged to normally occupy a position of operative engagement with one contact, a slow acting motor for rotating the shaft in one direction and thereby rotating the cams from operative engagement with said one contact to operative engagement with a second contact and subsequently to operative engagement with the third contact, and means for each terminal block for varying its position with respect to the camshaft manually operative when the clamping means of the block is released whereby the time of operating the contact of a block may be individually advanced or retarded.

11. A circuit controlling mechanism comprising two oppositely arranged sets of contacts, a rotatable shaft disposed between said sets of contacts carrying cams each having a lobe adapted to operate a particular contact, a motor mechanism including a coiled spring for rotating said shaft in one direction from a wound-up position where the cams operatively engage the contacts of one set to a run-down position when the cams operatively engage the contacts of the opposite set, manually operated means for rotating the shaft from the run-down to the wound-up position, means for dampening the speed of rotation of said shaft effected by said motor, adjusting means including a worm gear for governing the initial tension of said coiled spring, and manually operated means for actuating said worm gear whereby a predetermined speed of rotation of the shaft from the wound-up to the run-down position is readily established.

12. A circuit controlling mechanism comprising two oppositely arranged contacts, a rotatable shaft disposed between said contacts carrying cams each having a lobe adapted to operate a particular contact, a motor mechanism including a coiled spring for rotating said shaft in one direction at a constant speed for moving the cams from a normal position where they operatively engage one of said contacts to a reverse position where they operatively engage the other of said contacts in a predetermined time interval, manually operated means for rotating the shaft in the opposite direction for winding up the coiled spring of said motor, dampening means for governing the speed of rotation of said motor, adjusting means including a worm gear for governing the original tension of said coiled spring, and manually operated means for actuating said worm gear whereby the operation of said motor may be adjusted to maintain said predetermined time interval of operation.

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