July 4, 1933. K. MANRODT 1,916,485

TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

Filed Dec. 15, 1931 4 Sheets-Sheet 1

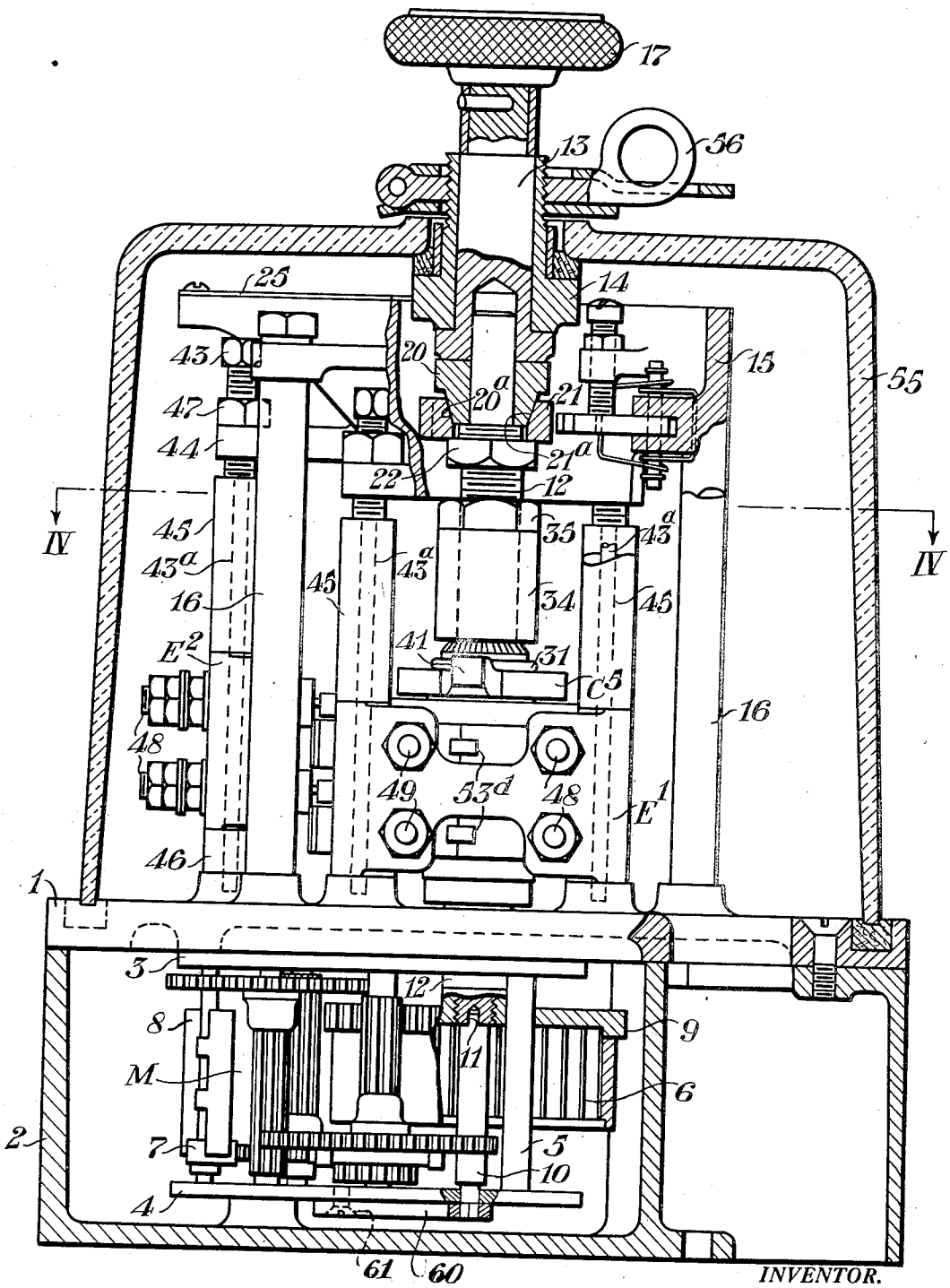


Fig. 1.

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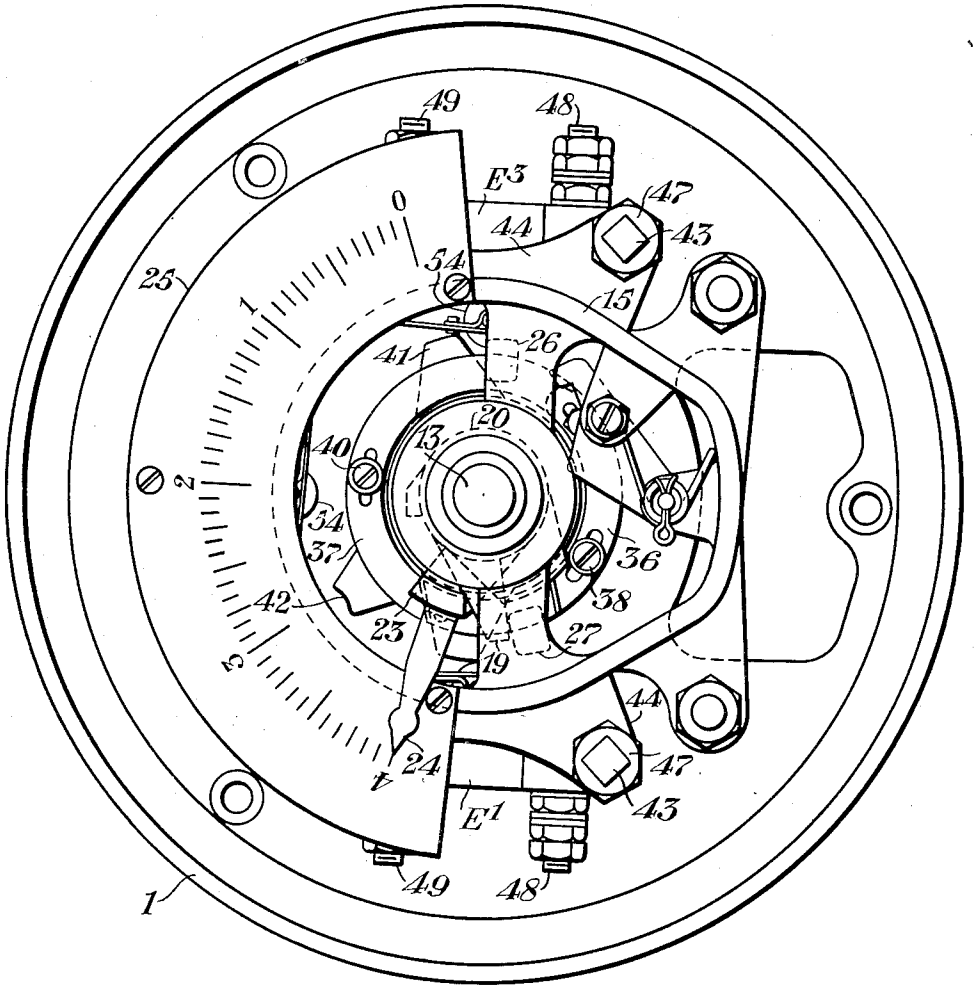


Fig. 2.

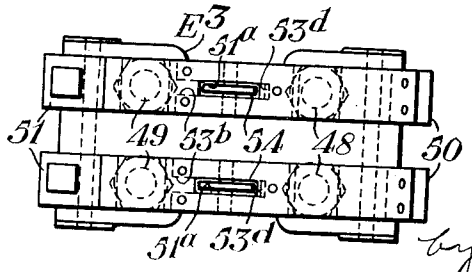


Fig. 8.

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TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

Filed Dec. 15, 1931 4 Sheets-Sheet 3

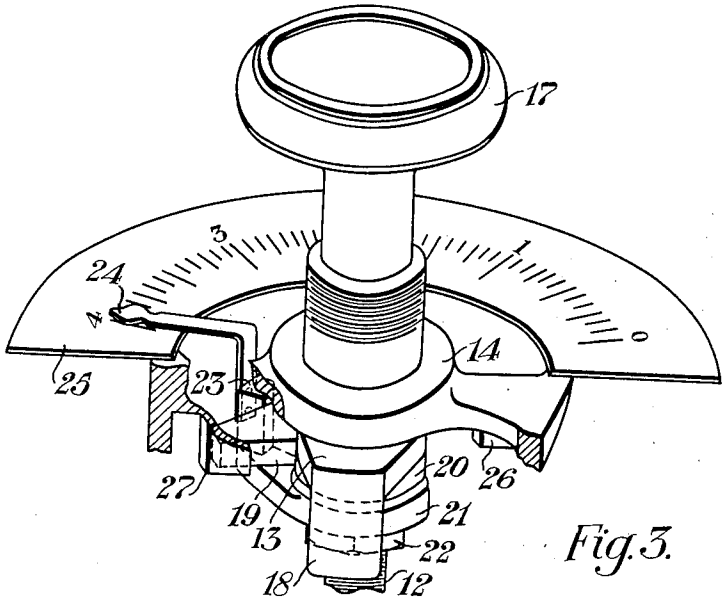


Fig.3.

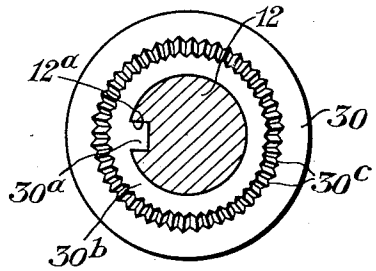


Fig.6.

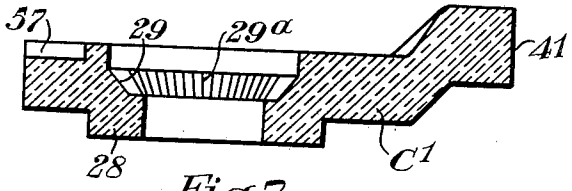


Fig.7.

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TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

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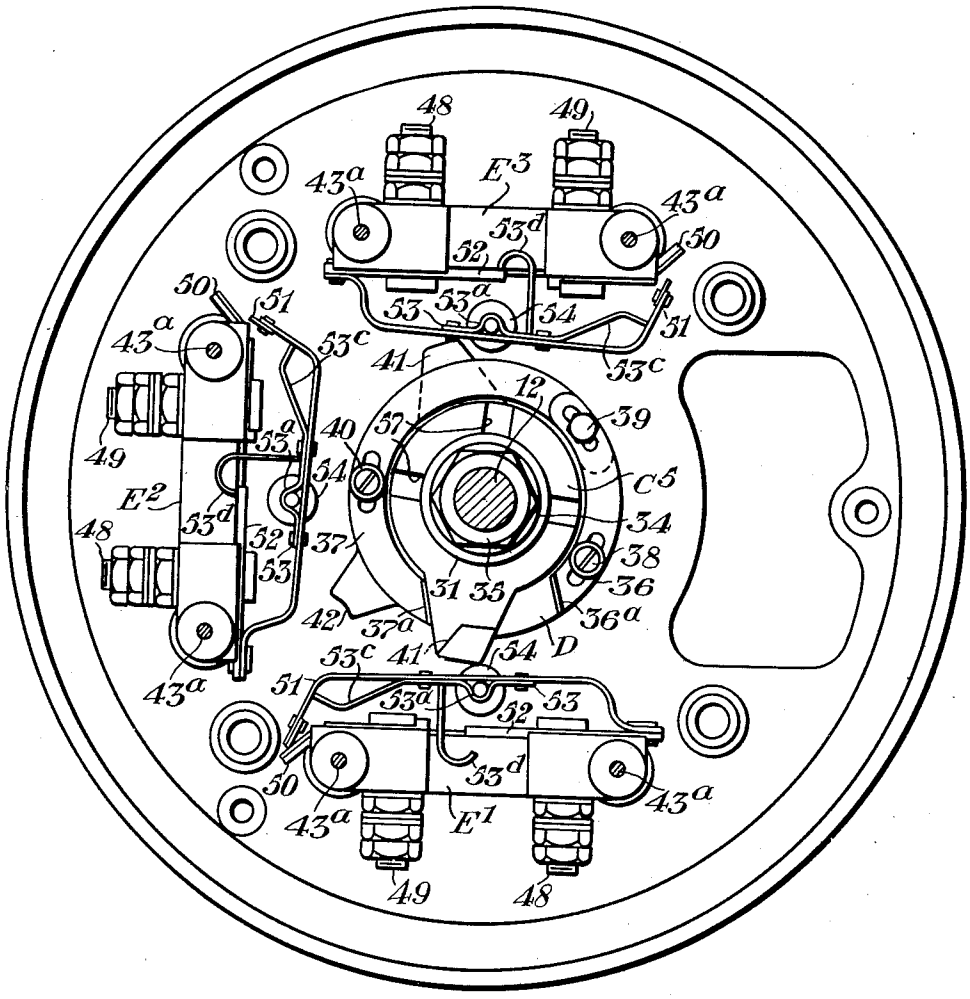


Fig. 4.

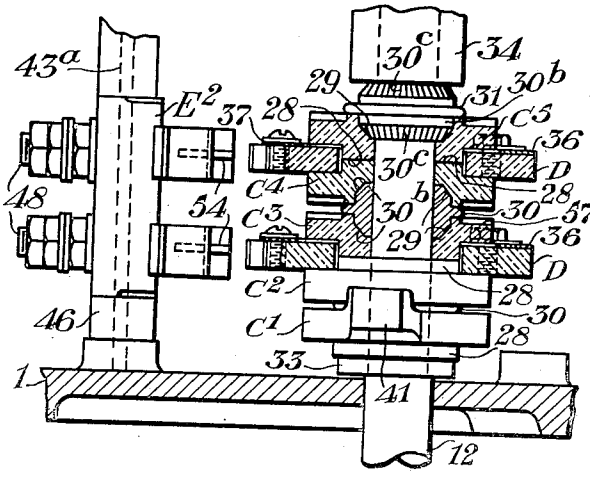


Fig. 5.

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UNITED STATES PATENT OFFICE

KURT MANRODT, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

TIME GOVERNED CIRCUIT CONTROLLING MECHANISM

Application filed December 15, 1931. Serial No. 581,122.

My invention relates to time governed circuit controlling mechanisms, and particularly to improvements in mechanisms of the type shown and described in Letters Patent of the United States No. 992,236, granted to W. P. Neubert and W. H. McClelland, Sr., on May 16, 1911.

One object of my invention is to provide an improved adjustable cam structure for operating the contacts of such mechanisms.

Other objects of my invention will appear as the description proceeds.

I will describe one form of mechanism embodying my invention, and will then point out the novel features thereof in claims.

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 top plan view of the mechanism shown in Fig. 1 with the cover and certain of the parts removed to more clearly illustrate the construction. Fig. 3 is a perspective view of a portion of the mechanism shown in Figs. 1 and 2. Fig. 4 is a sectional view taken on the line IV—IV of Fig. 1. Fig. 5 is a detail view, partly in section, and partly in elevation, of a portion of the mechanism shown in Figs. 1, 2 and 4. Fig. 6 is an enlarged view showing the cam shaft 12 and one of the driving collars 30 forming part of the mechanism illustrated in the preceding views. Fig. 7 is an enlarged vertical longitudinal sectional view of one of the cams C forming part of the mechanism illustrated in Figs. 1, 2 and 4, inclusive. Fig. 8 is a front elevation of the terminal board E^3 forming part of the mechanism shown in Figs. 1, 2 and 4.

Similar reference characters refer to similar parts in each of the several 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 of the mechanism are mounted. Suspended from the supporting plate 1 within the base 2 is a frame work consisting of two plates 3 and 4 separated by spacing studs 5, and mounted in this frame work is a clockwork mechanism M. This mechanism is similar in all respects to the mechanism shown and described in the patent to Neubert et al., referred to hereinbefore, and comprises briefly a train of gears actuated by a mainspring 6 and driving an escapement pawl 7 to which is secured a damper or fan 8 for the purpose of regulating the rundown time of the mechanism. The mainspring 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 journallel in a recess 11 formed in the lower end of a cam shaft 12 which, in turn is securely fastened to spring cage 9 and is journalled adjacent its lower end in the supporting plate 1. The end of the shaft 10 which is journaled in the plate 4 extends through this plate and is secured underneath this plate to a crank 60 which is provided to enable the mainspring to be wound up a certain amount when the apparatus is originally set up. After this initial winding of the mainspring has been completed, the crank 60 is then secured to the plate 4 by means of a screw 61, and it will be obvious that the shaft 10 is thereafter held in a fixed position. The spring cage 9 is operatively connected with the gear train of the clockwork mechanism by means of an integral gear cut on the outer face of the cage. With this construction, when the cam shaft 12 is rotated in a clockwise direction it winds the mainspring 6, and if the shaft is then released, the spring will drive the cam shaft in a counter-clockwise direction at a constant speed, as will be readily understood from the foregoing and from an inspection of the drawings.

Referring now also to Figs. 2 and 3, the upper end of the cam shaft 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 turning of this member, and the lower end of the winding member is provided with a depending lug 18 (see Fig. 3). When the winding member 13 is rotated in a clock-

wise direction, the lug 18 engages a radial arm 19 formed on a collar 20 which is rigidly fastened to the cam shaft directly below the winding member 13, and causes the cam shaft to rotate with the winding member, thus winding the mainspring 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 conical portion 20^a formed on the collar 20 as shown in Fig. 1. By this arrangement, the angular position of the sleeve 21 with respect to the cam shaft 12 may be quickly and conveniently adjusted by merely loosening the jam nut 22, rotating the sleeve 21 to the desired position, and again tightening the jam nut. Projecting from the side of the sleeve 21 is a substantially L-shaped arm 23 having fixed thereto a pointer 24 which, when the cam shaft 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 cam shaft 12 may be rotated in a clockwise direction. The extreme position to which the cam shaft 12 may be rotated in a counter-clockwise direction is limited by a depending lug 27 on the bracket 15 which is adapted to engage the radial arm 19 on the collar 20.

Mounted on an intermediate portion of the cam shaft 12 (see Fig. 5) are a plurality of similar cams, here shown as five in number, and designated by the reference characters C^1, C^2, C^3, C^4 and C^5, respectively. These cams may be fastened to the cam shaft in any suitable manner, but for reasons which will appear hereinafter, it is highly desirable that the angular positions of these cams with respect to the cam shaft may be quickly and conveniently adjusted, and I therefore prefer to fasten the cams to the cam shaft in the following manner.

As will be apparent from an inspection of Figs. 5 and 7, each cam C is provided on one face with an outstanding boss 28 and in the other face with a tapered central bore 29 having serrations or teeth 29^a formed on its entire circumference. The cams are loosely mounted on the cam shaft, and are assembled with alternate cams facing in one direction and with the remaining cams facing in the opposite 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 driving collar 30, having an inwardly extending projection or feather key 30^a, which is of the proper size to fit slidably in a keyway 12^a formed lengthwise on the shaft 12 (see Fig. 6) is disposed in the socket formed by each adjacent pair of recesses 29, and each of these collars is provided with two oppositely disposed hubs 30^b. Each of these hubs is tapered to fit the bore 29 in the adjacent cam, and is provided on its periphery with teeth 30^c which match the teeth on the circumference of the cooperating bore. Another driving collar 31, similar in all respects to the driving collars 30, is mounted on the cam shaft 12 above the upper cam C^5 and has its lower hub 30^b fitting the bore 29 in the upper face of this cam. The cams C and collars 30 are clamped together on the cam shaft 12 between a shoulder 33 against which the boss 28 on the lower cam C^1 abuts, and a sleeve 34 which engages the upper side of the driving collar 31, by means of a nut 35 which is screwed onto the cam shaft above the sleeve 34. With the cams C fastened to the cam shaft in this manner, it will be apparent that in order to adjust the angular position of any cam C with respect to the cam shaft, it is only necessary to back off the nut 35 a sufficient distance so that the teeth on the circumference of the bore of such cam may be disengaged from the teeth on the cooperating hub of the associated driving collar, turn the cam to the desired position, and again tighten the nut. The adjusted cam will then be held in its adjusted position because of the co-action between the teeth on the cooperating hub of the associated collar and the teeth on the circumference of the bore in the cam.

Projecting from each cam C is a cam lobe 41 which operates one of the contacts of the mechanism as will be described more fully hereinafter.

Mounted for rotation about the bearing formed by each pair of confronting bosses 28 is an intermediate cam D. Each of these intermediate cams is provided on its upper face with two arcuate stops 36 and 37, having confronting upturned ends 36^a and 37^a, respectively. Each stop 36 is fastened to the associated intermediate cam by means of two screws 38 and 39 which pass through elongated arcuate slots in the stops and are screwed into threaded holes in the cam, and each stop 37 is similarly fastened to the associated cam by means of the screw 39 and a screw 40. By this arrangement, the angular positions of the stops 36 and 37 with respect to the associated intermediate cam may be adjusted within certain limits by merely loosening the screws 38 and 39 or 39 and 40, as the case may be, turning the stop to the desired position, and again tightening the screws. The upturned ends 36^a and 37^a are disposed on opposite sides of the cam lobe 41 on the cam C which is directly above the associated intermediate cam D and at times cooperate with the cam lobe to cause the associated intermediate cam to be rotated in response to rotation of the cam shaft 12, in a manner which will be described more fully hereinafter. Each intermediate cam is pro-

vided with a cam lobe 42, the outer end of which is curved inwardly a slight amount, as clearly shown in Figs. 2 and 4. The cam lobes 42 cooperate, in a manner to be made clear presently, with certain of the contacts of the mechanism, which contacts I will now describe, together with the contacts which are operated by the cam lobes 41 on the cam C.

The contacts of the mechanism are mounted on a plurality of similar terminal boards, here shown as three in number, and designated by the reference characters E^1, E^2 and E^3, respectively. These terminal boards are disposed about the cam shaft 12 on three sides of a rectangle, as best seen in Fig. 4, and are each held in place by means of two studs 43, the upper ends of which are screwed through threaded lugs 44 projecting from the side of the bracket 15, as shown in Fig. 1. The lower ends of the studs 43 are formed with a rod-like projection 43^a which passes through a spacing collar 45 and through a suitable hole in the terminal board, and extends into a boss formed on the supporting plate 1. The studs which fasten the terminal board E^2 to the mechanism also pass through a short spacing collar 46 located below the terminal board E^2, which causes this terminal board to occupy a somewhat higher vertical position than the remaining terminal boards E^1 and E^3, as will be apparent from an inspection of Fig. 1. The function of the upper spacing collars 45 is to permit the addition of other terminal boards above those shown, if additional contacts on the mechanism are needed. The spacing studs 43 are locked in place by lock nuts 47.

Each terminal board E carries two contacts. These contacts are exactly alike, and an understanding of each may be had from a description of one. Referring particularly to the upper contact on the terminal board E^3 shown in Figs. 1, 4 and 8, this contact comprises a fixed contact member 50 which is fastened to the terminal board E^3 by means of a terminal post 49 of the usual construction, and a flexible contact finger 51 which is fastened at one end to the outer end of a fixed conducting member 52, which in turn, is fastened to the terminal board E^3 by means of a terminal post 48, also of the usual construction. The flexible contact finger 51 is bowed away from the terminal board, as best seen in Fig. 4, and fastened to this finger at the side which is nearest the terminal board, is a bracket 53. The bracket 53 is formed with a semi-circular offset portion 53^a and with a slot 53^b which extends at right angles to the axis of the semi-circular offset portion 53^a. The slot 53^b registers with a similar slot 51^a formed in the contact finger 51, and located within the slots 51^a and 53^b is a roller 54 having integral axially extending shafts which are journalled in the bearing formed by the semi-circular offset portion 53^a and the adjacent side of the finger 51. The bracket 53 is also formed with a stop 53^c which tends to maintain the conducting tip of the contact fingers in the desired position when the finger is not engaging the fixed contact member 50, and with a stop 53^d, the curved end of which cooperates with the inner end of the conducting member 52 to limit the amount of opening of the contact formed by the contact member 50 and contact finger 51.

The parts are so arranged and so proportioned that the upper and lower contacts on the terminal board E^1 cooperate respectively with the cam lobes 41 on the cams C^3 and C^1. The upper and lower cams on the terminal board E^3 similarly cooperate respectively with the cam lobes on the cams C^4 and C^2, and the upper and lower contacts on the terminal board E^2 cooperate respectively with the cam lobes 42 on the intermediate cams D.

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 a staple 56.

The operation of the apparatus as a whole is as follows: As shown in the drawings, the parts are in their normal or rundown positions. That is to say, the radial arm 19 is engaging the stop 27, both contacts on the terminal board E^1 are held closed by the cam lobes 41 on the cams C^3 and C^1 engaging the respective rollers 54 on these contacts, and all of the remaining contacts are open. When a release is desired, the operator rotates the knob 17 in a clockwise direction until stopped by the arm 23 engaging the stop 26. At the very beginning of this clockwise movement, the cam lobes 41 on the cams C^3 and C^1 move out of engagement with the rollers 54 of the contacts on terminal board E^1, thus permitting both of these contacts to open, and upon slight further movement of the knob 17, the cam lobes 41 on the cams C^4 and C^2 move into engagement with the rollers 54 of the contacts which are mounted on the terminal board E^3, thus closing these contacts. These latter contacts only remain closed, however, for the interval of time required for the cam lobes 41 to pass the rollers on these contacts. Near the end of the clockwise movement of the knob 17, the cams D which, during this movement have been rotated due to the engagement of the cam lobes 41 on the cams C^3 and C^5 with the upturned ends 37^a of the stops 37, reach the positions in which the curved ends of the cam lobes 42 on these cams receive the cooperating rollers 54 of the contacts which are mounted on terminal board E^2. When the cam lobes 42 on the cams D are in these latter positions, the contacts on terminal board E^2 are both held closed.

The clockwise rotation of the knob 17 also winds the mainspring 6, as previously de-

scribed, and as a result, upon releasing the knob 17, the clockwork mechanism will return the parts to their normal positions. It will be readily understood that during this return movement, since the cams D are free to rotate about the bearings formed by the bosses 28 upon which they are journalled but are resisted from turning by engagement of the convex ends of the associated cam lobes 42 with the convex surfaces of the rollers 54 on the contacts on terminal board E^2, these cams will remain in the positions in which the cam lobes 42 engage the rollers 54 of the contacts on terminal board E^2 and hold these contacts closed, until after the cam shaft 12 has been rotated from its wound-up position to a position a short distance beyond the position in which the cam lobes 41 on the cams C^5 and C^3 move into engagement with the upturned ends 36^a of the stops 36, at which time due to the engagement of the cam lobes 41 with these stops, the cams D will then be rotated to the positions in which the cam lobes 42 are out of engagement with the rollers 54 of the contacts on terminal board E^2, thus permitting these contacts to open. The parts are so proportioned, that while the contacts on terminal board E^2 are still closed, the cam lobes 41 on the cams C^4 and C^2 will move into engagement with the rollers 54 of the contacts on terminal board E^3, and will hold these contacts closed for a brief interval of time (for example twenty seconds) the length of which time depends upon the width of the face of the cam lobes 41. Just before the parts reach their normal positions, the cam lobes 41 on the cams C^3 and C^1 move into engagement with the rollers 54 of the contacts on the terminal board E^1, thus closing these contacts. When the cam shaft 12 has reached its full normal position, the radial arm 19 engages the stop 27, and prevents further rotation of the shaft.

It will be readily understood from the foregoing that, for a given proportioning of the parts, the length of the time required for the parts to return to their normal positions, depends upon the angular position of the sleeve 21 with respect to the cam shaft 12. The angular position of the sleeve 21 with respect to the cam shaft 12 may be quickly and conveniently 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 apparatus. As here shown, the parts are adjusted to provide the maximum release time which, in the accompanying drawings, is represented to be four minutes. The time which has elapsed since the parts have left their wound-up positions may be read at any instant during the release by the position of the pointer 24 on the dial 25.

It will also be readily understood from the foregoing that since the angular positions of the cams C with respect to the cam shaft 12 and the angular positions of the stops 36 and 37 with respect to the cams D are all adjustable, the various contacts may be made to operate at any time during the release that is desired. Furthermore, by providing the cam lobes 41 on the cams C^2 and C^4 with wider or shorter faces, the length of time that the contacts on terminal board E^3 remain closed during the release may be varied to any desired value.

In adjusting the release time, the mechanism is first rundown. The jam nut 22 is then loosened and the sleeve 21 is turned to the position in which the pointer 24 indicates the desired release time. The jam nut 22 is then again tightened to wedge the sleeve 21 against the collar 20. The cam positions are next adjusted. This adjustment is made by loosening the nut 35 and inserting a small screwdriver in a small recess 57 (see Figs. 4, 5 and 7) formed in the cam which it is desired to adjust, and against the adjacent driving collar 30. A slight prying effort will disengage the driving collar from the cam, which may then be rotated and set to close the contacts at the time desired. After this latter adjustment has been made, the nut 35 is again tightened to maintain the cams in their adjusted positions. The method of adjusting the stops 36 and 37 on the cams D will be readily understood from an inspection of the drawings without describing it in detail.

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 rundown position of the mechanism, a second set of contacts which are closed in the wound-up position of the mechanism and which remain closed for a predetermined interval during the release of the mechanism, and a third set of contacts which become closed for a brief interval of time while the second set of contacts are closed during the release of the mechanism.

A time governed circuit controlling mechanism of the type 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 contacts on the terminal boards E^3 and E^2 are connected in series in the lock circuit, and as a result, this circuit is closed for a brief interval of time (usually twenty seconds) during the total release time, and is open in both the normal and reverse positions and during the winding up operation. This compels the operator to fix his attention on the work at hand and take his unlock during the twenty seconds as indicated by the pointer 24 on the dial 25, or be compelled to again operate the release to full wound-up position and again wait a

predetermined time for a release. The twenty second interval is adjustable to terminate at any point of travel before the pointer 24 has again reached the normal position.

It should be particularly pointed out that while in describing my invention, I have show the mechanism provided with only six contacts, additional contacts may be provided by replacing the spacing collars 45 with additional terminal boards having contacts mounted thereon, and by replacing the sleeve 34 with additional cams C and D similar to those previously described.

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, means for rotating said shaft from one extreme position to another extreme position at a constant rate of speed, three contacts, means controlled by said shaft for closing a first one of said contacts when and only when said shaft is in said other extreme position, other means controlled by said shaft for closing a second one of said contacts when said shaft occupies said one extreme position and for subsequently maintaining said contact closed during a portion of the movement of said shaft from said one extreme position to said other extreme position, and still other means controlled by said shaft for controlling the third one of said contacts in such manner that said third contact is open when said shaft occupies either extreme position but that said third contact becomes closed for a predetermined interval of time while said second contact is closed during movement of said shaft from said one extreme position to said other extreme position.

2. A circuit controlling mechanism comprising a rotatable shaft, means for rotating said shaft in opposite directions, a first cam fixed to said shaft and provided with a cam lobe, a first contact controlled by said first cam, a second cam rotatable with respect to both said first cam and said shaft, two stops on said second cam located on opposite sides of said cam lobe and cooperating therewith for at times causing rotation of said second cam in response to rotation of said shaft, and a second contact controlled by said second cam.

3. A circuit controlling mechanism comprising a rotatable shaft, means for rotating said shaft in opposite directions, a first and a second cam loosely mounted on said shaft and each provided on one face with a boss, said cams being assembled on said shaft with their bosses confronting to form a bearing, means for clamping said cams to said shaft in adjusted positions with respect to said shaft, a cam lobe on said first cam, an intermediate cam journaled for rotation about the bearing formed by said confronting bosses, two arcuate stops each having upturned ends and each provided with an elongated arcuate slot, two screws one passing through each stop and screwed into said intermediate cam for fastening said stops to said intermediate cam in such manner that the upturned ends of said stops confront each other in spaced relation on opposite sides of said cam lobe in positions to be engaged by said cam lobe, and a plurality of contacts one controlled by each of said cams.

4. A circuit controlling mechanism comprising a rotatable shaft, means for rotating said shaft in opposite directions, a first and a second cam loosely mounted on said shaft and each provided on one face with a boss and on the opposite face with a tapered bore having teeth on its entire circumference, said cams being assembled with their bosses confronting and forming a bearing, two driving collars on said shaft one adjacent the outer face of each of said first and second cams and each having a hub tapered to fit the bore in the adjacent cam and provided with teeth which match the teeth on the cooperating bore, means for clamping said driving collars and said cams together, a cam lobe on said first cam, an intermediate cam journaled for rotation about the bearing formed by said confronting bosses, two stops on said cam having spaced upturned ends which cooperate with the opposite sides of said cam lobe for at times rotating said intermediate cam in response to rotation of said shaft, and a plurality of contacts one controlled by each of said cams.

5. A circuit controlling mechanism comprising a rotatable shaft, means for rotating said shaft in opposite directions, a first and a second cam loosely mounted on said shaft and each provided on one face with a boss and on the opposite face with a tapered bore having teeth on its entire circumference, said cams being assembled with their bosses confronting and forming a bearing, two driving collars on said shaft one adjacent the outer face of each of said first and second cams and each having a hub tapered to fit the bore in the adjacent cam and provided with teeth which match the teeth on the cooperating bore, means for clamping said driving collars and said cams together, a cam lobe on said first cam, an intermediate cam journalled for rotation about the bearing formed by said confronting bosses, two arcuate stops each having upturned ends and each provided with an elongated arcuate slot, two screws one passing through each stop and

screwed into said intermediate cam for fastening said stops to said intermediate cam in such manner that the upturned ends of said stops confront each other in spaced relation on opposite sides of said cam lobe in positions to be engaged by said cam lobe, and a plurality of contacts one controlled by each of said cams.

6. A circuit controlling mechanism comprising a rotatable shaft provided with a keyway, a plurality of cams loosely mounted on said shaft and each having a boss on one side and a tapered bore in the other side provided on its entire circumference with teeth, said cams being assembled on said cam shaft with alternate cams facing in one direction and with the remaining cams facing in the opposite direction, whereby each pair of adjacent cams provides either a bearing formed by a pair of confronting bosses or a socket formed by a pair of bores, a plurality of driving collars on said shaft one disposed in the socket formed by each pair of bores and each provided with a feather key of the proper size to fit slidably in the keyway in said shaft, each said driving collar also being provided with two oppositely disposed hubs each tapered to fit the bore in the associated driving collar and each provided on its entire circumference with teeth which match the teeth on the circumference of the cooperating bore, means for clamping said cams and said driving collars together on said cam shaft, a cam lobe on each of said cams, a plurality of intermediate cams one mounted for rotation about the bearing formed by each pair of confronting bosses, a plurality of adjustable stops two secured to each intermediate cam and cooperating with the opposite sides of a different one of said cam lobes for at times causing rotation of said intermediate cams in response to rotation of said cam shaft, and a plurality of contacts one controlled by each of said cams.

In testimony whereof I affix my signature.

KURT MANRODT.