Aug. 8, 1939. R. B. HUNTER ET AL 2,169,049

DRUM CONTROLLER

Filed Jan. 28, 1937

Fig. 1

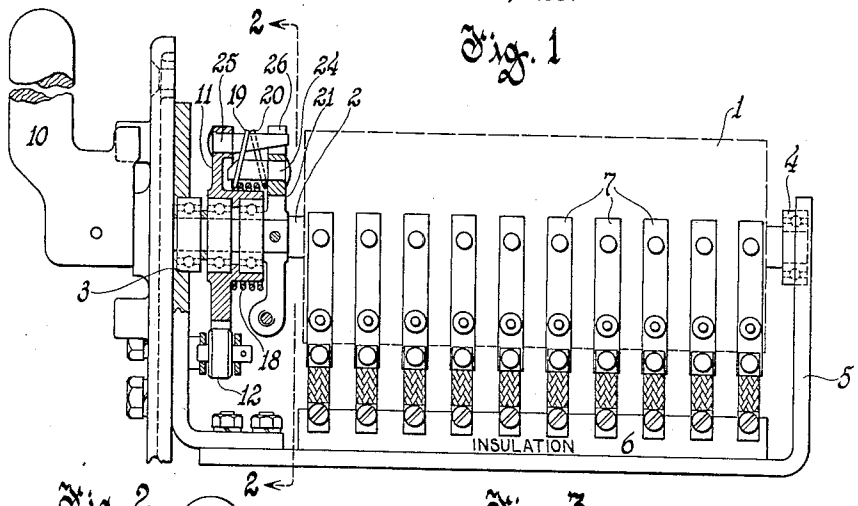


Fig. 2

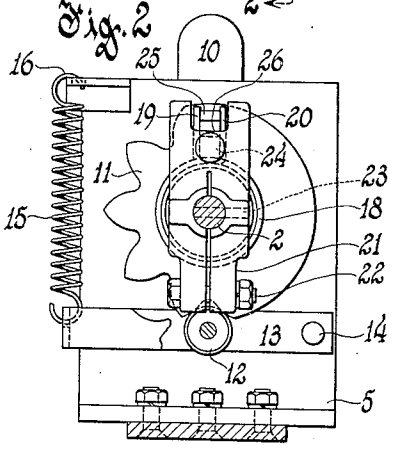


Fig. 3

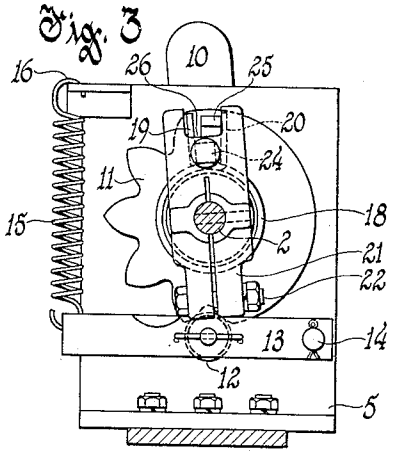


Fig. 5

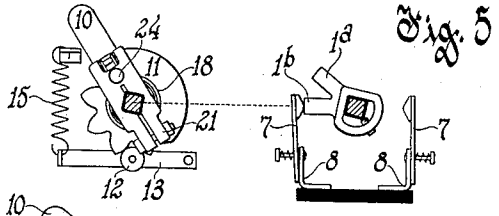


Fig. 6

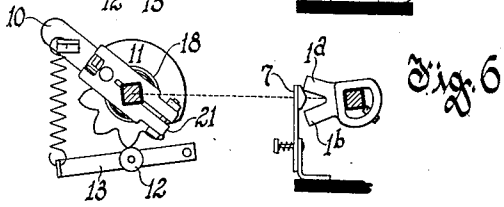


Fig. 7

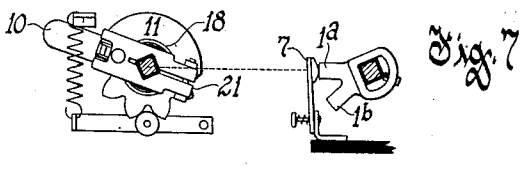
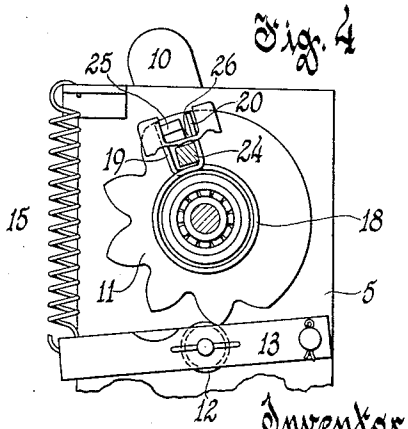


Fig. 4



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DRUM CONTROLLER

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Application January 28, 1937, Serial No. 122,720

9 Claims. (Cl. 200—6)

This invention relates to improvements in circuit controllers and is especially advantageous for controllers of the so-called drum type. In practice there are many instances where it is desired to employ a drum type controller for establishing sequentially different circuit connections, interrupting all connections each time a change is made, as in the case of control of multi-speed alternating current motors. In many instances, especially in motor control it is very undesirable to have the controller left in any circuit interrupting position other than a given off position, and there has long been a demand for a simple and effective controller of the character mentioned with provisions whereby if it is inadvertently left in a circuit interrupting position other than the given off position it will with certainty either advance or return to a circuit closing position.

Various means to this end have been proposed but they have been complicated and certain of the proposals have involved accelerated movement of the drum in commutating the control connections, whereas in the control of alternating current circuits a relatively slow movement of the drum in commutating circuits is preferable to an accelerated movement of the drum.

The present invention has among its objects to provide a simple and effective controller having the aforestated desirable characteristics.

Other objects and advantages of the invention will hereinafter appear.

One embodiment of the invention is illustrated in the accompanying drawing which will now be described, it being understood that the invention may be embodied in other forms without departing from the scope of the appended claims.

In the drawing,

Figure 1 is a side view, partly in section, of the controller;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Figs. 3 and 4 are views like Fig. 2 but showing parts in different relations, and

Figs. 5, 6 and 7 are schematic views illustrative of the operation of the controller.

The controller illustrated comprises a drum 1 carried by a shaft 2 having bearings 3 and 4 in a frame 5, the bearings being preferably of the ball type. As will be understood, the drum 1 is provided to carry the desired movable contacts which in practice may be arranged thereon in any preferred manner and which for simplicity of illustation have been omitted from the drawing except in the schematic views wherein two such contacts 1^a and 1^b are shown. The frame 5 also carries an insulating base 6 having mounted thereon in an opposed relation two sets of contact fingers 7, there being any preferred number of fingers in each set. Only one set of contact fingers appears in Fig. 1 but the schematic views show contact fingers of opposite sets. The contact fingers may be of any preferred form and supported in any preferred way, as by individual supports 8, Fig. 5.

The drum shaft 2 has an extension external of the frame to which is attached an operating handle 10. The shaft 2 carries within the frame a star wheel 11 which defines the positions of rest of the drum, said star wheel being of conventional form except that it has a limited rotary play relative to the shaft. As is customary, the star wheel has a cooperating roller 12 carried by a lever 13 fulcrumed as best shown in Fig. 2 at 14 to the frame, and having attached at its free end a helical spring 15, the free end of which spring is attached to the frame at point 16. The star wheel has a connection with the shaft 2 which comprises a helical torsion spring 18 surrounding the shaft and having its extremities 19 and 20 straddling pins hereinafter referred to which are fixed respectively to the star wheel and to a dog 21 non-rotatably fixed to the shaft 2. The dog 21 comprises a substantially oblong member with an orifice to receive shaft 2, said dog being split from one end through such orifice and its split portion having a clamping pole 22. The dog 21 preferably is keyed to the shaft 2 by a tapered pin 23. The dog has mounted thereon a pin 24 which projects between the extremities 19 and 20 of the spring 18 into a recessed portion of the star wheel, and the star wheel has fixed thereto a pin 25 which also projects between the extremities of said spring into a notch 26 provided in the end of the dog.

The spring 18 thus yieldingly holds the star wheel in a given relation with the dog and hence with shaft 2, the pin 25 on the star wheel being then centrally disposed in the notch 26 in the dog. Such relationship of the parts is obtained in each position of rest of the drum, and hence upon rotation of the shaft 2 in either direction the star wheel will remain at rest until the play afforded by the notch 26 in the dog is taken up.

Referring to Figs. 2 to 4, the normal relation of parts is shown in Fig. 2, whereas Fig. 3 shows the handle 10 moved towards the left to take up the play between the pin 25 on the star wheel and the right hand wall of the notch 26 in the dog. This change in relation of parts which, as will be apparent, stores energy in spring 18 is maintained

as long as the star wheel is forcing downwardly the star wheel roller 12. Then when the active peak of the star wheel engages the top of the roller the stored energy in spring 18 continues the throw of the star wheel independently of rotation of shaft 2 until the pin 25 on the star wheel engages the opposite side of the notch in the dog, as shown in Fig. 4. The active peak of the star wheel has then attained such a relation to the star wheel roller 12 as to insure its continued throw and consequent continued rotation of the drum as a function of the energy stored in the spring 15 acting on lever 13. The parts function in the same or reverse manner upon coaction of any one of the peaks of the star wheel with the roller. Thus assuming that the drum handle is operated and released before the movement of the drum is completed, the drum will with certainty either move on to the next position or back to the position it formerly occupied.

Referring now to Fig. 5 which shows schematically the mechanism of Fig. 2 with the dog and the star wheel pins in a normal relation and which also shows certain drum contacts and coacting fingers, the drum contact 1^b in this instance is in full engagement with one of the contact fingers. If now it is desired to disengage the drum contact 1^b from and to engage drum contact 1^a with the contact finger aforementioned the operating handle is moved counterclockwise, and as shown in Fig. 6 the disengagement of contact 1^b and engagement of contact 1^a is effected as the peak of the star wheel forces downwardly the star wheel roller 12 and while the relationship of the dog and star wheel remain as shown in Fig. 3. In this operation of the drum the contact 1^b is disengaged from the contact finger prior to engagement of the contact 1^a with the contact finger and should the operating handle be released while the star wheel is in the position shown in Fig. 6 the star wheel would be driven backwardly and would reverse the movement of the drum to restore the contacts to the relation shown in Fig. 5, the contact 1^a being disengaged from the contact finger 7 prior to reengagement of contact 1^b with said contact finger. On the other hand, should the movement of the operating handle be continued from the position shown in Fig. 6 the star wheel would be driven by the energy stored in the spring 18 and into a relation with the star wheel roller such as to insure continued throw of the drum into the position shown in Fig. 7 for full engagement of contact 1^a with its cooperating contact finger. The operating mechanism will then occupy the position depicted in Fig. 7 wherein the star wheel and dog on the shaft 2 are restored to their normal relation depicted in Figs. 2 and 5.

As aforenoted, it is of importance to insure a slow make and a slow break of the drum contacts in a controller for multi-speed alternating current motors, and as will be apparent the means hereinbefore described are adapted to insure attainment of this desirable result in the normal operation of the drum.

What we claim as new and desire to secure by Letters Patent is:

1. In a star wheel mechanism for drum controllers and the like, in combination, a rotatable contact carrying shaft, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of a plurality of rotary positions, a handle fixed to said shaft for effecting rotation thereof, means providing a lost motion connection between said handle and said star wheel, said means comprising a pair of projections interposed between said handle and said star wheel and respectively connected thereto, a coiled torsion spring surrounding said shaft and having its free ends arranged to normally bias said projections into a given relationship to each other, the arrangement being such that the lost motion is taken up upon a predetermined degree of angular movement of said handle in either direction to provide a positive driving connection between the same and said star wheel, said torsion spring being adapted to restore said projections to their normal relationship upon movement of the active peak of said star wheel into a dead center relationship with said spring biased member, whereby movement of said star wheel out of said dead center relationship is insured.

2. In a star wheel mechanism for drum controllers and the like, in combination, a rotatably supported contact carrying shaft, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward and yieldably hold the same in any one of a number of rotary positions defined by the notches in said star wheel, a handle fixed to said shaft for effecting rotation thereof, means providing a lost motion connection between said handle and said star wheel, said means comprising a pair of projections interposed between said handle and said star wheel and respectively connected thereto, a coiled torsion spring surrounding said shaft and having its free ends arranged to normally bias said projections into radial alinement with each other, the arrangement being such that said projections are moved out of such radial alinement upon a predetermined degree of angular movement of said handle in either direction, whereby energy is stored in said torsion spring and said lost motion is taken up to provide a positive driving connection between said handle and said star wheel, said torsion spring being adapted to restore said projections to said radially alined relationship upon movement of the active peak of said star wheel into a dead center relationship with said spring biased member, whereby said star wheel is definitely moved independently of said handle out of said dead center relationship into a relationship wherein it is adapted to be positioned by said spring biased member.

3. In a star wheel mechanism for drum controllers and the like, in combination, a rotatably supported contact carrying shaft, a handle fixed to said shaft for effecting rotation thereof, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of its rotary positions, a member rigidly attached to said shaft for rotation therewith, spring means interposed between said member and said star wheel to normally hold the same in a given relationship to each other, means associated with said star wheel and said member to provide a lost motion connection therebetween, the arrangement being such that upon a predetermined angular movement of said member in either direction energy is stored in said spring means and said lost motion is taken up, the energy stored in said spring means being adapted to be released upon movement of the active peak of said star wheel into a given relationship to said biasing means to drive said star wheel in-

dependently of said member into a position wherein said biasing means is rendered effective.

4. In a star wheel mechanism for drum controllers and the like, in combination, a rotatable shaft, a handle fixed to said shaft for effecting rotation thereof, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of its rotary positions, a stud carried by said star wheel, a member rigidly attached to said shaft and having a stud, said studs being spaced different radial distances from the axis of said shaft, said last mentioned member having a notch formed therein to accommodate said first stud with a lost motion relationship therebetween in either direction, a torsion spring surrounding said shaft and having substantially parallel arms respectively arranged on opposite sides of said studs, whereby the latter are normally biased into radial alinement with each other, said torsion spring cooperating with the parts aforementioned to insure against dead centering of said star wheel with respect to said spring biased member, whereby step-by-step movement and positioning of said shaft in either direction is insured.

5. A drum for controlling alternating current circuits, in combination, a rotatable shaft, a handle fixed to said shaft for effecting rotation thereof, a plurality of contacts supported in a given relationship to said shaft, a plurality of contactors fixed to said shaft for rotation therewith, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of its rotary positions, a stud carried by said star wheel, a member rigidly attached to said shaft and having a stud, said studs being spaced different radial distances from the axis of said shaft, said last mentioned member having a notch formed therein to accommodate said first stud with a lost motion relationship therebetween in either direction, a torsion spring surrounding said shaft and having substantially parallel arms respectively arranged on opposite sides of said studs, whereby the latter are normally biased into radial alinement with each other, said star wheel cooperating with the parts aforementioned to normally enable slow break circuit interruption and slow make circuit completion by said contacts and contactors, and said torsion spring cooperating with said parts to insure against leaving said shaft in any intermediate off position.

6. A drum for alternating current circuits, in combination, a rotatable shaft, a handle fixed to said shaft for effecting rotation thereof, a plurality of contacts supported in a given relationship to said shaft, a plurality of contactors fixed to said shaft for rotation therewith, a star wheel supported by said shaft for rotation with respect thereto, a roller member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of its rotary positions, a stud carried by said star wheel, a member rigidly attached to said shaft and having a stud, said studs being spaced different radial distances from the axis of said shaft, said last mentioned member having a notch formed therein to accommodate said first stud with a lost motion relationship therebetween in either direction, a torsion spring surrounding said shaft and having substantially parallel arms respectively arranged on opposite sides of said studs, whereby the latter are normally biased into radial alinement with each other, said star wheel cooperating with the parts aforementioned in a manner to provide for sequential disengaging and initial engaging movement of said contactors with respect to said contacts prior to movement of the active peak of said star wheel into dead center relationship with said roller member, and said torsion spring cooperating with said parts to insure definite movement of said star wheel from said dead center relationship into a position wherein said spring biased roller member is rendered effective.

7. In a drum positioning device of the character described, in combination, a rotatable shaft, means for effecting rotation of said shaft, a star wheel supported by said shaft for rotation with respect thereto, a roller member spring biased into cooperative relationship to said star wheel to bias the latter toward and yieldably hold the same in any one of a number of rotary positions defined by the notches in said star wheel, a stud carried by said star wheel, a member rigidly attached to said shaft for rotation therewith, a stud carried by said member, said studs being spaced different radial distances from the axis of said shaft, said last mentioned member having a notch formed therein to accommodate said first stud with a lost motion relationship therebetween in either direction, a torsion spring surrounding said shaft and having substantially parallel arms respectively arranged on opposite sides of said studs, whereby the latter are normally biased into radial alinement with each other, said studs being moved from such relative radial alinement upon rotation of said shaft, whereby the arms of said torsion spring are further separated and said lost motion is taken up to positively move said star wheel, said spring arms being adapted to re-aline said studs in their normal relationship upon movement of the active peak of said star wheel into dead center relationship with said roller member, whereby said star wheel is definitely moved out of said dead center relationship independently of said member.

8. In a drum controller, in combination, a rotatable shaft, a plurality of contacts fixed to said shaft for rotation therewith, a plurality of contact fingers supported in a given relationship to said shaft, a handle fixed to said shaft for effecting rotation thereof, a star wheel supported by said shaft for rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward one or another of its rotary positions, and means including a resilient connection and affording a limited degree of lost motion between said handle and said star wheel for insuring against dead centering of any one of the peaks of said star wheel with respect to said spring based member, the arrangement being such that a predetermined degree of rotation of said shaft in either direction is required to take up said lost motion, whereby to normally enable slow break circuit interruption and slow make circuit completion by said contacts and contact fingers.

9. A drum controller for alternating current circuits comprising, in combination, a rotatable shaft, a plurality of contacts fixed to said shaft for rotation therewith, a plurality of contact fingers supported in a given relationship to said shaft, a handle fixed to said shaft for effecting rotation thereof, a star wheel supported by said shaft for

rotation with respect thereto, a member spring biased into cooperative relationship to said star wheel to bias the latter toward and yieldably hold the same in any one of a number of rotary positions defined by the notches in said star wheel, and means including a resilient connection tending to hold said handle and said star wheel in a given relationship to each other, said means affording a limited degree of lost motion between said handle and said star wheel for insuring against dead centering of any one of the peaks of said star wheel with respect to said spring biased member, whereby a predetermined degree of rotation of said shaft in either direction is required to take up said lost motion to normally enable slow break circuit interruption and slow make circuit completion by said contacts and contact fingers, and said star wheel cooperating with the parts aforementioned in a manner to provide for sequential disengaging and initial engaging movement of said contacts with respect to said contact fingers prior to movement of the active peak of said star wheel into dead center relationship with said spring biased member.

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