April 16, 1929. R. T. KINTZING 1,709,673

REGULATOR

Filed July 19, 1924 2 Sheets-Sheet 1

Fig. 1.

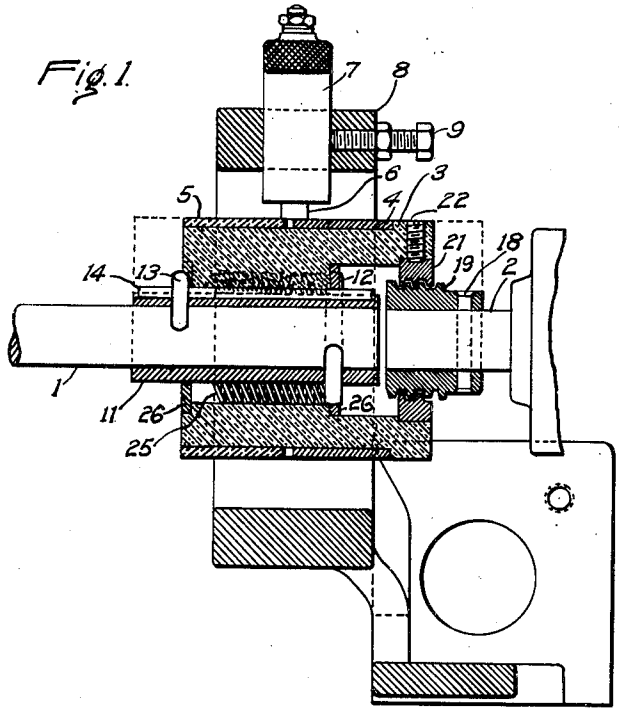


Fig. 3.

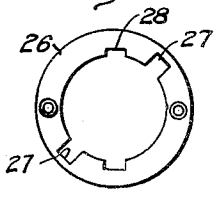
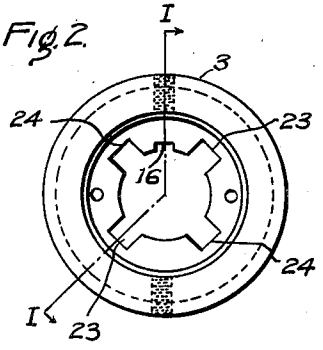


Fig. 2.



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Fig. 6.

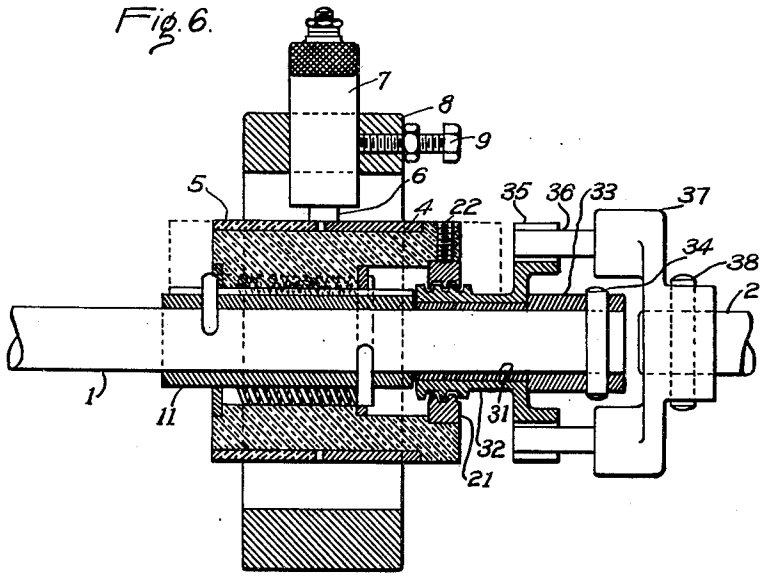


Fig. 5.

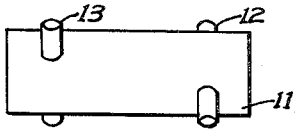
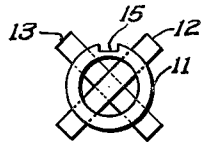


Fig. 4.



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UNITED STATES PATENT OFFICE.

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REGULATOR.

Application filed July 19, 1924. Serial No. 727,099.

My invention relates to rotary contactors for regulators, and more particularly to rotary contactors that are operated in accordance with the differential speeds of two rotating shafts.

My invention has special application to speed regulator systems of the character described and claimed in the application of Stephen A. Staege, for regulator systems, Serial No. 743,578, filed Oct. 14, 1924.

The essentials of such a regulator system comprise a motor, the speed of which is to be regulated, and a master motor or speed-reference means with which the speed of the controlled motor is to be compared. The field-winding circuit of the controlled motor is provided with a resistor, the effective value of which is governed by a rotary contactor comprising a drum that is provided with conducting and non-conducting surface elements, which rotate in contact with a plurality of brushes. Suitable means, differentially responsive to the speed of the controlled motor and the speed of the master motor, is provided to vary the position of the contactor drum with reference to the brushes. This variation in the position of the drum causes the resistor to be short-circuited for a greater or lesser time during each revolution of the drum, and, in this way, varies the effective value of the resistor so as to maintain the proper speed relation between the controlled motor and the master motor.

One object of my invention is to provide means within the contactor drum for biasing the drum toward the center of the operative range of the drum-operating differential mechanism to insure re-engagement of the mechanical differential after it has operated to the limit of its range.

Another object of my invention is to provide a rotary contactor device having means for alining the differentially related shafts operating the same.

Other objects of my invention will appear from the following specification.

Referring to the drawing, forming a part of this specification,

Figure 1 is a sectional view of one embodiment of my invention, taken on the line I—I of Fig. 2;

Fig. 2 is an end view of the contactor drum;

Fig. 3 illustrates a washer that is used on the contactor drum to hold compression members in place;

Fig. 4 is an end view of a bushing that is secured to the shaft and upon which the contactor drum is mounted;

Fig. 5 is a perspective view of the bushing; and

Fig. 6 is a sectional view, illustrating a modification of the arrangement disclosed in Fig. 1 and showing means for alining the shafts operating the differential mechanism.

Referring to Fig. 1, the numeral 1 represents a shaft driven in accordance with the speed of the motor to be regulated, and the numeral 2 represents a shaft driven in accordance with the speed of the master motor with which the speed of the controlled motor is to be compared. The contactor drum 3, which is provided with conducting and non-conducting surface elements 4 and 5, respectively, is mounted upon the shaft 1 to rotate in contact with a plurality of brushes 6, only one being illustrated in the drawing. The brushes 6 are held in place by means of brush holders 7, which are mounted in a ring frame 8 and secured by any suitable means, such as a set screw 9. A bushing 11 (see also Figs. 4 and 5) is provided on the shaft 1 and is secured thereto by means of pins 12 and 13 extending through the shaft at right angles to each other and near the ends of the bushing.

A key 14 is provided to fit tightly in a slot 15 that extends longitudinally of the bushing and also to fit loosely in a slot 16 on the interior of the contactor drum 3, so that the drum may be slidably mounted upon the shaft but will rotate with it. A pin 18, passing through the shaft 2, secures a screw element 19 thereto near one end thereof. The element 19 is provided with screw threads that are adapted to co-operatively engage the interior threads of a nut member 21, which is secured to the drum by means of a set screw 22.

The interior of the contactor drum is provided with longitudinal slots that are arranged diagonally opposite each other, in pairs, as 23—23 and 24—24. Within these slots are provided compression springs 25, which are held in place between two washers 26 and the ends of the pins 12 and 13. The washers 26 (see Fig. 3) are provided with slots 27 to accommodate one of the pins 12 or 13, and a slot 28 to accommodate the key 14. The

washer 26 at the right end of the drum 3 is so attached that the slots 27 are in line with the slots 23 of the drum to accommodate the passage of the pin 12 therethrough. The washer 26 at the left end of the drum 3 is attached so that the slots 27 coincide with the slots 24 of the contactor drum to permit passage therethrough of the pin 13. The two compression springs 25 in slots 23—23 are engaged on the one end by the pin 12, and on the other end by the washer 26 at the left end of the drum.

It will be seen, therefore, that, should the nut and screw members 21 and 19 rotate at different speeds for any length of time, the co-operating threads of these elements would cause the nut to travel either to the right or to the left, until the threads of these two elements no longer engage. In this event, two of the springs 25 would be compressed, forcing the drum toward its central position so that, upon a proper speed relation between the shafts 1 and 2, the screw threads of the nut and screw members 21 and 19 would again engage.

Should the drum 3 be moved toward the right, the spring element 25 in the slots 23—23 of the contactor drum would be compressed against the ends of the abutment or pin 12, while, should the contactor drum be forced toward the left, the spring members 25 in the slots 24—24 would be compressed against the ends of the abutment or pin 13, thus biasing the nut and screw members into engagement. The operative range of the contactor drum 3 is indicated in dotted lines.

In the embodiment of my invention illustrated in Fig. 6, a bushing 31 is provided on the shaft 1, adjacent to the bushing 11. Upon the bushing 31 is mounted a sleeve 32, that is provided with screw threads for engaging the nut member 21 of the contactor drum. The sleeve 32 is prevented from moving toward the left by the bushing 11, and is prevented from moving toward the right by the collar 33, which is attached to the shaft 1 by means of pin 34. The sleeve 32 is provided with coupling sockets 35, which are engaged by pins 36 of the coupling member 37, this member being attached to the shaft 2 by means of a pin 38.

The sleeve 32, being mounted upon the shaft 1, insures an alinement of the sleeve with the drum 3 and a proper meshing of the screw-threaded elements of the mechanical differential. The drum 3 will rotate in accordance with the speed of the shaft 1, while the sleeve 32 will rotate in accordance with the speed of the shaft 2; and, since the sleeve 32 is prevented from sliding lengthwise of the shaft 1, it will co-operate with the drum 3 through the differential mechanism to govern the linear motion thereof in accordance with the differential speeds of the shafts 1 and 2.

Many modifications of my invention may be made within the spirit thereof, and I do not wish to be limited other than by the scope of the appended claims.

I claim as my invention:

1. In a rotary contactor, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon said one shaft, and means for biasing said drum toward a neutral or central zone.

2. In a rotary contactor, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon said one shaft, and means actuated upon movement of said drum from a central position for biasing said drum toward the central position.

3. In a rotary contactor, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, a screw element mounted upon the other of said shafts, a nut element attached to said drum and co-operating with said screw element to control the position of said drum upon its shaft, and means for biasing said drum toward a neutral or central zone to insure re-engagement of said screw and nut elements after overtravel sufficient to disengage these elements.

4. In a rotary contactor, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, a screw element mounted upon the other of said shafts, a nut element attached to said drum and co-operating with said screw element to control the position of said drum upon its shaft, and biasing means mounted within said drum for biasing said drum toward a neutral or central zone to insure re-engagement of said screw and nut elements after overtravel sufficient to disengage these elements.

5. In combination, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon said one shaft, and means within said drum for biasing said drum toward the center of its range of operation upon said shaft.

6. In combination, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith,

contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon its shaft, said drum having a plurality of lineal slots, and means within said slots for biasing said drum toward the center of its range of operation upon said shaft.

7. In combination, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate therewith, contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon its shaft, said drum being provided with longitudinal slots therein, spring members in said slots, means affixed to said shaft for engaging the ends of said spring members, and means affixed to said drum for engaging the opposite ends of said spring members, said several means co-operating to bias said drum toward its central position.

8. In combination, a pair of shafts, a rotatable drum slidably mounted upon one of said shafts and adapted to rotate with said shaft, contacting means actuated by movements of said drum for controlling an electric circuit, means differentially responsive to the speeds of said shafts for varying the position of said drum upon its shaft, said drum being provided with longitudinal slots therein, spring members in said slots, pins passing through said shaft for engaging the ends of said spring members, and means affixed to said drum for engaging the opposite ends of said spring members, whereby certain of said springs bias said drum toward its central position upon its departure in one direction therefrom, and certain other of said springs bias the drum toward its central position upon its departure in the other direction therefrom.

9. In combination, a pair of rotatable shafts, a circuit controlling contactor drum slidably mounted upon one of said shafts and keyed to said shaft to rotate therewith, a screw-threaded sleeve rotatably mounted upon the other shaft, the screw-threaded portion thereof being adapted to engage a screw-threaded portion of said drum, said sleeve being coupled to rotate with the other of said shafts.

10. In combination, a pair of rotatable shafts, a circuit controlling contactor drum slidably mounted upon one of said shafts and keyed to rotate therewith, a sleeve rotatably mounted upon said shaft and coupled to rotate with the other of said shafts, and means differentially responsive to the speeds of said shafts for effecting an endwise movement of said contactor drum.

11. In combination, a pair of rotatable shafts, a circuit controlling contactor drum slidably mounted upon one of said shafts and keyed to rotate therewith, a sleeve rotatably mounted upon said shaft and coupled to rotate with the other of said shafts, means differentially responsive to the speeds of said shafts for effecting an endwise movement of said contactor drum, and means for biasing said drum toward the center of its operative range, said means comprising compression members within said drum, abutments affixed to said shaft for engaging said compression members, and abutments affixed to said drum for engaging said compression members.

12. In combination, a pair of rotatable shafts, a circuit controlling contactor drum slidably mounted upon one of said shafts and keyed to rotate therewith, means differentially responsive to the speeds of said shafts for effecting an endwise movement of said contactor drum, and means for biasing said drum toward the center of its operative range, said means comprising compression members within said drum, abutments affixed to said shaft for engaging said compression members, and abutments affixed to said drum for engaging said compression members.

In testimony whereof, I have hereunto subscribed my name this 7th day of July, 1924.

REESE T. KINTZING.