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ROTATING CONTACTOR RELAY

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Fig. 1.

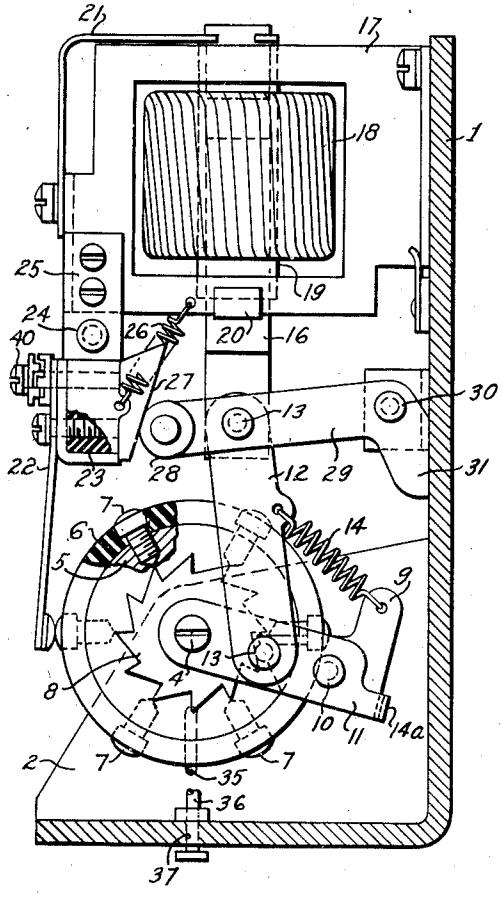


Fig. 2.

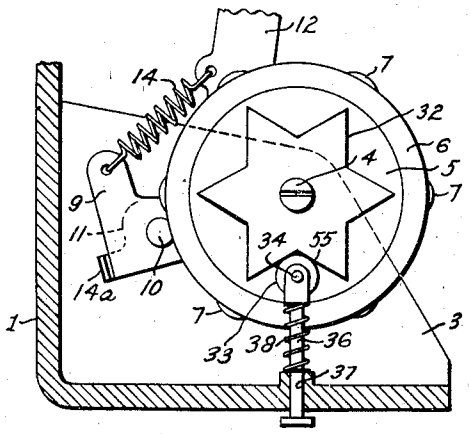
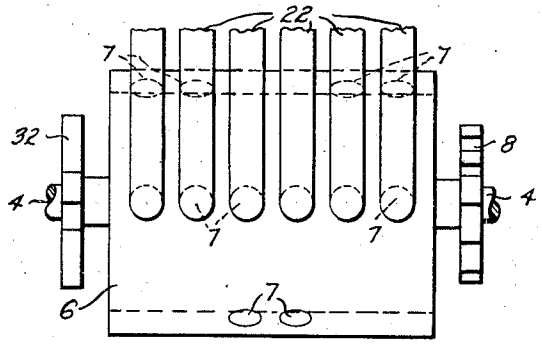


Fig. 3.



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ROTATING CONTACTOR RELAY

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10 Claims. (Cl. 200—105)

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My invention relates to relay-type switching devices whose contact device contains a rotating contact member for the selective or sequential control of circuit connections.

One of the objects of my invention is to provide a contactor of this type which affords controlling a relatively large number of different circuit connections each requiring the actuation of a different group or different number of individual contacts arranged for any desired sequence of operation; and it is also aimed at rendering such a contactor suitable for the remote control of such circuit connections.

Another object of my invention is the provision of a rotating contactor whose contact device lends itself readily to being adapted within wide limits to any desired number, arrangement and sequence of individual contact so that the same device can be used for a large number of different control purposes and control circuits.

Still another object of the invention aims at simplifying the construction and reducing the material and space requirements of relay contactors for controlling a large multiplicity of individual contacts, especially in conjunction with the other objects stated herein.

It is also a purpose of this invention to improve rotating contactors of the type above mentioned to improve the switching operation in mechanical and electrical respects. A more particular object, in the latter aspect, is to ensure a safe interruption or closure of the relay contacts at the proper moment, especially when simultaneously controlling a multiplicity of contact engagements.

A further object, related to the foregoing, is to reduce the friction to be overcome by the relay drive when rotating the rotary contact member, especially if a large number of contacts is to be controlled. A more specific object is to render this friction independent of the contact pressure of the contacts to be controlled so that the pressure may be chosen, adjusted or varied without affecting the relay operation or the energy requirements of the relay drive.

Lastly, this invention also aims at providing a rotary relay contactor for controlling a multiplicity of contacts in which the friction to be overcome by the drive when performing a switching operation, or the energy requirements of the drive, are substantially independent of the selected number of the relay contacts.

In order to achieve these objects, my invention provides a relay for stepwise operation of a rotary contact member in which this contact member has a cylindrical metal core rotatable about its cylinder axis and carries an insulating cover on its peripheral surface. The cover is traversed by contact elements of a chosen number and arrangement which are screwed into or otherwise fastened to the core so that the latter forms a common conductive connection between these elements. A number of contact fingers, brushes or the like conductive parts rest against the cylinder surface so that they engage either the insulating surface of the cover or a number of contact elements depending upon the rotary position of the cylinder member.

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According to another feature of my invention, the stationary contacts or contact fingers which cooperate with the rotating contact member of a relay type switching device as above mentioned are movably mounted so that they can be disengaged from the rotating contact member. A control device or mechanism is provided and so coupled with the drive of the rotating contact member that the stationary contact fingers are disengaged shortly previous to a rotation of the rotary contact member and, preferably, remain disengaged as long as such rotation continues.

In still another aspect of my invention, a cam mechanism is provided for breaking the electric contact between the rotating contact member and the contact fingers cooperating therewith, and this cam mechanism is actuated by an electromagnet which also serves to impart a stepwise rotation to the rotary contact member.

These and other features of my invention and the advantages afforded thereby will be more fully understood from the following description of the embodiment illustrated in the drawing, in which:

Figure 1 is a part sectional side elevation of a rotary contact or relay according to my invention.

Fig. 2 is a partial and part sectional view of the rotary contact element and some appertaining parts seen from below the plane of illustration of Fig. 1, while

Fig. 3 is a partial front view of the rotating contact element and a group of contact fingers cooperating therewith.

The illustrated relay contains a support or frame structure 1 of substantially L-shaped cross section. This structure has two parallel side walls 2 (Fig. 1) and 3 (Fig. 2). A shaft 4 consisting preferably of steel is journalled between the two walls 2 and 3, preferably in insulating bearings (not illustrated). The shaft 4 carries

a cylindric metal core 5 whose peripheral surface is covered by insulating material 6. The cover 6 consists of a Micarta tube which is tightly pressed over the metal cylinder 5. A number of contact elements, denoted by 7, traverse the cover 6 and are fastened to the core 5. In the illustrated embodiment, the contact elements 7 consist of screws which are screwed into the core 5. Thus, the exterior surfaces of the contact elements 7 are all in conductive connection with the core 5 and hence with one another.

Firmly attached to the shaft 4 is a ratchet wheel 8 which is engaged by a pawl 9 pivoted at 10 to a lever 11 which is rotatably mounted on shaft 4 (Fig. 1). A link member 12 is journalled at 13 to the arm 11. A coil spring 14 connects the link 12 with the pawl 9 and tends to rotate the pawl about its pivot 10 in counterclockwise direction relative to the arm 11. This relative rotation is limited by a stop 14*a* formed by the arm 11. When in the inoperative position, arm 11, pawl 9 and link 12 assume the positions relative to one another as shown in Figs. 1 and 2.

The link 12 is pivotally attached at 13 to the plunger type armature 16 of an electromagnet whose magnetic frame 17 is firmly attached to the support 1. The magnet is provided with a solenoid coil 18 whose bore contains a tubular member 19 for guiding the armature 16. The guiding member is atached to the magnetic frame 17 at 20 and also held in position by means of a fastening strap 21 which is likewise secured to the frame 17.

A plurality of contact fingers 22 are mounted on an insulating carrier 23 which is pivoted at 24 to a bracket 25. This bracket is firmly secured to the magnetic frame 17. A spring 26 extending between the frame 17 and the carrier 23 biases the carrier and the contact fingers in the clockwise direction, and hence presses the contact fingers against the rotary contact member, the contact pressure being determined by the selected spring.

The carrier 23 is provided with a cam 27. The cam is engaged by a roller 28 which is mounted on a link 29. A pivot 30 connects the link 29 with the structure 1 so that the axis of the roller 28 is limited to angular motion about the pivot axis at 30. This motion is limited by a stop 31 formed by the link 29. The link is also pivoted, at 13, to the magnet armature 16 and thus limits the downward motion of the armature and of the link 12.

As illustrated in Fig. 2, a star wheel 32 is firmly mounted on the shaft 4 of the rotary contact member. This star wheel is engaged by a roller 33 whose shaft 34 is guided in an elongated slot 35 (Fig. 1) in each plate 2 and 3 so that the roller is capable of guided motion towards and away from the star wheel 32. The roller shaft 34 is mounted on a tappet 36 which passes through an opening 37 in the support 1. Also for the purpose of providing a proper guidance for the reciprocable roller 33, a coiled compression spring 38 is placed on the tappet 36 and serves to press the roller 33 against the star wheel. The elements 36 and 38 are omitted in Fig. 1 in order to render visible the location of the guiding slot 35.

The above described relay operates as follows:

When the solenoid coil 18 is energized by a control current, for instance by remote control, it attracts the armature plunger 16 and moves it in the upward position, thereby entraining the links 29 and 12. The upward motion of roller 28 in coaction with cam 26 turns the carrier 23 in the clockwise direction in opposition to the biasing force of spring 26 and thus removes the contact fingers 22 from the rotary contact member. As a result, the electric contacts previously established between the fingers 22 and the group of contact elements 7 are interrupted before the rotation of the contact member begins. Immediately subsequent to the contact interruption and due to the same upward stroke of the plunger armature, the arm 11 and the pawl 9 are moved counterclockwise. The pawl 11 engages the ratchet wheel 8 and turns this wheel and the rotating contact member until the next group of contacts 7 reaches the operating position. During this motion the roller 33 (Fig. 2) is pushed downwardly by the star wheel 32 and upon surpassing the peak of the adjacent tooth of the star wheel contributes to placing the rotating member into the next operating position. Once this position is reached, it is properly secured by the stopping action of the roller 33.

When now the solenoid coil 18 is deenergized, the plunger armature 16 drops back into the original position. During this return motion the pawl 9 turns clockwise relative to the arm 11 because the stop 14*a* is ineffective as regards this direction of pawl rotation. As a result, the pawl slides ineffectively over the teeth of the ratchet wheel 8 until it reaches the illustrated position of rest. At the end of this return motion, i. e., after the rotating contact member has reached its new position, the cam mechanism permits the carrier 23 and its contact fingers 22 to assume the original position so that the contact fingers establish an engagement with the new group of contacts 7 then placed in the operating position.

As apparent from Fig. 3, each group of contacts extends in parallel to the cylinder axis of the rotary member and may contain any desired number of contact elements 7. The arrangement of these elements relative to the contact fingers 22 is chosen in accordance with the desired sequence and other conditions of operation. That is, the rows or groups of contacts may contain different numbers of contacts and the arrangement of the contacts within each group may also be different from that in other groups. Each of the contact fingers 22 is provided with a contact terminal 40 (Fig. 1). Consequently, when a contact finger 22 engages a contact element 7, its terminal 40 is conductively connected with the core 5 and the other contact elements 7 then in electric engagement with other fingers 22. In this manner, a selected number of chosen circuits is established. This permits the operation of various control circuits or the connection of different measuring instruments in accordance with the desired operation to be performed by the relay. It will also be apparent that one and the same basic construction of the rotatable contact member is applicable for different control purposes, since it is merely necessary to bore holes through the insulating cover 6 and into the core 5 at those places where a contact element 7 is needed. In each operating position those contact fingers which rest on the surface of the insulating cover 6 are ineffective, and only those which find a contact element 7 in this position of the rotary member are inserted into the electric circuit.

Due to the fact that the contact fingers are disengaged from the rotary member previous to the rotation of the latter, a safe interruption of all circuits at the proper moment is ascertained. At the same time the friction to be overcome by

the ratchet mechanism and the drive magnet is reduced to a minimum and rendered independent of the number of contact fingers and also of the number of contact elements in engagement with the contact fingers at the time of the switching operation. By virtue of this fact, the energy requirements of the electromagnet are relatively low and are not affected by the chosen number of contacts. For the same reason, the operation of the relay is uniform during the several switching steps of its cycle even if different numbers of contact elements are in operation in different positions of the rotary member.

In the illustrated embodiment, the shaft **4** may be conductively connected with the core **5** and may then serve as a supply conductor for the contact elements. However, it is also possible to insulate the core **5** from the shaft **4** and all other elements attached to the shaft while employing one or several of the contact fingers **22** for supplying current to the core **5** and the contact elements **7** attached to the core.

It will be understood by those skilled in the art that while I have illustrated a particular ratchet mechanism and a cam mechanism for actuating the rotatable contact member and the contact fingers respectively, other mechanical devices capable of producing or transmitting the desired form of motion may be employed instead. In view of the possibility of such and other modifications within the scope of my invention, I wish this specification to be understood as illustrative and not in a limiting sense.

I claim as my invention:

1. A contactor comprising, in combination, a rotary contact member, a contact assembly normally engaging said member and being movable away from the periphery of said member, drive means for imparting a stepwise rotation to said member, and means controlled in dependence upon said drive means and connected with said assembly for temporarily moving said assembly away from said member so as to disengage said assembly from said member during rotation of the latter.

2. A contactor comprising, in combination, a rotary contact member, a contact assembly normally engaging said member and being movable away from said member in a substantially radial direction relative to said member, a ratchet mechanism for imparting a stepwise rotation to said member, and mechanical transmission means coupled with said mechanism and connected with said assembly for temporarily disengaging said assembly by moving it away from said member during rotation of the latter.

3. A contactor comprising, in combination, a rotary contact member, a bank of contacts normally engaging said member, a holder carrying said bank of contacts and being movable away from said member in a substantially radial direction relative to said member, electromagnetic drive means for imparting a stepwise rotation to said member, and mechanical transmission means coupled with said drive means and connected with said holder for moving said bank of contacts so as to disengage it from said member during rotation of the latter.

4. A contactor comprising, in combination, a movable contact member having a plurality of groups of contacts, a plurality of contact fingers for engaging one of said contact groups at a time, drive means for moving said member to change the group of contacts to be engaged by said fingers, and transmission means controlled in dependence upon the operation of said drive means and connected with said contact fingers for moving said fingers away from the periphery of said member so as to disengage them mechanically from said groups of contacts during the motion of said member.

5. A contactor comprising, in combination, a rotatable cylindric contact member having a plurality of groups of contacts at its peripheral surface, a plurality of contact fingers for engaging one of said contact groups at a time, drive means for rotating said member to change the group of contacts to be engaged by said fingers, and transmission means disposed between said drive means and said contact fingers for moving the latter away from said groups of contacts preparatory to the rotation of said member.

6. A contactor comprising, in combination, a rotary contact member, a contact assembly normally engaging said member and being movable away from the periphery of said member, a mechanism for imparting a stepwise rotation to said member, a mechanism for moving said contact assembly out of engagement with said member, and an electromagnet connected with both said mechanisms so as to disengage said assembly from said member preceding and during the rotation of the latter.

7. A contactor comprising, in combination, a rotatable cylindric contact member having a plurality of groups of contacts at its peripheral surface, a plurality of contact fingers for engaging one of said contact groups at a time, a ratchet mechanism for imparting a stepwise rotation to said member, a cam mechanism for imparting an oscillating motion to said contact fingers towards and away from said peripheral surface, and an electromagnet having an armature linked to both said mechanisms so as to hold said contact fingers away from said surface preparatory to and during the rotation of said member.

8. A contactor comprising, in combination, a frame structure, an electromagnet mounted on said structure and having a reciprocable armature, a ratchet mechanism linked to said armature to be operated thereby, a contact member rotatable relative to said structure and connected with said mechanism to perform stepwise rotation upon actuation of said armature, a carrier pivoted to said structure, a contact mounted on said carrier for normally engaging said member, and a cam mechanism linked to said armature for moving said carrier so as to hold said contact radially away from said member preceding and during a rotation of the latter.

9. A contactor comprising, in combination, a rotary contact member having a metallic core, an insulating cover concentrically disposed on said core and having a plurality of openings, and a plurality of different groups of contacts conductively fastened to said core and projecting through said openings; a movable contact assembly having a plurality of contact fingers arranged for engaging said contact member in order to touch said contacts of one of said groups at a time; drive means for imparting a stepwise rotation to said member to change the group of contacts to be touched by said fingers; and transmission means connecting said drive means with said assembly for moving the latter so as to disengage said fingers from said contact member when rotating said member.

10. A contactor comprising, in combination, a

frame structure, an electromagnet mounted on said structure and having a reciprocable armature, a ratchet mechanism linked to said armature to be operated thereby, a contact member rotatable relative to said structure and connected with said mechanism to perform stepwise rotation upon actuation of said mechanism, said member having elongated cylindric shape and being provided with a plurality of different groups of contacts located at its peripheral surface, each group extending substantially in parallel to the axis of rotation, and an assembly of contact fingers mounted on said structure and normally engaging one of said groups of contacts at a time so that the circuit connections between said member and said assembly are changed upon each actuation of said electromagnet, said assembly being movable away from the periphery of said member, and transmission means connecting

said magnet with said assembly for moving said assembly away from said member during the rotation of said member.

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