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E. M. HEWLETT.

CONTROLLING END PLAY OF ROTARY MACHINES.

(Application filed Aug. 31, 1900.)

(No Model.)

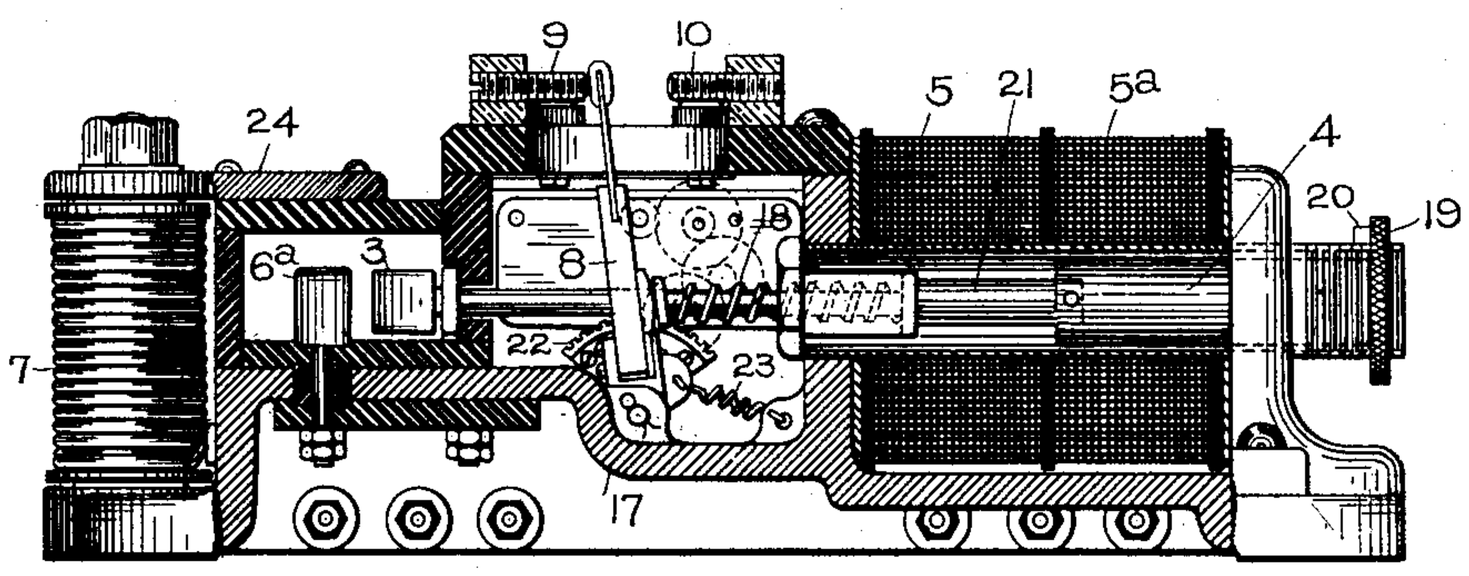

Fig. 1.

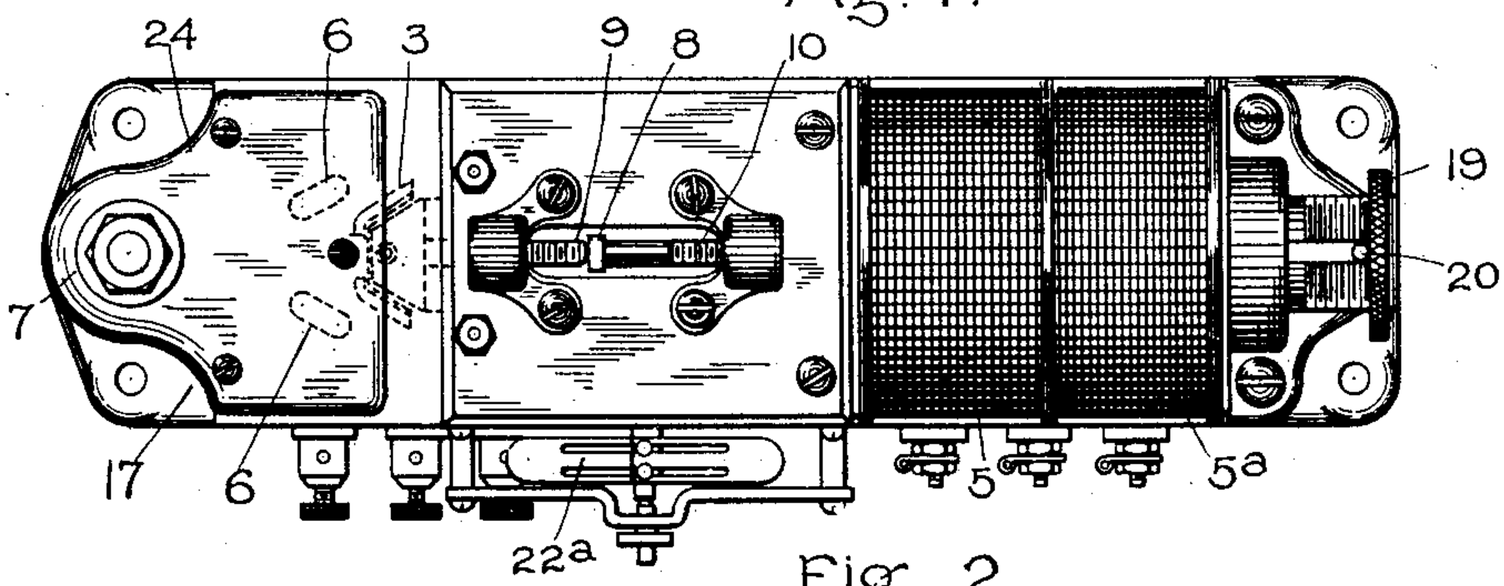

Fig. 2.

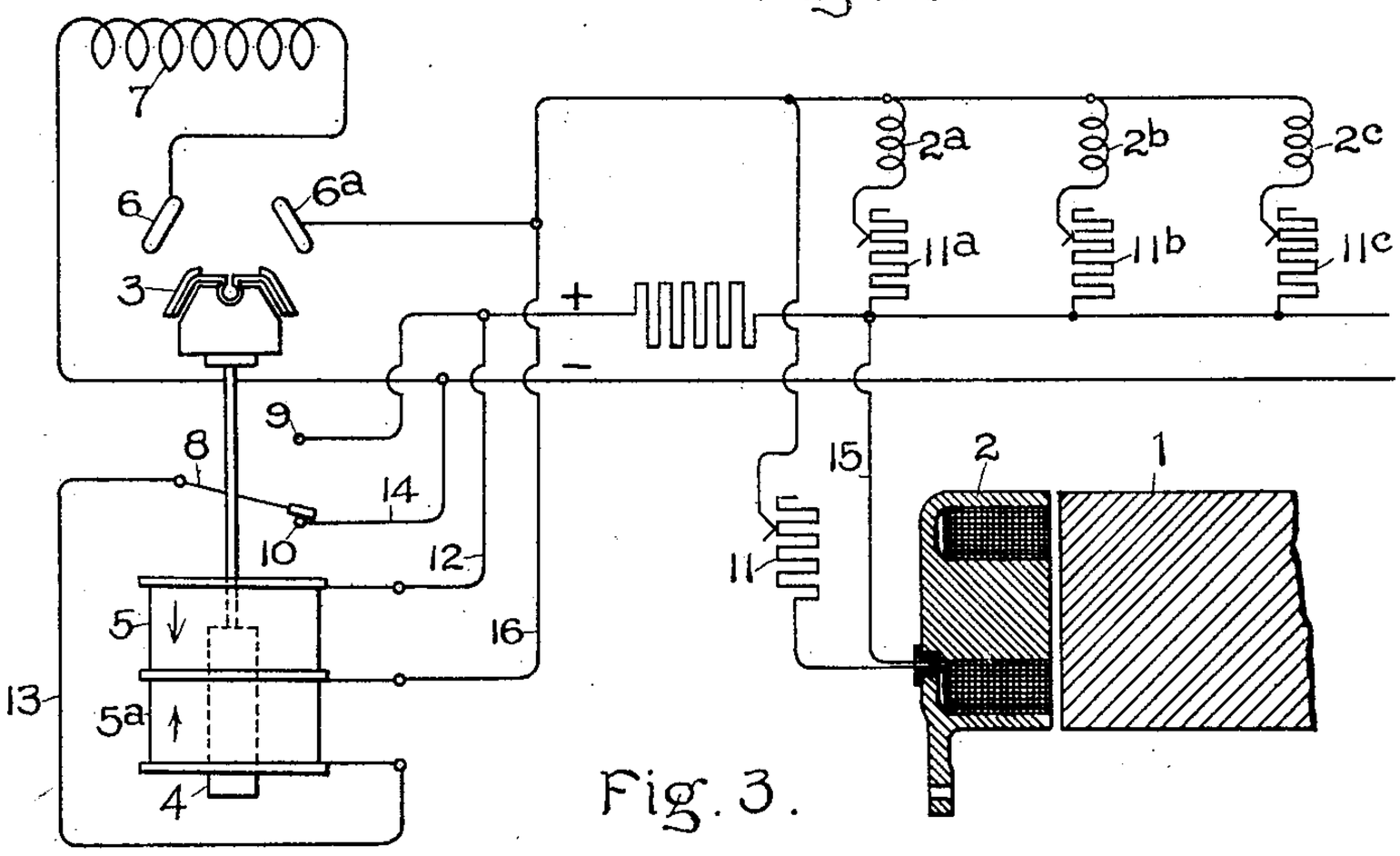

Fig. 3.

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UNITED STATES PATENT OFFICE.

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CONTROLLING END PLAY OF ROTARY MACHINES.

SPECIFICATION forming part of Letters Patent No. 661,049, dated November 6, 1900.

Application filed August 31, 1900. Serial No. 28,651. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Controlling End Play of Rotary Machines, (Case No. 1,050,) of which the following is a specification.

In operating many types of machines where one of the parts is mounted on a revolving shaft it is desirable to control the end play of the shaft and to render it periodic. In such types of machines as dynamo-electric machines, electric motors, or rotary converters it is especially desirable to have the shaft periodic in its lateral motion relatively to the brushes, since where there is no end play a grooving of the commutator results, which interferes with the proper engagement of the brushes and causes sparking and pitting of the commutator-bars. In machines which are belt-driven the shaft is kept in to-and-fro lateral movement by reason of the play of the belt over the pulleys; but in direct-connected machines and in rotary converters the shaft is held in a fixed position with relation to its bearings by the field-magnets, and unless provisions are made to positively secure end play the commutator is worn into a groove. Devices have accordingly been provided for securing a to-and-fro lateral movement of the shafts of such machines. Some of these involve the employment of an electromagnet mounted on a bracket or frame to face the end of the rotary shaft, which is periodically energized by an electric current and imparts a lateral thrust of the shaft, thereby effecting a lateral movement in its bearings, and thus causing the commutator to wear more uniformly over its entire or a large portion of its face; but so far as I know none of these devices were organized so that a proper adjustment of the controlling force could be made to suit the natural period of oscillation of the shaft. My invention involves apparatus for effecting this result on any desired number of machines by a single controlling device, means being provided by which the periods of end play may be adjusted. The period of the shaft is not always the same, as it varies with the strength of the field-magnets, the weight of the parts, and the inclination of the machine.

In carrying out the invention I employ a common exciting-circuit for the several end-play magnets, the closure of which is effected by a timing device which holds the circuit closed for a sufficient interval to permit the shaft to be drawn up to the magnet and then opens it, and after a further determined interval closes it again.

My invention involves an end-play device the controlling force of which is adjusted relatively to the period of the movable part, also a common controlling-circuit for a plurality of end-play devices, and means for closing and opening of the circuit for a determinate period to establish the desired rate of lateral oscillation of the shaft.

It comprises also other features of novelty in the controlling-circuits and features of construction in the controlling mechanism, which will be hereinafter more fully described and will be definitely indicated in the claims.

In the accompanying drawings, illustrating the invention, Figure 1 is a longitudinal sectional elevation of a controlling device for end play. Fig. 2 is a top plan view of the same, and Fig. 3 is a diagram of the controlling-circuits.

Referring first to the diagram, 1 represents a shaft opposite the end of which is mounted an end-play magnet 2, which when energized draws up the shaft. In an electromagnetic device, such as a rotary converter or dynamo-electric machine or motor, the shaft is drawn up, so as to shift it laterally against its magnetic field of force, which when the magnet is deënergized draws it back again. In a machine of other character a control-spring might be used to effect the return of the shaft. The same controlling-circuit may include any desired number of end-play magnets for other machines, as indicated at 2^a 2^b 2^c. The controlling-circuit includes a circuit-closer 3, mounted on the end of a rod secured to an iron core 4 4, controlled by a solenoid 5 5^a, formed of two sections, which may be differentially connected, as will be hereinafter more fully described. Coöperating with the contact 3, which is formed of a number of thin strips of

phosphor-bronze or other good conducting metal, mounted so that its ends can effect an elastic engagement, is a pair of fixed contacts 6 6ª. The contacts 6 6ª are mounted in cooperative relation to a magnetic field established by a coil 7, which acts as a blow-out to extinguish the arc when the circuit is opened. When the core 4 is lifted, it effects a slow movement of a pivoted contact-lever 8, playing between two fixed stops 9 10. The movement of the lever 8 is retarded by a timing device, so that a regular interval of time elapses after leaving its contact 10 before it engages the contact 9. Assuming that the wires plus and minus represent the two leads of a charging-circuit, the minus-wire may be connected with one terminal of the coil 5ª, the other terminal being connected with one end of the coil of the end-play magnet, the other end of the magnet-coil being connected with the positive wire. Where currents of considerable potential are employed, a resistance 11 may be included in the circuit. A similar arrangement of the end-play coils of other machines that may be controlled by the same circuit is made, as indicated at 11ª 11ᵇ 11ᶜ. In shunt to the branch, including the lever 8 and the coil 5ª, is a branch including the contacts 6 6ª and the blow-out coil 7. The coils 5 5ª form a continuous winding, the middle point of which is connected in circuit with the end-play magnet, as already described, and the upper point of which is connected with the positive main by a wire 12. It will thus be seen that when the lever 8 engages the contact 10 a circuit is closed by way of wire 13, lever 8, and wire 14 to the negative main and by way of both coils 5 and 5ª and wire 12 to the positive main, plunger 4 is lifted, and the contacts 6 6ª bridged by elastic contact 3. The circuit is then made through the end-play magnets by way of wire 15, resistance 11, contacts 6 6ª, and blow-out coil 7 to the negative main. The shaft 1 is thereby drawn to the magnet. Simultaneously the upward movement of the core through the instrumentality of the time device is gradually carrying the contact-lever 8 away from contact 10 and after a determinate interval brings it into engagement with contact 9. This establishes a new circuit from the positive main by way of contact 9, lever 8, wire 13, coil 5ª, contacts 6 6ª, and coil 7 back to the negative main, which by its differential action demagnetizes the core 4 and permits it to be thrown by a spring to the position shown in the diagram. During the transit of the lever 8 from contact 10 to contact 9 sufficient energy goes through coil 5 by way of wires 12 16, contacts 6 6ª, and coil 7 to hold the plunger in its forward position until the differential circuit is established by engagement of the lever 8 with contact 9, and during this time the end-play magnet is active in moving the shaft, which requires more than a momentary impulse to shift it.

The mechanical organization by which the movements of the controlling apparatus are governed will be understood from an examination of Figs. 1 and 2, in which the same reference-numbers indicate like parts to those referred to in the diagram. The parts are supported in a cast-iron frame 17. The plunger is retracted by a helical spring 18, the tension of which may be governed by an adjusting-screw 19, mounted on a projecting end of the brass tube in which the core moves and engaging a pin 20, movable along the slot of the tube, as indicated in Fig. 2. Thus the initial tension of the spring 18 may be varied, one end of the spring being fastened to the lever 8 and the other end to a rod 21, connected to the plunger. The rod 8 carries a gear-sector 22, engaging a time-train, as indicated in dotted lines in Fig. 1, the last shaft of which carries an adjustable fly 22, (see Fig. 2,) the two slotted vanes of which may be set so as to vary the speed of the train. With the lever 8 is connected a spring 23 to throw the lever to the right when the magnet is deenergized. Blow-out coil 7 has one extended pole formed by the iron casing and the other formed by a plate of iron 24, a box of indurated fiber open at the ends being mounted between the two poles, in which box are housed the contacts 6 6ª and the movable bridge 3. The parts as thus organized and connected, as indicated in the diagram in Fig. 3, close the circuit through both sections of the solenoid 5 5ª, drawing in the core 4, compressing the spring 18, and pushing against lever 8. The current is sufficiently strong to compress the spring and shift the plunger sufficiently forward to bridge contacts 6 6ª. The time-train permits the lever 8 to be shifted slowly, during which time the solenoid-circuit is held completed as to one section, as hereinbefore described, and during which the shaft is being drawn laterally. When the lever 8 engages contact 9, the position indicated in Fig. 1, a new circuit is made, as hereinbefore described, putting the coils 5 5ª in opposition, thereby releasing the core 4, and the spring 23 is permitted to slowly return the lever 8 to its normal position, during which time the shaft is drawn away from the end-play magnet. Thus the end-play magnets 2 2ª 2ᵇ 2ᶜ of the several machines controlled are periodically energized and deënergized at intervals which may be determined by the adjustment of the fly 22 and the tension of the springs to suit the natural period of oscillation of the shaft, thus producing uniform wear on the commutator. If desired to still more accurately adjust the conditions for different machines, the resistances 11 11ª, &c., may be adjusted in each case to a point where the rate of the circuit-closer and the natural rate of the shaft exactly coincide.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. Means for producing end play of a rubbing-surface with relation to a shaft comprising means for periodically shifting one of the engaging parts at intervals corresponding to its period of natural oscillation.

2. Means for producing end play of a rubbing-surface with relation to a shaft comprising means for laterally shifting one of the engaging parts and means for adjusting the periods of shifting action to maintain the said part in oscillation, thereby effecting uniform wear.

3. Means for producing end play of a rubbing-surface with relation to a shaft comprising means for laterally shifting one of the engaging parts and adjusting devices for timing the shifting action according to the lateral movement of the shaft.

4. Means for producing end play of a rubbing-surface with relation to a shaft comprising means for shifting one of the engaging parts endwise of the shaft, a controlling electric circuit and an adjustable timing device for determining a periodical charging of the circuit with current.

5. Means for producing end play of a rubbing-surface with relation to a shaft comprising an electromagnet for relatively shifting one of the engaging parts, a circuit including the magnet, a circuit-controller, and a time-train governing the period of the circuit-controller.

6. Means for producing end play of a rubbing-surface with relation to a shaft comprising means for laterally shifting one of the engaging parts, and a regulable time-limit-controlling device adapted to effect engagement and disengagement of the shifting device for determinate intervals.

7. Means for producing end play of the shafts of a plurality of machines comprising an end-play magnet on each machine, a common charging-circuit for the magnets of all machines, and a time-limit circuit-controller for the circuit.

8. Means for producing end play of a rubbing-surface with relation to a shaft comprising an end-play magnet, a circuit including the same, a circuit-controller, means for periodically operating the circuit-controller with uniform relation to the lateral excursions of the shaft, and means for retaining the circuit closed to prolong the thrust of the end-play magnet.

9. A time-limit device for electric circuits comprising a magnetically-operated main circuit-controller in a charging-circuit, an auxiliary circuit-closer controlling the same, a time-limit device for opening the auxiliary circuit-closer, and a demagnetizing-circuit, closed by the auxiliary circuit-closer after a determinate interval of time, to open the main circuit-controller.

10. A time-limit device for electric circuits comprising a differential magnet, an armature controlled thereby to govern the circuit, a circuit-closer governing the magnet, a timing device for the circuit-closer adapted to hold the magnet charged for a determinate interval, and a demagnetizing-contact for neutralizing the magnet at the expiration of said interval.

In witness whereof I have hereunto set my hand this 29th day of August, 1900.

EDWARD M. HEWLETT.

Witnesses:

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CAROLYN L. HAYNES.