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ROTARY DRIVING MECHANISM

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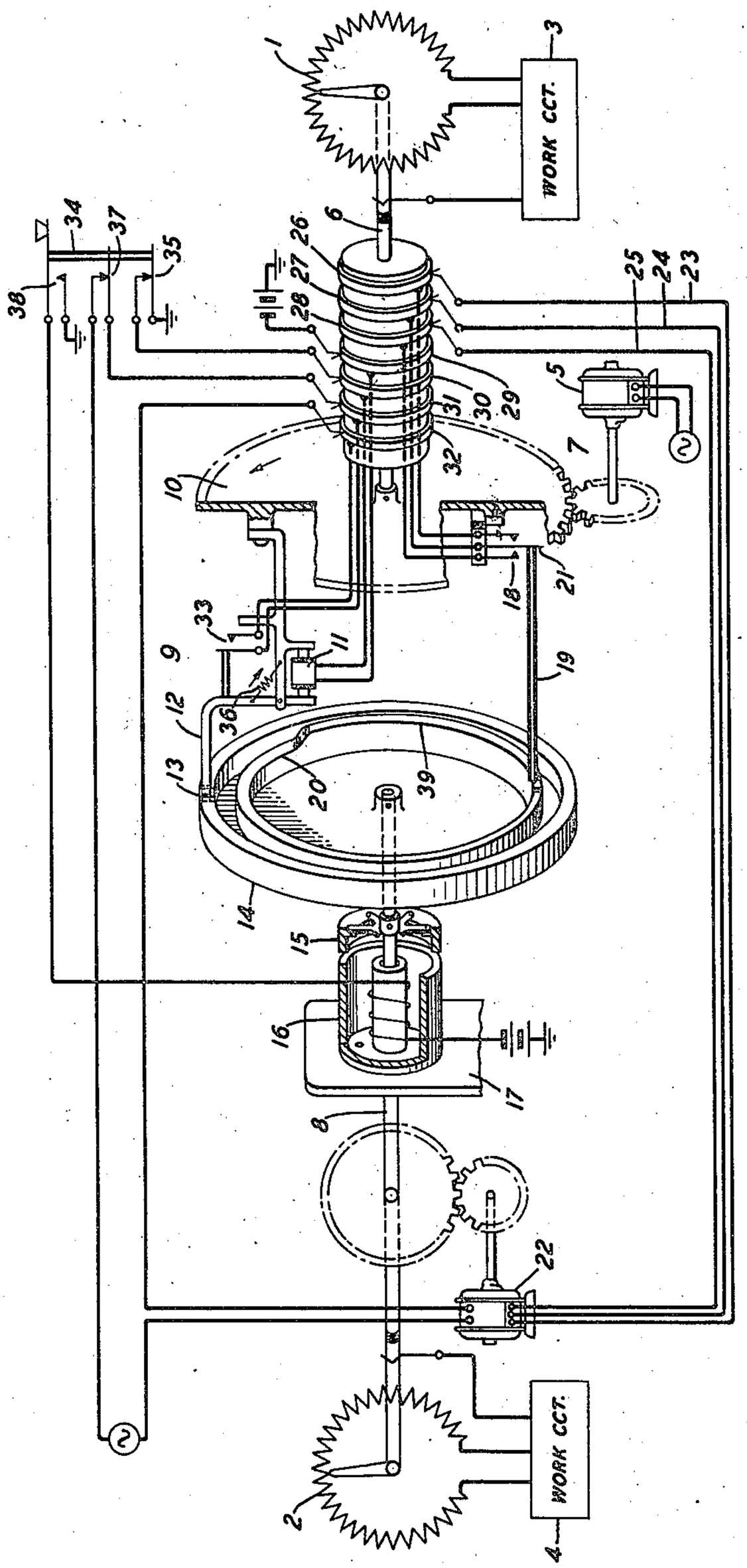

FIG. 1

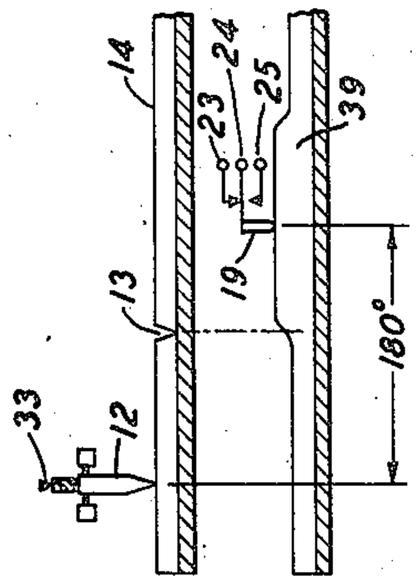

FIG. 2

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ROTARY DRIVING MECHANISM

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This invention relates to rotary driving mechanism and the object of the invention is a decoupling and recoupling means whereby a driven member may be disconnected from its drive and stopped at any instant and then quickly reconnected to the driving member in exactly its original angular relationship with the driving member.

According to the invention, the driven member is connected to the drive in accurately predetermined angular relationship by an electrically controlled latching device and carries an armature which normally rotates freely with respect to stationary magnetic braking means.

The driven member may be brought to rest at any desired instant by operating a control key which releases the latching device and simultaneously energizes the magnetic brake. When the key is released, the brake is deenergized and the driven member is recoupled to the drive by a motor which rotates the driven member in the proper direction to engage it with the latching device with minimum travel. This saving of time in the recoupling operation is effected by means of direction contacts in the motor circuit which are closed selectively in accordance with the angular displacement of the driven member from the predetermined angular relationship.

In the drawing, Fig. 1 is a rotary driving mechanism according to the invention and Fig. 2 is a developed view showing the latching mechanism and the cam which controls the recoupling motor.

The mechanism of this invention may be used for various purposes but in the embodiment shown by way of illustration, the potentiometers 1 and 2 are normally rotated to produce cyclically varying voltages in the work circuits 3 and 4, respectively. The motor 5 drives the shaft 6 directly through suitable reduction gearing 7 and drives the shaft 8 indirectly and intermittently through the latching device 9 rotating with the gear 10. The device 9 comprises an electromagnet 11 having a pivoted armature 12 which is held by magnetic attraction in the position shown with the tapered end of the armature engaging the V notch 13 in ring 14 which is secured to the shaft 8.

The shaft 8 also carries an annular magnetic ring armature 15 and extends to the arm of the potentiometer 2 through a stationary electromagnet 16 mounted on the frame 17 of the apparatus. The gear 10 is provided with a reversing switch 18 which is operated by the cam follower 19 in cooperation with the cam 20 on the shaft 8. The switch 18 is preferably of a type which, when operated to open one contact, automatically closes

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on the other contact to avoid the possibility of the mechanism being stopped with the stator winding open-circuited.

For clarity of illustration, the spacing between the cam 20 and the gear 10 has been greatly increased and it will be understood that in practice the follower 19 would be relatively short and so light as to be easily held in contact with the cam, as for example, by the restoring force of the deflected contact spring 21. Similarly an appreciable spacing is shown between the armature 15 and the body of the electromagnet 16 but in practice when electromagnet is energized, the usual axial motion of the shaft 8 may be practically eliminated by plating the inner face of the armature with chromium to provide a magnetic separator in which case the armature may rotate in contact or on the verge of contact with the body of the magnet as in the structure shown in Patent 2,003,913 to Wente.

The shaft 8 is connected through suitable gearing to a recoupling motor 22 which is of the conventional reversing type with its reversing wires 23, 24, 25 connected through slip rings 26, 27 and 28 on the shaft 6, to the contacts of the switch 18. Similar rings 29 to 32 are provided for the external connections to the latching device 9.

With the apparatus in the condition shown, the motor 5 is driving both potentiometers but the circuit to motor 22 is open at contact 33 of the latching device. When the key 34 is depressed, the breaking of contact 35 opens the energizing circuit of the magnet 11 whereupon the spring 36 retracts the armature 12 from the notch 13 and closes contacts 33. This disconnects the shaft 8 from the motor 5 but the circuit of motor 22 remains open due to the opening of contact 37 on the key 34. The closing of contact 38 on the key energizes the magnet 16 which attracts the armature 15 and arrests the rotation of the potentiometer 2. In apparatus of this type, the potentiometers are usually driven at very low speeds such as one or two revolutions per minute and by proper timing of the operation of the contacts of the key 34, the shaft 8 is stopped almost instantaneously.

When the potentiometer 2 is to be reconnected to the drive, the key 34 is released thereby opening at contact 38 the circuit of the braking magnet 16 and closing at contact 35, the circuit of the latching magnet 11 which forces the armature 12 into sliding contact with the ring 14. In this position of the armature 12 contact 33 remains closed as shown in Fig. 2 and the closing of contact 37 on the key 34 completes the power

supply circuit to the recoupling motor 22. This motor rotates the shaft 8 at a relatively high speed compared with the speed of shaft 6 until the notch 13 in the ring 14 is aligned with the armature 12. The magnet 11 then forces the armature into the notch, the circuit of the motor 22 is opened at contact 33 and the potentiometer 2 is driven by the motor 15 in exactly its former angular relationship with the potentiometer 1.

In order to recouple the shaft 8 to the shaft 6 in the minimum time, the direction of rotation of the shaft 8 during this recoupling operation should be opposite to the direction of rotation of the shaft 6 except when at the instant the key 34 is released, the moving armature has passed but is still relatively near the notch 13 in the then stationary ring 14.

The cam 20 on the shaft 8 is therefore shaped so that the switch 18 is closed to the left to connect conductors 24 and 25 together to give opposite rotation to the shaft 8 during the major part of a revolution of the gear 10 with respect to the cam.

The follower 19 is mounted on the gear 10 diametrically opposite the armature 12 and with shaft 8 in the position shown in Fig. 1. The follower is engaging the cam 20 at a point adjacent the elevated position 39. If when the key 34 is released, the shaft 6 has rotated only slightly beyond the notch 13 as shown in Fig. 2, the follower 19 will be on this elevated portion 39 of the cam, the switch 18 will be closed to the right and the motor 22 will drive to shaft 8 in the same direction as shaft 6 until the notch 13 overtakes the armature 12. However, if, when the key 34 is released, the armature has rotated so far beyond the notch that the follower 19 is contacting the lower portion of the cam, the switch 18 will be closed to the left and the motor 22 will drive the shaft 8 in the clockwise direction (as viewed in Fig. 1) until the notch 13 meets the armature 12. One end of the elevated portion of the cam should be aligned with the notch 13 as shown in Fig. 2 but the proportion of the total circumference of the cam 20 over which the elevated portion 39 extends may, of course, be varied to suit the conditions of the particular case.

In the mechanism shown, the rotor of motor 22 is driven by the shaft 6 when that shaft is connected to the gear 10. If this load is objectionable the shaft of this motor may be provided with a conventional electromagnetic clutch which is engaged only when the shaft 8 is disconnected from the gear 10. This may be effected for example by energizing the clutch through contact 38 of the key 34.

What is claimed is:

1. In a rotary drive, a rotating drive shaft and a driven member capable of rotating together for

an unlimited number of revolutions, a latching device connecting the shaft to the member in predetermined angular relation, magnetic braking means for the driven member, a switch, means operative in one position of the switch at any angular position of the driven member for releasing the latching device and energizing the braking means and restoring means operative in another position of the switch for rotating the member into engagement with the latching device to restore the predetermined angular relation between the shaft and the member.

2. A drive, according to claim 1, having contacts operated in accordance with the angular relationship betwen the shaft and the member for determining the direction of rotation of the restoring means.

3. In a rotary drive, a rotating drive shaft and a driven shaft capable of rotating together for an unlimited number of revolutions, means for coupling the shafts in predetermined angular relation comprising a ring having a notch mounted on one of the shafts and a latching device mounted on the other shaft and engaging the notch in the ring, braking means for the driven shaft, switching means operable at any point in the rotation of the driven shaft to disengage the latching device and energize the braking means to stop the driven shaft, means for driving the driven shaft to reengage the latching device, a control circuit therefor and means operated upon the reengagement of the latching device for disabling the driving means.

4. A drive, according to claim 3, in which the driving means is a motor, in combination with contacts mounted on one of the shafts for reversing the direction of rotation of the driving means, a cam mounted on the other shaft and means cooperating with the cam for selectively operating the contacts to condition the driving means for rotation in one direction when the drive shaft is lagging with respect to the driven shaft and for rotation in the other direction when the drive shaft is leading with respect to the driven shaft.

5. In a rotary drive, a rotating drive shaft, a driven shaft coupled thereto in predetermined angular relationship, a switch means actuated in one position of the switch for decoupling and stopping the driven shaft substantially instantaneously, means actuated in another position of the switch for rotating the driven shaft into the predetermined angular relationship with the drive shaft, and means operated in accordance with the angular displacement of the shafts from the predetermined relationship for determining the direction of rotation of the driven shaft when the switch is moved into said other position.

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