Nov. 11, 1947. C. G. ROPER 2,430,619

CYCLE STOP POWER MECHANISM

Filed Jan. 13, 1942 3 Sheets-Sheet 1

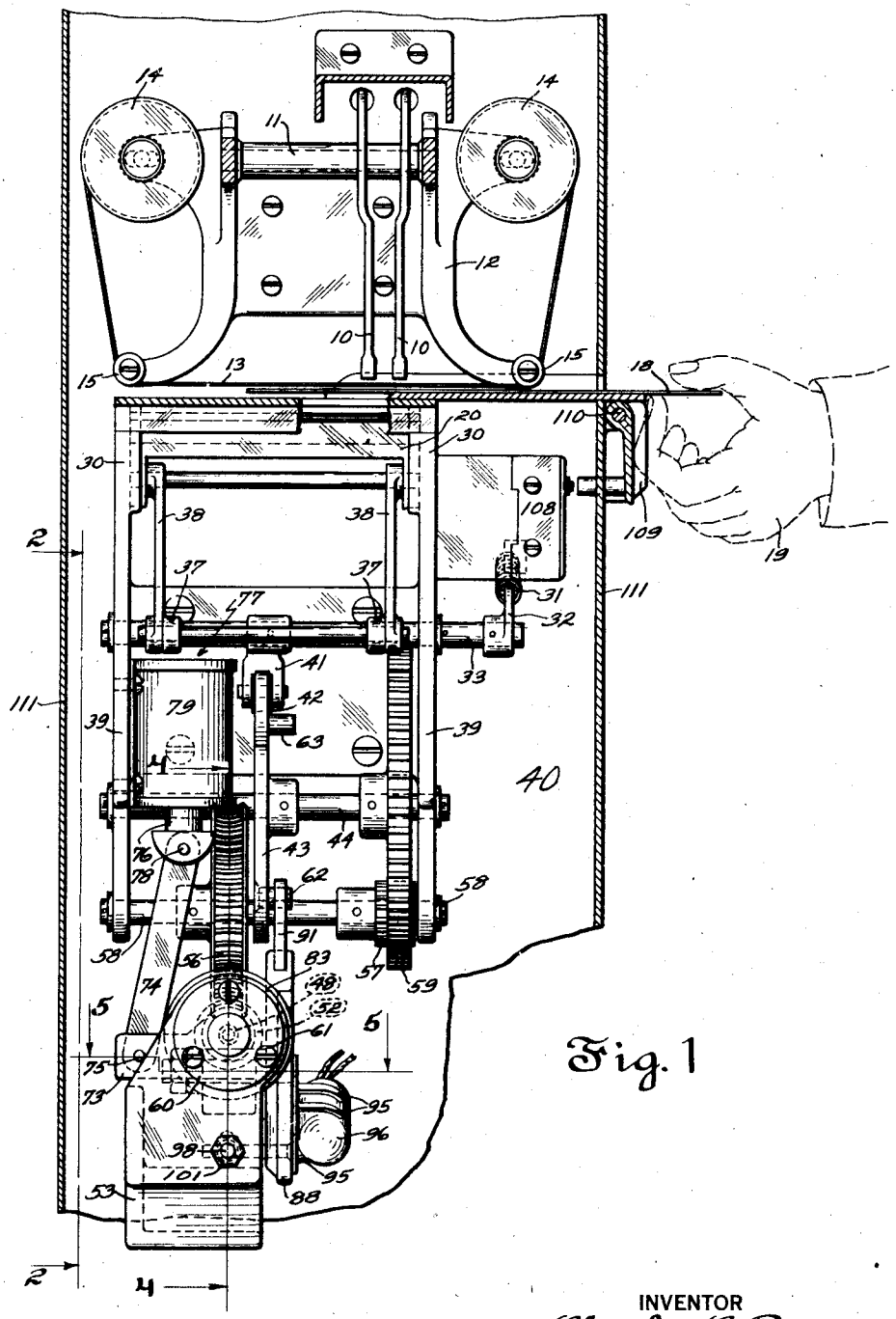

Fig. 1

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Filed Jan. 13, 1942 3 Sheets-Sheet 2

Fig. 3

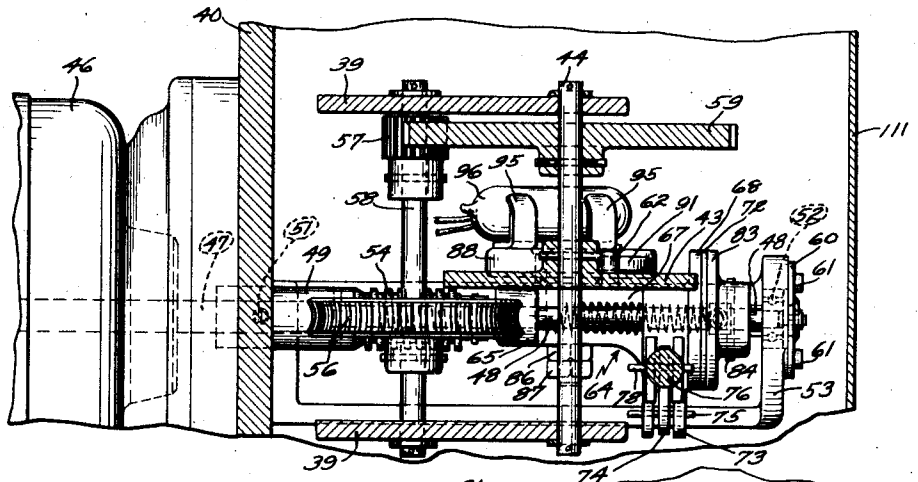
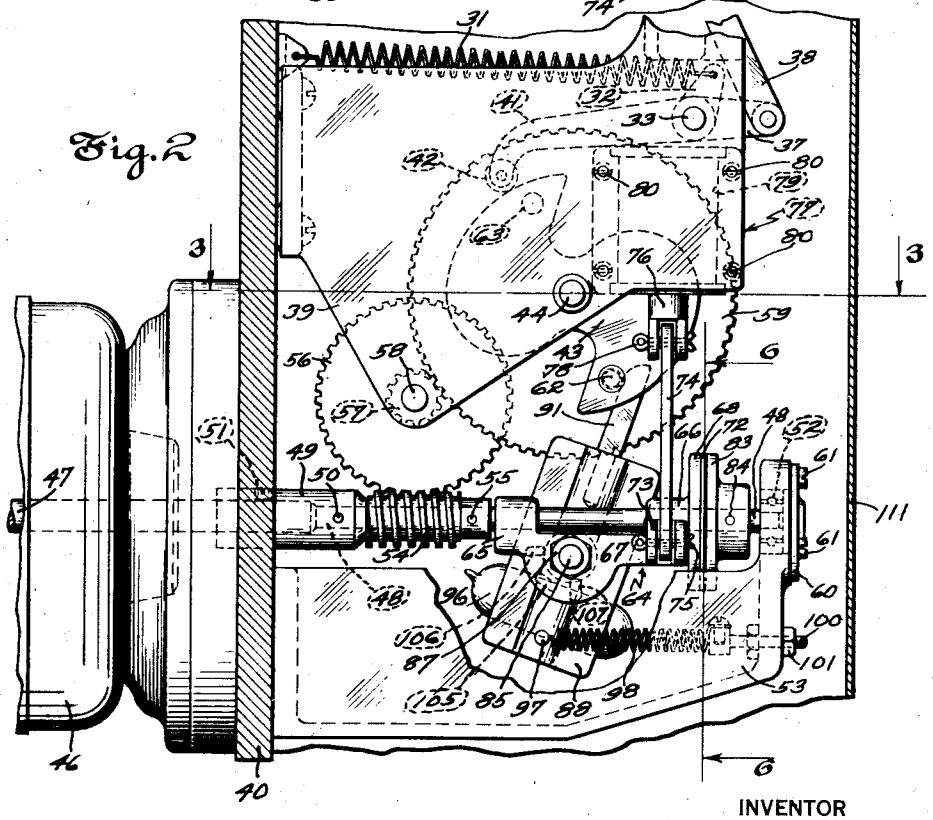


Fig. 2



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Filed Jan. 13, 1942 3 Sheets-Sheet 3

Fig. 6

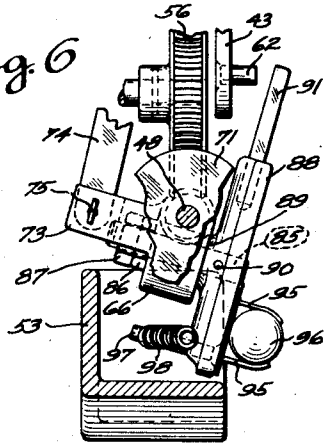

Fig. 4

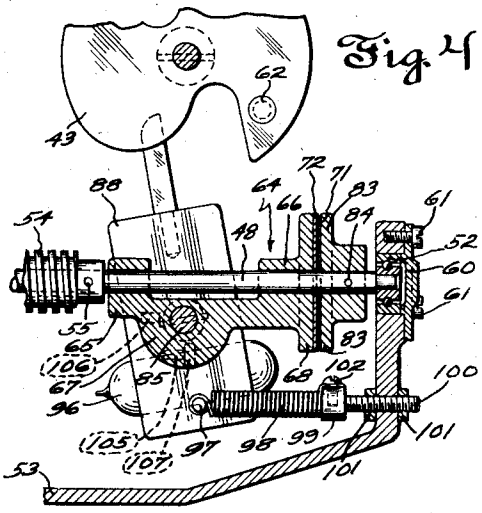

Fig. 5

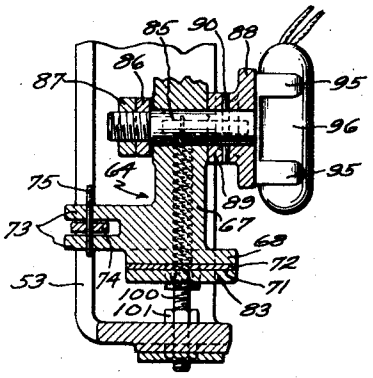

Fig. 7

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2,430,619

CYCLE STOP POWER MECHANISM

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Application January 13, 1942, Serial No. 426,596

15 Claims. (Cl. 192—144)

1

This invention relates to cyclic power stop mechanism serving as an intermittently operating prime mover for causing coordinated action of work performing parts such for example as in a weight recording unit. The invention particularly concerns mechanism for this use designed to be set into action either manually or automatically, and from a remote source of control, and which thereupon becomes operative to complete its cycle of recording action and then automatically terminate such action when recording has been accomplished.

Certain details of the improved constructions and modes of operation of the herein disclosed power stop mechanism may be compared with structures and functions of analogous mechanism disclosed in United States Patent 2,198,139 and copending applications Serial Nos. 259,787, filed March 4, 1939, now United States Patent 2,332,819, dated October 26, 1943, and 350,185, filed August 3, 1940, now United States Patent 2,370,686, dated March 6, 1945. Certain features of construction disclosed but not claimed herein are claimed in one or the other of said copending applications.

One object hereof is to provide an electromechanical cycle stop power mechanism capable of automatically terminating its cycle of recording movement through electrical instrumentalities, particularly through electrical energization of a solenoid adapted to perform mechanical actuation of a current switching device.

A further object is to provide a simple and effective means for checking the coasting movement of the power mechanism after electrical deenergization of its driving motor and before momentum of the coasting parts has carried them beyond a critical stopping point in the designed cycle of their movements.

A further object is to accomplish both a current switching effect and a mechanical braking effect through actuation of a single mechanical part whereby the required power disconnect and self braking mechanism is reduced to a very simple and rugged form involving a minimum number of parts.

A still further object is to swingingly suspend a combined current switching and mechanical braking instrumentality on the shaft of the power motor or on some direct extension of the same for enabling the mechanical brake to act upon the prime mover with maximum mechanical advantage, and further for reducing the number of journal bearings needed for supporting the rotary parts of the mechanism.

2

The above and related objects of the invention will appear in greater detail from the following description of an illustrative embodiment in which reference is had to the accompanying drawings wherein all figures showing parts in section are assumed to be views looking in the direction of the arrows applied to the section planes.

Fig. 1 is a fragmentary view of a complete recording apparatus which as to its parts concerned with weight printing operations may be constructed as shown in fuller detail in the aforesaid U. S. Patent No. 2,198,139 and in my copending application Serial No. 350,185, filed August 3, 1940, now United States Patent 2,370,686, dated March 6, 1945.

Fig. 2 is a view taken partly in section on the plane 2—2 in Fig. 1.

Fig. 3 is a fragmentary plan view taken in section on the plane 3—3 in Fig. 2.

Fig. 4 is a fragmentary view taken in section on the plane 4—4 in Fig. 1.

Fig. 5 is a fragmentary plan view taken in section on the plane 5—5 in Fig. 1.

Fig. 6 is a fragmentary view taken in section on the plane 6—6 in Fig. 2.

Fig. 7 is a diagram of the automatic control system involving the electro mechanical parts of Figs. 1 to 6, inclusive.

It will suffice to mention that the weight printing, or recording apparatus is inclusive of swingable type carrying segments 10 pivotally suspended side by side from a horizontal support shaft 11 whose ends are mounted in a frame head 12 carrying an inked ribbon by means of the spools 14 drawn taut between guide rollers 15.

Under the ribbon 13 a record blank, such as a card or paper strip 18, may be inserted by the hand 19 of the operator so that it rests between the ribbon and an underlying striker platen 20. This platen is vertically reciprocative in frame guides 30 at its ends and at times is shoved upward along said guides to strike an impression on card 18 by the force of extension spring 31 acting thereon through arm 32, shaft 33, and the spaced arms 37 which together with arm 32 are fixed on shaft 33 and coupled to platen 20 by means of links 38. Shaft 33 has bearings at its ends in bracket 39 which is fixedly bolted to the rear upright frame wall 40. Also fast on shaft 33 is a follower arm 41 carrying at its free end the roller 42 which bears against the periphery of the S-shaped cam 43 fixed on cam shaft 44 journaled in frame bracket 39.

Firmly and detachably secured to the rear outside surface of vertical frame wall 40 is an elec-

tric motor 46 whose shaft 47 passes freely through a clearance aperture in said wall and is connected end-to-end in fixed rotative relation to a cycle controlling shaft 48 by means of the rigid coupling sleeve 49 which, as shown in the drawings, is secured to shaft 48 by a pin 50 and is secured to the motor shaft by a set screw 51. The right end of shaft 48 as best shown in Fig. 4 is of reduced diameter and is journaled in a ball bearing 52 lodged in the upstanding terminal of a bearing bracket 53. Like the frame brackets 39, bearing bracket 53 may be detachably mounted on the upright frame wall 40. A cover cap 60 is secured to a bracket 53 by screws 61 and retains the outer race ring of ball bearing 52 against axial outward thrust which may be exerted upon the inner race ring of the ball bearing by an engaging shoulder on shaft 48. Bearing 52 resists such thrust.

Adjacent the coupling sleeve 49, shaft 48 carries a worm 54 whose hub is fixed to the shaft by pin 55. Worm 54 drives the before mentioned cam shaft 44 through the medium of worm wheel 56. Together with a pinion 57, worm wheel 56 is fast to a short shaft 58 journaled in frame brackets 39. Pinion 57 meshes with a large spur gear 59 fast on cam shaft 44.

A cam 43 fast on shaft 44 carries a stud 62 projecting from its side which stud may be duplicated at a diametrically opposite point, as 63, radially equidistant from shaft 44. Cam 43 makes use of one or more such studs as 62 to terminate its own cycle of rotary movement at a predetermined point or points in the cycle, acting for this purpose through the instrumentality of electrical circuit controlling devices with the assistance of a mechanical stop brake that will next be described. Cam 43 and its one or more studs 62 are sometimes referred to herein as a cycle controlling or cycle performing rotor which performs revolving movement in synchronism with the rotation of shaft 48 because of the reduction gearing hereinbefore described.

The circuit controlling device of the present improvements is shiftable by means of the cycle controlling rotor and may be constructed as follows. A carriage in the form of collar structure 64, including spaced hub portions 65 and 66, is free to slide axially in relation to shaft 48 and also loose thereon for rocking movement relative thereto. These hub portions are rigidly joined by a cradle bar 67. The right hub 66 is enlarged in diameter to form a disc-like head 68 which presents a brake face 71 that may or may not be afforded by a separate thin disc of material such as the friction facing 72 shown fast to disc 68. The right hub portion 66 of the collar structure is further provided with a forked lug 73 comprising a short radial crank arm to whose free end is pivotally coupled an actuating link 74 by means of hinge pin 75. Link 74 is likewise pivotally coupled at its top end to core plunger 76 of an electromagnet 77 by means of hinge pin 78. Any or all of these parts may be called shifter parts for effecting and controlling the rocking movements of the collar structure. The solenoid body 79 of electromagnet 77 is detachably mounted on the frame bracket 79 by means of screws 80. In keeping with conventional construction of power stroking solenoids, plunger 76 is provided within the solenoid body 79 with stop means limiting both its upward and downward reciprocative movements relative to said body. Fig. 4 of my aforesaid copending application Serial No. 350,185 shows that an additional frame carried

adjustable stop abutment may if desired be located in the path of swing of crank arm 73 to limit the downward swing thereof to the position shown in Fig. 1 hereof.

Disc head 68 may be referred to as the stationed brake member since it is loose relative to shaft 48 and its rotative movement is limited to a small angular range by the link 74. Opposed to this stationed brake member is a live or running brake member 83 having a flat brake surface engageable on occasions by the flat brake face 71 on the collar structure whose hub is secured to shaft 48 by a pin 84 so that brake member 83 is rigidly fixed on its shaft.

As best shown in Fig. 5, the cradle bar 67 of collar structure 64 carries journaled crosswise thereof a stub shaft 85 retained axially with rotative freedom by thrust nut 86 and lock nut 87. The other end of stub shaft 85 carries an upright rocker plate 88 whose hub 89 is fixedly secured to shaft 85 by pin 90. Rocker plate 88 is therefore free to swing in two directions relative to power shaft 48, one of these directions being about the axis of shaft 48 and the other direction being in a plane parallel to the axis of shaft 48. At its top, rocker plate 88 carries a follower blade 91 which reaches into the path of revolving travel of the cam wheel stud 72. Below stub shaft 85, the rocker plate carries spring clips 95 adapted to receive and detachably hold and support the sealed glass tube 96 of a mercury switch. In a similar location rocker plate 88 carries a spring stud 97 to which is pivotally attached one end of a normally close-coiled extension spring 98 whose other end, as best shown in Fig. 4, abuts solidly against the enlarged head 99 of an abutment screw 100 held rigid with bearing bracket 53 by nuts 101. A screw 102 fixedly anchors the abutting end of spring 98 to the screw head 99. If desired to limit the maximum swinging movement of rocker plate 88 relative to the collar structure 64 a stop lug 105 may be placed on the former with room to move between stop lugs 106 and 107 on the latter.

Referring to Figs. 1 and 7 a manually operated momentary contact switch is indicated at 108 conveniently located to be momentarily closed by pressure of the hand 19 of the operator transmitted thereto through a depending clapper 109 that is hinged at 110 to one of the side walls 111 forming an enclosing casing for the apparatus.

The operation of my improved cycle stop power mechanism will be described in connection with the purpose of printing a record upon the blank card or ticket 18. As shown in Fig. 1, such card is inserted to a proper extent from right to left along a suitably apertured supporting guide and above the vertically movable platen 20 whereupon the knuckle of the operator's hand 19 may swing clapper 109 toward the left in Fig. 1 causing it to press upon the push button of the normally open momentary contact switch 108. This temporarily completes a circuit from supply main 113 to supply main 114 through the winding of solenoid 79 which instantly energizes electromagnet 77 causing its plunger 76 sharply to lift the crank arm 73 and thereby swing collar structure 64 clockwise about the power shaft 48 in Fig. 6 sufficiently to swing blade 91 clear of the cam stud 62.

Prior to this energization of electromagnet 77 the power motor 46 stood idle and deenergized because the circuit therethrough remained broken by mercury tube switch 96, but when blade 91 moves from its full line position in Figs. 1 and 7 to its position shown in Fig. 6 (indicated by

broken lines as 91*a* in Fig. 7) the spring 98 immediately rocks blade 91 and thereby the mercury tube holding plate 88 to their broken line positions 91*b* and 88*b* in Fig. 7 (shown in full lines in Fig. 4). Now the mercury moves within tube 96 to close the switch represented diagrammatically at 96 in Fig. 7 and thereby completes a circuit from supply main 113 through motor 46 to supply main 114. Momentary switch 108 may now be released by the hand of the operator and motor 46 begins its work of rotating cam shaft 44 counterclockwise in Figs. 2 and 4 through the reduction gearing 54, 56, 58 and 59. The self opening of momentary switch 108 will have deenergized electromagnet 77 whereupon the weight of plunger 76, link 74 and crank arm 73 swings collar structure 64 counterclockwise in Fig. 6 and brings blade 91 back into the path of rotation of cam stud 62.

When cam 43 has rotated a short distance, the follower roller 42 will be permitted to drop into the notch in cam 43 whereupon spring 31 turns shaft 33 counterclockwise in Fig. 2 and thereby sharply raises the platen 20 to strike record card 18 which is thereby pressed upward against ribbon 13 backed by type characters on segments 10, 10. Thus a record is printed on the blank 18. Continued rotation of cam 43 gradually withdraws the platen 20 downward against the tension of spring 31 until the parts are restored to their starting positions shown in Fig. 2. This may require a full or partial turn of cam 43 depending upon what degree of rotation of cam shaft 44 constitutes the cycle of automatically terminated action, and upon the number of studs 62.

As cam 43 nears the end of its cycle of action, a cam stud such as 62 or 63 revolves into wiping engagement with the blade 91 swinging both it and the rocker plate 88 back to its position shown in Fig. 2 against the pull of spring 98, whereupon the tilting of mercury tube 96 causes the circuit again to become broken through motor 46.

Simultaneously with the clockwise rocking of switch carrying plate 88 from its position in Fig. 4 to its position in Fig. 2, spring 98 becomes stretched and thereby draws the entire collar structure 64 toward the right in Fig. 4. This presses the brake surface 71 of the disc head 68 against the running brake member 83 which is at this time coasting freely by momentum of the turning parts which have been freed from power of motor 46. When the clockwise rocking of plate 88 has pressed the brake members 68 and 83 firmly together as in Fig. 2, the coasting of the motor shaft 47 and the gears 54, 56, 58 and 59 becomes abruptly checked because of the favorable mechanical leverage exercised by the brake thus acting directly upon the high speed end of the reduction train. All parts are thus finally brought to rest in their original positions shown in Figs. 1, 2 and 3 and in full lines in Fig. 7 until set in action to repeat the cycle of operation.

In Fig. 4, spring 98 is observed to exert no pull tending to press brake member 68 against brake member 83 because lengthwise contraction of the spring has completely closed its coils against each other and the spring as a whole abuts endwise against the head 99 of its anchorage screw 100. Thus no braking effect is exerted upon the motor while the rocker plate 88 is positioned as in Fig. 4.

Various departures from the details of construction and arrangement hereinbefore described are possible within the principles of operation underlying this invention wherefore the following claims will be understood as intended to

cover by their terms all fair equivalents and substitutes for such details as are herein disclosed.

I claim:

1. In cyclic power stop mechanism, the combination of, an electric motor, a shaft powered by said motor to rotate for performing useful work, a cycle controlling rotor connected to revolve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a cycle stop brake operative when applied to oppose rotation of said shaft and mechanically associated both operably and operatively with the said cycle controlling rotor in a manner to be actuated mechanically by movement of the latter and thus operatively applied during a cycle of rotary movement of said rotor.

2. In cyclic power stop mechanism, the combination of, an electric motor, a shaft powered by said motor to perform useful work, a cycle controlling rotor connected to revolve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a running brake member fixed to said shaft, a cooperative brake member carried on and in loose relation to said shaft, means to stay said cooperative brake member against rotation while said shaft is free to rotate, and means to thrust said cooperative brake member axially against said running brake member while the former is stayed thereby to oppose rotation of said shaft.

3. In cyclic power stop mechanism, the combination of, an electric motor, a motor powered shaft, a cycle controlling rotor connected to revolve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a running brake member fixed to said shaft, a cooperative brake member carried on and in loose relation to said shaft, means to stay said cooperative brake member rotatively while said shaft is free to rotate, and means mechanically actuated by said cycle controlling rotor arranged thereby to thrust said loose brake member axially against said running brake member for applying the brake at a predetermined point in the rotation of said rotor.

4. In cyclic power stop mechanism, the combination of, an electric motor, a motor powered shaft, a cycle controlling rotor connected to revolve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a running brake member fixed to the said shaft, a cooperative brake member carried on and in loose relation to said shaft, means to stay said cooperative brake member against rotation while said shaft is free to rotate, a spring connected and arranged yieldably to oppose movement of said cooperative brake member axially of the shaft in a direction away from said running brake member, and a shifter member mechanically actuated by the said cycle controlling rotor in operative association with said spring in a manner to thrust said cooperative brake member against said running brake member with forcefulness limited by the resilient yielding of said spring.

5. In cyclic power stop mechanism, the combination of, an electric motor, a motor powered shaft, a cycle controlling rotor connected to re-

volve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a running brake member fixed on said shaft, a collar structure carried by said shaft and carrying the said circuit controlling device and having a brake surface cooperative with said running brake member, said collar structure being slidably and rotatably loose with respect to said shaft for performing limited axial movement and also limited rocking movement relative thereto, and means to limit said rocking movement of the collar structure while said shaft is free to rotate.

6. In cyclic power stop mechanism, the combination of, an electric motor, a cycle performing shaft rotatable by said motor to perform useful work, a cycle controlling rotor connected to revolve in synchronous relation to the rotation of said shaft, a circuit controlling device shiftable by said rotor and electrically connected to start and stop the running of said motor, a running brake member fixed to said shaft, a collar structure axially and rotatively loose on said shaft having a brake surface adapted to cooperate with said running brake member and carrying said circuit controlling device, and an electromagnetic device electrically responsive to said circuit controlling device mechanically connected to effect a limited oscillatory movement of said collar structure about the axis of said shaft.

7. In cyclic power stop mechanism, the combination of, an electric motor, a shaft rotatable by said motor, a circuit controller electrically connected to govern said motor, a cycle performing rotor impelled by said shaft arranged to actuate said circuit controller at the end of a cycle of mechanism performance, a brake surface fixed to said shaft, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft operative to limit said rocking movement of said collar structure, a brake face on said collar structure engageable on occasions with said brake surface, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor.

8. In cyclic power stop mechanism, the combination of, an electric motor having an armature shaft, a circuit controller electrically connected to govern said motor, a rotor impelled by said shaft arranged to actuate said circuit controller at the end of a designed extent of running of said shaft, a brake surface fixed to said shaft, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft operative to limit said rocking movement of the collar structure in both directions, a brake face on said collar structure engageable on occasions with said brake surface, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor.

9. In cyclic power stop mechanism, the combination of, an electric motor, a shaft rotatable by said motor, a circuit controller electrically connected to govern said motor, a cycle performing rotor impelled by said shaft arranged to actuate said circuit controller at the end of a cycle of mechanism performance, a brake disc fixed on said shaft having a flat face, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft

operative to limit said rocking movement of said collar structure in both directions, a flat brake face on said collar structure engageable on occasions with said flat face of the brake disc, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor.

10. In cyclic power stop mechanism, the combination of, an electric motor having an armature shaft, a circuit controller electrically connected to govern said motor, a rotor impelled by said shaft arranged to actuate said circuit controller at the end of a designed extent of running of said shaft, a brake disc fixed on said shaft having a flat face, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft operative to limit said rocking movement of the collar structure in both directions, a brake face on said collar structure having a flat face engageable on occasions with said flat face of the brake disc, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor.

11. In cyclic power stop mechanism, the combination defined in claim 7, in which the said circuit controller comprises a mercury tube switch, and the said support therefor includes a vertical plate pivotally mounted on said collar structure in a manner to rock relatively thereto about an axis disposed crosswise of the said shaft.

12. In cyclic power stop mechanism, the combination defined in claim 7, in which the said circuit controller comprises a mercury tube switch, and the said support therefor includes a vertical plate pivotally mounted on said collar structure in a manner to rock relatively thereto about an axis disposed crosswise of the said shaft, together with a spring connected to urge said plate unidirectionally about said axis, and cooperative stop shoulders on said plate and the said collar structure respectively acting to limit the former to a predetermined normal position relative to the latter.

13. In cyclic power stop mechanism, the combination of, an electric motor, a shaft rotatable by said motor, a circuit controller electrically connected to govern said motor, a cycle performing rotor impelled by said shaft arranged to actuate said circuit controller at the end of a cycle of mechanism performance, a brake surface fixed to said shaft, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft operative to limit said rocking movement of said collar structure in both directions, a brake face on said collar structure engageable on occasions with said brake surface, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor, said stop means being operative on said collar structure through the medium of the said shifter devices.

14. In cyclic power stop mechanism, the combination of, an electric motor, a shaft rotatable by said motor, a circuit controller electrically connected to govern said motor, a cycle performing rotor impelled by said shaft arranged to actuate said circuit controller at the end of a cycle of mechanism performance, a brake surface fixed to said shaft, a collar structure on said shaft loose for rocking movement relative thereto, stop means

independent of said shaft operative to limit said rocking movement of said collar structure in both directions, a brake face on said collar structure engageable on occasions with said brake surface, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor, said shifter devices including a crank arm projecting from the said collar structure and an actuating link pivotally connected to said crank arm.

15. In cyclic power stop mechanism, the combination of, an electric motor, a shaft rotatable by said motor, a circuit controller electrically connected to govern said motor, a cycle performing rotor impelled by said shaft arranged to actuate said circuit controller at the end of a cycle of mechanism performance, a brake surface fixed to said shaft, a collar structure on said shaft loose for rocking movement relative thereto, stop means independent of said shaft operative to limit said rocking movement of said collar structure in both directions, a brake face on said collar structure engageable on occasions with said brake surface, a support for said circuit controller carried by said collar structure, and shifter devices connected to rock said collar about the axis of said shaft into and out of operative relationship to said rotor, said shifter devices including a crank arm projecting from the said collar structure, a link pivotally connected to said crank arm, and an electromagnet having an armature operatively connected to said link.

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