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TIME CYCLE CONTROLLER

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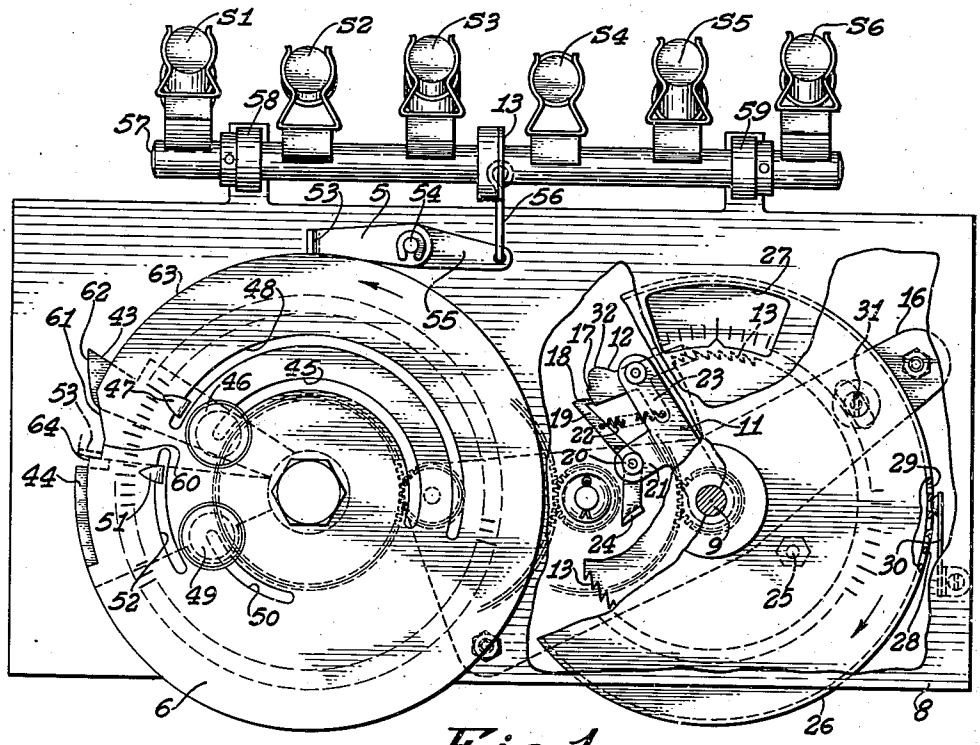

Fig. 1

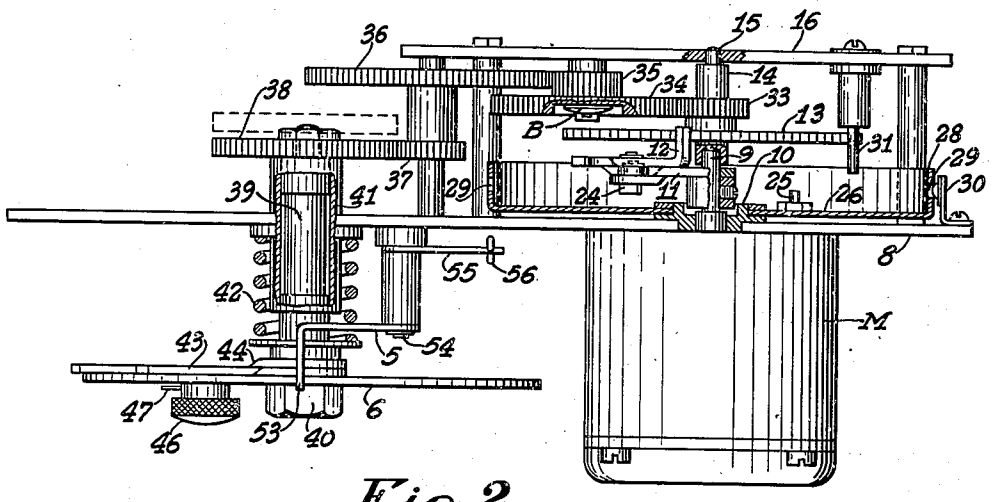

Fig. 2

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TIME CYCLE CONTROLLER

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3 Claims. (Cl. 161—1)

This invention relates to time cycle controllers.

In many industrial processes it is necessary to control the sequence and duration of a series of steps or operations involved therein. In order to effect this result, it is the practice to utilize a device known as a time cycle controller. Since the duration of the various steps or operations vary with different types of products, it is necessary that the controller be readily changeable by a simple adjustment so that the process operations can be quickly varied at will. Such a controller must be reliable in operation since the failure of the controller to establish the predetermined sequence and to measure accurately the duration of the several operations will result in a defective product. Furthermore, the controller should be of simple construction so that it can be easily repaired since it is usually employed in connection with an expensive machine which is disabled if the controller fails.

The main feature of the invention relates to a time cycle controller of simple and effective construction which is relatively inexpensive to manufacture and which will be reliable over a long period of service.

Another feature of the invention relates to a time cycle controller in which the time interval or intervals can be readily changed without disassembling the controller and without the need of adjusting tools.

These and other features of the invention will appear from the detailed description and claims when taken with the drawing in which Fig. 1 is a front elevation of a time cycle controller of the present invention with the enclosing case thereof omitted and with certain parts broken away in order to disclose more clearly the details of construction; and Fig. 2 is a plan view of the controller of Fig. 1 with portions thereof broken away to illustrate more clearly the arrangement of certain parts, the switch shaft and control switches being omitted for the sake of clarity.

The time cycle controller of the present invention includes several operation-determining elements such as circuit-controlling switches S1 to S6 actuated by a cam follower 5 in cooperation with a rotatable timing cam 6 which is driven through a gear train at a selectively variable rate from a fixed speed motor M.

The motor M, although it may be of the spring type, is preferably a synchronous electrical motor such as is used in time clocks. This motor is mounted on the front of the frame plate 8 and has its driving shaft 9 projecting toward the rear of the controller through the dial bushing 10 in the frame plate. On this motor shaft there is secured an arm 11 which has a pawl 12 pivoted on its upper end. This pawl at its right hand end, as viewed in Fig. 1, engages a ratchet wheel 13. The ratchet wheel is secured to a stub shaft 14 having its rear end journaled as at 15 in the rear frame plate 16, the forward end of this shaft being recessed so that it can rotate on the free end of the motor shaft 9 as a bearing. The left end of the pawl 12 is provided with a notch 17 adapted to be engaged by a hook 18 on the upper end of a latch 19 pivoted at 20 on a lug 21 integral with the arm 11. This latch is normally urged in a clockwise direction by a coil spring 22 having one end connected to the upper portion of the latch 19 and having its other end connected to the lower end of an arm 23 integral with and extending downwardly from the pawl 12. The lower end of the latch 19 is provided with an angular extension 24 which travels in a path whereby it periodically engages the pin 25. This pin is fixed on the rear surface of an adjustable dial disk 26 serving to determine the variable rate at which the gear train T is driven by the fixed speed motor M. This dial, which is rotatably mounted at the rear of the frame plate 8 on the dial bushing 10, has its front surface graduated, for observation through the window 27 in the plate 8. The dial is provided with a rearwardly projecting peripheral flange 28. This flange is provided with a series of holes 29 therethrough for engagement with a ball-type lock 30 mounted on the frame plate 8 so that the ball of the lock will enter one of the openings of the flange and thus retain the dial in the position to which it has been rotated during adjustment. It will be understood that the surface of the flange 28 may be knurled, if desired, so that the dial may be manually adjusted. The rear frame plate 16 has adjustably mounted in an arcuate slot therein a forwardly extending fixed pin 31 projecting in the path of the rounded top portion 32 of the pawl 12 so that in the course of the rotation of the pawl, the pin 31 will depress the left hand end of the pawl, that is, move it in a counterclockwise direction until the latch 19 engages the notch 17. In this way the driving pawl will be disengaged from the ratchet wheel 13 during each revolution of the motor shaft and will not be reengaged therewith until the extension 24 on the latch strikes the pin 25 on the adjustable dial 26, whereupon the latch 19 disen-

gages the notch 17 in the pawl. This permits the helical spring 22 to draw the pawl into re-engagement with the ratchet wheel so that it is again driven by the motor during the remainder of a given revolution of the motor shaft.

On the shaft 14 of the ratchet wheel 13 there is secured a pinion 33 which is a part of the gear train including the gears 34, 35, 36, 37 and 38. It should be mentioned that a friction brake is provided to prevent the gear train from "coasting" when the pawl 12 disengages the ratchet wheel 13. Although this brake can be made in various forms it preferably consists of a spring washer B which continuously engages a surface of the gear 34, as best illustrated in Fig. 2. The gear 38 is secured on the rear end of a shaft 39, to the front end of which the timing cam 6 is secured as by a nut 40. This shaft is mounted both for longitudinal and rotary movement in a cylindrical bearing 41 secured on the frame plate 8. A spiral spring 42 surrounding the forward portion of this bearing has its front end engaging the rear of the timing cam 6 and has its other end engaging the front of the frame plate 8. By this construction the cam may be forced rearwardly against the action of the spring 42 to disengage the gear 38 from the pinion 37. When thus disengaged the timing cam 6 may be manually rotated through any desired part of the cycle. However, when the manual pressure is withdrawn from the cam, the spring 42 will return the gear 38 into mesh with the pinion 37. It will be understood that the size of the teeth on the gear 38 and pinion 37 is such that they will readily remesh especially since the pinion 37 is usually rotating at such time.

Since it is desired to provide an even greater degree of flexibility in the adjustment of the controller than can be effected by the adjusting dial 26, sector plates 43 and 44 are adjustably secured to the cam, to change its contour at will. The sector plate 43, the outline of which is shown partially in full and partially in dotted lines in Fig. 1, is rotatably mounted on the shaft 39, being secured to the cam in various positions by any suitable means. However, the present securing arrangement includes an arcuate slot 45 concentric with the shaft 39, through which slot there extends an adjusting screw 46 engaging a threaded opening in the sector plate, so that the plate can be clamped against the rear face of the main cam 6.

In order to indicate at what time in the cycle the high spot of the sector 43 becomes effective, there is provided on the sector an index 47 which projects through an arcuate slot 48 in the timing cam 6 which slot, like the slot 45, is concentric with the shaft 39. The surface of the cam in the path of the index 47 may be provided with suitable graduations indicating units of time or other units of measure, to assist the operator in determining the adjustment of the sector 43.

A sector 44 of the outline indicated in Fig. 1, is also rotatably mounted on the shaft 39 and is clamped to the rear surface of the cam by means of the clamping screw 49 passing through the arcuate slot 50 in cam 6 into the sector. Similarly, an index 51 secured on the front of sector 44 projects through the arcuate slot 52, which slot, like slot 50, is concentric with the shaft 39. It will be understood that the face of the cam in the path of the index 51 is also graduated in certain units of time or the like to assist the operator in adjusting sector 44.

The composite periphery of the cam 6 and the sectors 43 and 44 is engaged by the angular portion 53 of the follower arm 5 which is pivoted at 54 on the frame. As herein illustrated, the rear arm 55 of the follower operates through a link 56 to rock a switch or control shaft 57. This shaft which is supported for rocking motion in the brackets 58 and 59 carried by the frame plate 8, has mounted thereon a series of electrical switches S1 and S6 inclusive, preferably of the mercury bottle type. Since these switches have their principal axes arranged at different inclinations with respect to the axis of the rocking shaft, they operate at different times as this shaft is rocked. These switches may, for example, control the operations of various types of processing machines. It will be understood, however, that instead of using mercury type switches, the follower may actuate a series of pilot or air relay valves, as disclosed in the patent to Foote No. 1,921,741.

At the end of each cycle of the controller, the end portion 53 of the follower is resting on the low point 60 of the cam, as indicated in dotted lines in Fig. 1. When the operator starts the timer in operation by means not shown, the motor M rotates the shaft 9 continuously. Since this shaft carries the arm 11 together with the pawl 12 and the latch 19 mounted thereon, in a clockwise direction, during a part of each revolution of the shaft 9 and the arm 11, the pawl 12 is in engagement with the teeth of the ratchet wheel 13 so that the gear train operates to drive the cam 6. As the rounded part 32 of the pawl passes under the fixed pin 31, the pawl is disengaged from the ratchet wheel and is held disengaged by the latch 19 which engages the notch 18 on the pawl. When this takes place, the gear train T stops. However, in the course of the rotation of the arm 11, the pin 25 on the adjustable dial 26 engages the extension 24 on the latch 19 so that this latch is forced to disengage the notch in the pawl. Thereupon the spring 22 causes the pawl to reengage the ratchet wheel.

Thus, during each revolution of the motor shaft, the ratchet wheel and consequently the gear train driven thereby, stops for a period of adjustable duration. It will be understood that by rotating the dial 26, the length of the stopping period in each cycle can be varied at will within the limits of adjustment.

As the motor M drives the cam 6, the end portion 53 of the follower arm 5 travels up the inclined portion 61 of the cam and up the inclined portion 62 of the sector 43. At it does so, the follower 5 rocks the shaft 57 forward thereby completing the operation of certain of the mercury switches S1 and S6. As the follower drops down to the main periphery 63 of the cam, certain of the switches are completely operated to effect their control in the cycle. Toward the conclusion of the cycle, the end portion 53 of the follower drops to the portion 64 of the periphery of the cam and then eventually to its dotted line position in engagement with the low portion 60 to effect operation of certain others of these switches.

It will be understood that the high point of the cam can be adjusted with respect to the cam plate 6 so that the mercury switches can be rocked to their forward position at any one of various times in the cycle of operation. This adjustment is effected by loosening the clamping screw 46 and thereafter rotating the sector 43 until its index 47 is opposite the graduation on

the cam surface which indicates the desired operation. Similarly the sector 44 can be adjusted by loosening the clamping screw 49 and moving the sector until its index 51 is opposite the graduation indicating the desired setting.

From the foregoing it will be seen that there has been provided a time cycle controller in which a substantially fixed speed motor operates through adjustable means to drive a cam at any desired rate, without the need of change gears or the like.

We claim:

1. A timing mechanism comprising elements to be operated in a predetermined sequence and for predetermined periods, means including a rotatable cam and a follower actuated thereby for operating said elements, means for driving said cam at a predetermined rate, said cam including a disk having an outline of predetermined contour and having an arcuate slot therein concentric with the axis of rotation thereof, a sector plate rotatable about the axis of rotation of said cam, a clamping screw passing through said arcuate slot in said cam for retaining the sector in its adjusted position, said cam having therein a second arcuate slot concentric with said first slot, graduations on said cam along said slot, and an index on said sector projecting through said second slot.

2. In a device of the class described, control mechanism, including a cam and follower cooperating therewith for operating said mechanism, means including a ratchet wheel for driving said cam at any one of several selected rates, an arm mounted for rotation about the axis of rotation of said ratchet wheel, a pawl mounted on said arm in a position to engage said ratchet wheel, means for normally holding said pawl in engagement with said ratchet wheel, a latch on said arm for holding said pawl out of engagement with said ratchet when disengaged therefrom, means mounted in a position to disengage said pawl from said ratchet wheel during each rotation of said arm, means adjustable in an arcuate path and serving to unlatch said latch whereby said pawl reengages said ratchet wheel.

3. In a device of the class described, control mechanism, including a cam and follower cooperating therewith for operating said mechanism, means including a ratchet wheel for driving said cam at any one of several selected rates, an arm mounted for rotation about the axis of rotation of said ratchet wheel, a pawl mounted on said arm in a position to engage said ratchet wheel, spring means for normally holding said pawl in engagement with said ratchet wheel, a latch on said arm for holding said pawl out of engagement with said ratchet when disengaged therefrom, a pin mounted in a position to disengage said pawl from said ratchet wheel during each rotation of said arm, a second pin adjustable in an arcuate path and serving to unlatch said latch whereby said pawl reengages said ratchet wheel.

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