Feb. 23, 1965 H. E. REINECKE 3,170,330

TIMING CONTROLLER

Filed Jan. 19, 1960

Fig. 1.

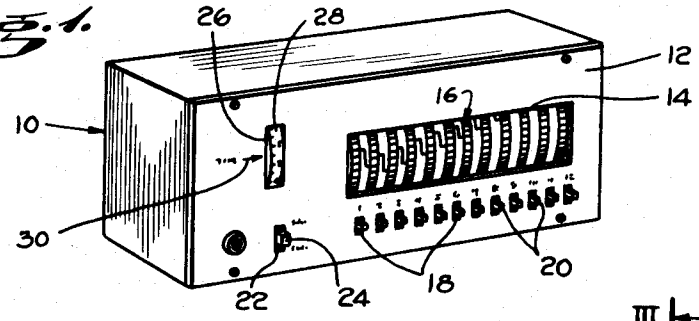


Fig. 2.

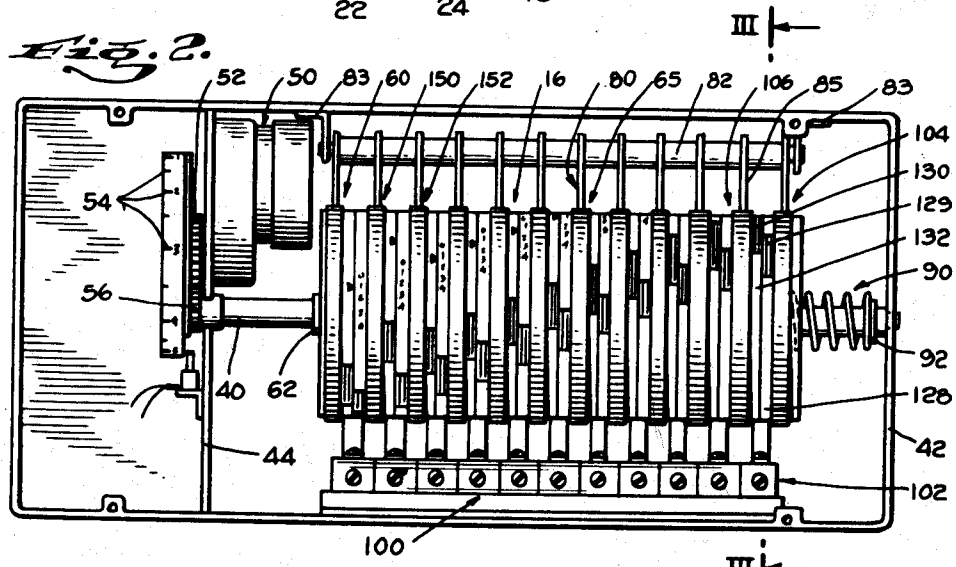


Fig. 4.

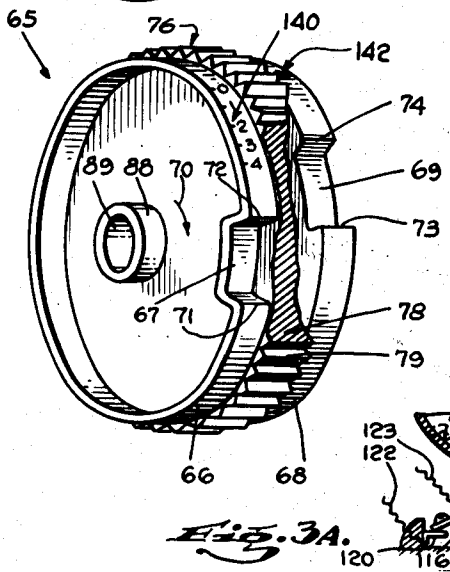


Fig. 3.

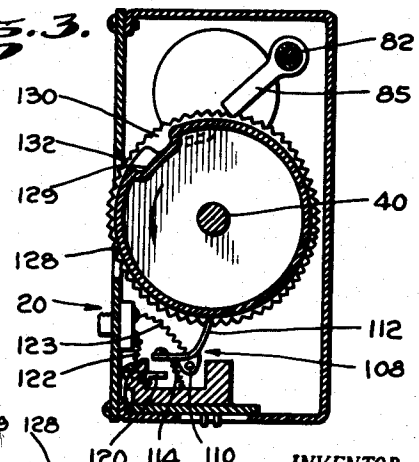
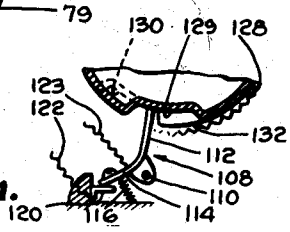


Fig. 3A.



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TIMING CONTROLLER

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This invention relates generally to timing controllers of the type used for sequentially actuating members such as contact elements of electric switches and more particularly describes such an apparatus including a plurality of individually adjustable disk members of novel configuration mounted upon a common shaft, each such disk cooperating with an adjacent disk to cammingly actuate a switch member during operation.

In its preferred embodiment as hereinafter shown and described the invention includes a controller disk provided with a pair of spaced generally cylindrical peripheral camming surfaces, each of the surfaces being interrupted by camming recesses. Typically the two recesses on a single disk are angularly spaced from one another. Each of the recesses is defined by leading and trailing edges and in the preferred form of the invention the angular spacing between the recesses on a single controller disk is such that the trailing edge of one of the recesses is substantially aligned with the leading edge of the other such recess. A number of controller disks of the above type are assembled in an array on a shaft or similar rotatable member and are resiliently biased together in mutually abuttable relation so that an appreciable amount of friction exists between adjacent disks. In this way the user may adjust the disks relative to one another as may be desired by manually moving one disk relative to another against the frictional engagement existing between them.

Desirably the disks are provided with suitable indicia means suitably calibrated for use for a particular application as will be later understood, in order to facilitate setting of adjacent controller disks by the user in accordance with a desired schedule. This permits a selected duration of coincidence of recesses on juxtaposed camming surfaces of adjacent disks with a consequent adjustable duration of cammed actuation of switch members.

In operation the array of controller disks mounted upon the shaft as above described is caused to rotate by suitable motor means, preferably at a very low rate of speed such as one or two revolutions per day, The elements to be actuated by camming engagement with the camming peripheral surfaces of the several controller disks are so arranged that each such element is in slidable contact with juxtaposed peripheral surfaces of a pair of adjacent disks. The geometry of the relationship of the elements to be moved, exemplarily electric switch members, is such that movement occurs to a position different from normal when the recesses of the two juxtaposed peripheral surfaces coincide. The coincidence is bounded by the leading edge of one recess and the trailing edge of the other. In the interval during which such coincidence occurs the actuated element is permitted to move to a certain position and, when such coincidence terminates, the movable element is cammed back into its normal position. In the arrangement wherein the movable element is part of or otherwise actuates an electric switch, it is obvious that the switch may be either normally closed or normally open, as desired for a particular application.

Each of the controller disks is desirably provided with unidirectional clutch means permitting its rotation in only one direction such as a ratchet or the like in order to preclude the possibility of injury to the movable element during setting of the device.

A typical application of the timing controller of the present invention is in the control of a number of sprinkler circuits in a lawn watering system and such use of the device may be referred to occasionally herein although it will be readily apparent that other applications and uses of the device are within the contemplation of the invention.

Accordingly, it is a principal object of the present invention to provide a timing controller having a plurality of disks of novel construction arranged in a rotatable array for actuating movable elements such as electric switches or the like. Another object is to provide in a device of the above character a controller disk having a pair of spaced generally cylindrical peripheral surfaces, each such surface being interrupted by a radially displaced portion, such portions being angularly spaced relative to one another. Still another object is to provide such a disk wherein the displaced portions are recessed. A further object is to disclose in a timing controller of the above character an arrangement whereby a plurality of controller disks are mounted upon a slowly rotatable shaft in an array so arranged so as to be easily selectively adjusted by the user in accordance with a desired schedule.

Other objects and purposes of the invention will be understood from a study of the following description of a preferred embodiment thereof taken in connection with the accompanying drawing in which:

FIG. 1 is a perspective view of a timing controller embodying the present invention mounted in a typical housing.

FIG. 2 is a front elevational view of the device of FIG. 1 with the front cover removed in order to show the internal construction.

FIG. 3 is a sectional view taken on line III—III of FIG. 2.

FIG. 3A is a fragmentary view of the lower part of FIG. 3 at a later moment of time during operation of the present device.

FIG. 4 is a perspective view of one of the controller disks in accordance with the present invention with part broken away for clarity of illustration.

Referring now in detail to the drawing and first to FIG. 1 thereof there is indicated generally at **10** a generally rectangular housing enclosing the apparatus of the present invention and including a front plate or cover **12** having a generally rectangular window **14** extending a substantial portion of the length in order to give access to an array of controller disks projecting slightly through the window, the array being indicated generally at **16**. The front plate **12** is also provided with a plurality of spaced openings **18** near its lower edge through which project a number of switch members **20** which may be desirable for manual control of the individual circuits of the automatically controlled switches if desired. Near the left portion of the cover plate **12** there may be provided an opening **22** for access to a projecting switch handle **24** constituting a master off-on switch for the apparatus. Additionally there may be provided an opening **26** through which projects an hour-dial **28** which may be set to a desired point opposite the arrow **30** by the user when selecting a desired commencing time for actuation of the first switch by the present device.

In FIG. 2 the device is seen with the front cover plate **12** removed. The array **16** of controller disks are mounted upon a shaft **40** which is rotatably journaled at one end in the end wall **42** of the housing and at its other end in an interior partition **44** of the housing.

Means are provided for rotating the shaft **40** at a desired rate of speed. In the present illustration a motor indicated generally at **50** drives a gear **52** at the rate of one revolution per day and the gear **52** in turn is fixed to

the dial 28 bearing hourly indicia 54 thereon. Gear 52 is in mesh with a smaller gear 56 mounted upon the shaft 40 and thus drives the shaft at two revolutions per day. The array 16 of the controller includes an end disk indicated generally at 60 which is fixed by suitable conventional means 62 to the shaft 40. Another disk indicated generally at 65 in the array 16 is seen in enlarged detail in FIG. 4. As will be readily there seen, the controller disk 65 includes a pair of spaced generally cylindrical peripheral camming surfaces 66 and 68 of equal radii, each of these surfaces being interrupted by a displaced portion of different radius 67 and 69 respectively. These portions are here shown as having smaller radii than the remaining portions of the respective cylindrical surfaces 66 and 68 and hence constitute recessed portions relative to such surfaces. The controller disk 65 is assumed to be rotating in the direction indicated by the arrow 70, and accordingly the recess 67 is defined by a leading edge 71 and a trailing edge 72, while the recess 69 is defined by the leading edge 73 and a trailing edge 74. In the preferred embodiment of the invention the two recesses of a disk are staggered so that the trailing edge 72 of one of the recesses is in substantial alignment with the leading edge 73 of the other recess.

Means are desirably provided for preventing reverse rotation of the controller disk 65. In the present embodiment such means include a central serrated section indicated generally at 76, a portion of which is broken away at 78 in order to clarify the construction of the disk and particularly the relationship of the two portions 67 and 69 of different radii from their respective peripheral surfaces 66 and 68. The individual teeth 79 of the serrated portion 76 are engaged by a movable ratchet member 80 which is rotatably suspended from a hanger rod 82 carried by the housing and attached thereto by suitable bracket means 83 above the array 16 of controller disks. Operation of the ratchet member 80 will be readily understood by reference to the corresponding ratchet member 85 seen in FIG. 3, keeping in mind that the disk as seen in FIG. 3 rotates counterclockwise during operation.

Desirably, the controller disk 65 is a unitary body of rigid material such as plastic or the like and in the preferred form is provided with a central hub 88 having a bore 89 therethrough for fitting the shaft 40. The sides of the disk may be recessed in shell-like configuration as indicated to save weight and material so that the peripheral portions having cylindrical surfaces 66 and 68 are actually flanged sections of the body, and the disk is axially bounded by smooth surfaced faces, preferably the axially oppositely directed annular faces of the flanged sections, lying in axially spaced planes normal to the disk axis.

The controller disks of the array 16 are held in assembled relation as seen in FIG. 2 on shaft 40 with an axially bounding face of each of the disks being in frictional abutting contact with an axially bounding face of an adjacent disk or disks. The disks are so retained by resilient means such as a helical spring 90 at the right end of the shaft 40 as seen in FIG. 2, the outer end of the spring 90 abutting against an enlarged collar 92 on the shaft.

Mounted beneath the array 16 of controller disks there is a bank of switches indicated generally at 100, each of the switches being in alignment with the juxtaposed camming surfaces of adjacent controller disks in the array 16. Thus the extreme right switch indicated generally at 102 is in alignment with the juxtaposed camming surfaces of the extreme right controller disk indicated generally at 104 and the next adjacent disk indicated generally at 106. The switch 102, as well as other switches in the bank 100, may be of any desired type such as microswitches or the like, either normally on or normally off, so long as they are of a type which may be actuated by movement of a finger constituting a cam follower. They need not be electrical switches, but could be pneumatic or hydraulic valves for example. In the showing of FIGS. 3 and 3A the switch is shown as including a movable switch member indicated generally at 108 and arranged for pivoted rotation about an axis 110 and provided with a pair of angularly related arms 112 and 114. The switch member 108 is urged in a counter-clockwise direction about the pivotal axis 110 as seen in FIGS. 3 and 3A by suitable resilient means indicated schematically at 116. The forwardly projecting arm 114 is adapted, when in its lower position seen in FIG. 3A, to make electrical contact with a fixed contact member or element 120. Suitable electrical conductors 122 and 123 extend between the switch 102 and the corresponding one of the manual switches 18 carried on the front wall of the housing of the present device, there being a sufficient amount of slack in the conductors 122 and 123 to facilitate connection being made prior to final assembly of the front cover plate 12 with the housing. The exact electrical connections and the necessary circuit elements are not shown in detail herein since such connections and circuitry are well known in the art, are capable of many modifications for particular purposes and form no part of the present invention.

Comparison of FIGS. 3 and 3A will clearly show the camming action which is characteristic of the operation of the present invention. FIG. 3 shows a section through the left hand camming surface 128 of the controller disk 104. Camming surface 128 includes a recess 129 and a similar recess 130 is formed in the non-corresponding camming surface 132 of the adjacent controller disk 106. These two recesses 129 and 130 overlap by a relatively small angular extent as shown. The upper arm 112 of switch 108 constitutes a cam follower riding on the two surfaces 128 and 132. Accordingly the arm 112 is maintained depressed in FIG. 3 and switch contact members 114 and 120 are hence open, while the position of the recesses in FIG. 3A allows the arm 112 to be moved upwardly under the force of spring 116 and the switch contact members 114 and 120 to be closed.

Indicia means are provided on the controller disks to facilitate setting the desired time interval of coincidence of recesses for actuation of switch members. In the present illustrative embodiment the indicia include a scale of spaced numbered lines indicated generally at 140 (see FIG. 4) on the left hand camming surface of each disk and an arrow or similar indicator 142 on the right hand camming surface of each disk. Setting is accomplished by aligning the arrow 142 of one disk with a selected spot along the scale 140 of the adjacent disk to the right. In the scale 140 the digits 0, 1, 2, 3 and 4 indicate the number of quarter hours for which the device is set, but manifestly any other unit of time might be used as desired.

Setting of a desired time interval is easily done. The operator digitally holds one disk immobile by means of the serrations 79 and rotates the adjacent disk, again digitally by means of its serrations 79. It is to be particularly noted that, by reason of the frictional contact between adjacent disks, setting of one pair of adjacent disks does not affect the settings of other pairs of disks. Hence, in a sprinkler system having a plurality of circuits to be energized sequentially, the time interval of one circuit can be adjusted without in any way changing the previously set time intervals and sequence of remaining circuits. Furthermore, with the trailing edge of one recess of a disk aligned with the leading edge of the other recess of the same disk, each circuit will be actuated sequentially with no lost time and no overlapping, so that the sprinkler system is used to its best capacity.

It is to be distinctly understood that, in the interest of clarity and conciseness of presentation, no attempt is here made to show all details of circuitry and the like which might be used in a complete system. The invention defined in the following claims is not limited to any particular circuitry, speed of revolution of the disks or other such parameters as determined by the needs of an individual application. It will be understood that, although the cooperating camming surfaces of adjacent disks have been referred to as juxtaposed herein, some degree of spacing between them is permissible so long as

the finger constituting the cam follower rides on both surfaces.

I claim:

1. In a timing controller, in combination: means rotatably mounting and driving a shaft; a plurality of timing disks rotatably carried on the shaft, each comprising a unitary body provided with a pair of axially spaced camming surfaces fixed relative to one another constituting generally cylindrical surfaces having interrupting recesses formed therein; means for resiliently biasing said disks into adjacent frictional relation; means for imparting shaft rotation to one of the disks; and follower means each resilienly biased into movable contact with both a camming surface of one disk and the non-corresponding camming surface of the adjacent disk.

2. The invention as stated in claim 1 wherein the recesses on each disk are angularly spaced.

3. The invention as stated in claim 2 wherein the leading edge of one recess on a disk is in substantial alignment with the trailing edge of the other recess.

4. The invention as stated in claim 1 wherein said means for imparting shaft rotation to one of the disks includes an additional timing disk fixed to the shaft in adjacent frictional relation with one of said plurality of disks.

5. The invention as stated in claim 4 wherein said additional disk is provided with a camming surface constituting a generally cylindrical surface having an interrupting recess formed therein and including an additional

follower means resiliently biased into movable contact with both said last named camming surface and the adjacent non-corresponding camming surface of the adjacent timing disk.

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