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INTERVAL TIMER

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This application constitutes a continuation-in-part of the Paul A. Martin application, Serial No. 621,681, filed November 13, 1956 and issued November 8, 1960, as Patent No. 2,959,646 for Indexing Interval Timer and assigned to the assignee of the instant invention.

This invention relates to a timer apparatus for sequentially energizing or deenergizing one or more electric circuits. It specifically relates to a sequential controlling mechanism with which the programming of one or more sequentially operated circuits may be relatively adjusted with respect to the programming of another group of sequentially operated circuits. The specific timing apparatus disclosed hereinafter is particularly suitable for controlling the operation of a combination washer-drier in which either or both of the washing and drying operations may be preset to operate over predetermined timed intervals.

The timer mechanism disclosed hereinafter incorporates a motor driven shaft to which one or more cams regulating the washing operation of a combination washer-drier are affixed and to which one or more main cams regulating the drying operation in this combination washer-drier are also affixed. In the disclosed embodiment of this timer mechanism, the main cams regulating the drying operation are provided with secondary cams or cam segments which are revolvably mounted adjacent the main dry cams on the timer drive shaft.

Manual variation of the secondary cams to vary the effective cam profiles of the drying cams thereby adjusting the programming between the wash and dry circuits is achieved by movement of a control lever which rotates the secondary cams relative to the main drier cams through a differential gear mechanism mounted on the timer drive shaft. By coordinating the positioning of the timer cams with appropriate indicia corresponding to the functions controlled by those cams as indicated by the positioning of the control lever and the timer control knob attached to the timer drive shaft, a washer-drier incorporating this invention may be preset to control and indicate the duration of the wash and dry cycles, the starting and stopping points for the machine and the precise stage being performed by the machine as it progresses through its complete fabric treatment operational cycle.

In the accompanying drawing:

FIGURE 1 is an enlarged fragmentary view of a timer forming the basis for the invention of this application;

FIGURE 2 is a view taken along line 2-2 of FIGURE 1; and,

FIGURE 3 is a view taken along line 3-3 of FIGURE 2.

The subject matter forming the basis for the aforementioned Martin application Serial No. 621,681, now Patent No. 2,959,646, is referred to for a more complete description of the basic operation of a timer of this type as used in conjunction with a washer-drier.

A modified construction forming the primary disclosure for the instant invention is shown in FIGURES 1-3. From a comparison of FIGURES 3 of U.S. 2,959,646 and 2 herein it will be apparent that the sole difference in the construction details of the two embodiments shown in these figures resides in the epicyclic differential gear package located between the panel member 15 and the front timer plate 46. The remaining portions of the timer construction, circuitry connected to

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this timer construction and the general overall mode of operation for the embodiment of FIGURES 1-2 are identical to that of the first embodiment in U.S. 2,959,646 so that the same reference numerals will be used in the explanation of this second embodiment wherever possible. The differences in construction and detailed operation will be set forth, however.

Looking now at FIGURE 2, it will be seen that the timer drive shaft 36, through cooperation of flat 63 located on that timer shaft, mounts the sun or drive gear 131 which is maintained in place on shaft 36 by means of the spacer member 84, lock nut 83 and the timer control knob 86.

The sleeve 45 mounting the auxiliary dry cams 54 and 55 is provided with a driven gear 133 which may be affixed to sleeve 45 in any suitable manner. These gears 131 and 133 not only drive the auxiliary dry cams 54 and 55 as well as providing a means for adjusting the angular displacement between auxiliary cams 54 and 55 with respect to the main dry cams 42 and 41, respectively, but also serve, in this embodiment, to regulate the axial positioning of the planetary differential unit of which these gears are a part.

The differential unit also includes a pair of planetary pinions 135 meshing with drive gear 131 and a second pair of planetary pinions 136 meshing with the driven gear 133. These two sets of planetary pinions 135 and 136 are freely revoluble on the cross pins 137 which penetrate the front and rear washer-shaped planetary carriers 138 and 139, respectively, and are provided with enlarged ends to sandwich these confining washers and planetary pinions together.

It will be seen from FIGURE 2 that the central portions of the confining washers 138 and 139 overlap gears 131 and 133, respectively, so as to provide a means for maintaining these pinions in mesh with their respective cooperating gears even though sleeve 45, together with shaft 36, may be moved axially to actuate line switch 95 in response to axial manipulation of control knob 86.

The planetary pinions 135 are encircled by and mesh with a nonrotatable ring gear 141 provided with a pair of diametrically opposed ears 142 which receive in a sliding fit the guide pins 143 attached to the front timer plate 46. This construction allows ring gear 141 to be moved axially without being revoluble.

A second adjustable ring gear member 145 encircles and meshes with the planetary pinions 136. This ring gear is connected to the manually adjustable lever 78 which penetrates panel member 15.

Lever 78, as shown in FIGURE 1, protrudes through back panel member 15 in an arcuate slot 148 positioned above knob 86 and extending slightly over 90° in arcuate extent. Separate dry time setting indicia 149 is located adjacent this slot 148 to indicate the dry time setting positions of lever 78 therefor.

Between the nonrotatable ring gear 141 and the adjustable ring gear 145 is a ring of friction material 151 which is cemented to the nonrotatable ring gear 141 and engages the contiguous face of adjustable ring gear 145. A pair of wave washers 152 adjacent ring gears 141 and 145 bear against the confining washers 138 and 139 to maintain the adjustable ring gear 141 in a frictional contact with the friction material 151 so as to provide a means for positioning these ring gears in a vertical position and maintaining a sufficient contact force on the adjustable ring gear 145 to keep that latter member from rotating during the rotation of timer shaft 36. In spite of the use of friction material 151, however, adjustable lever 78 may be easily moved relative to friction material 151 due to the relatively small frictional forces produced by this sandwich unit. It should be noted that while a pair of wave washers 152 have been used in this illus-

trative unit for symmetrical positioning of ring gears 141 and 145 on their respective engaging gears, other various biasing devices may also be used to restrict rotation of lever 78 without departing from the principle of operation basically disclosed in the accompanying figures.

Now with reference to the presetting and operation of the timer mechanism shown in FIGURES 1-3, it will be noted that the positioning of lever 78 in FIGURE 1 corresponds identically to that setting of lever 78 shown in FIGURE 2 of U.S. 2,959,646. The difference between these two figures is in the location of the setting lever 78 with respect to the dry timer indicia 122. In FIGURE 2 of U.S. 2,959,646, the setting lever 78 may be oscillated throughout an 180° arc immediately adjacent the dry timer portion of indicia 122 whereas in FIGURE 1 the setting lever 78 may be oscillated throughout an arc of approximately 90° adjacent the indicia 149 located above timer control knob 86.

The general setting operation and overall mode of operation between constructions of FIGURE 2 of 2,959,646 and FIGURE 1 is substantially identical. For example, if lever 78 is moved to the 25 minute mark of indicia 149 as indicated in FIGURE 1, the reference arrow 121 will rotate in a clockwise direction until it reaches the 25 minute mark on indicia 122 when the mechanism will automatically shut off exactly as in the embodiment shown in FIGURE 2 of U.S. 2,959,646. Control of the washing operations is identical in both timer constructions.

However, the means by which the auxiliary dry cams 54 and 55 are rotated relative to the main dry cams 42 and 41, respectively, varies somewhat in these two embodiments. This will be apparent from an inspection of FIGURE 3 of U.S. 2,959,646 and FIGURE 2 hereof together with an understanding of the detailed mode of operation of the device illustrated in the latter figure.

During the rotation of timer drive shaft 36, drive gear 131 rotates in the same direction and at the same speed due to its fixed connection to the timer drive shaft 36. Since the ring gear 141 is restrained from rotation, the planetary pinions 135 are forced to roll around the inside of ring gear 141 with their axes of rotation traveling in the same direction as that of drive gear 131 even though the actual direction of rotation of pinions 135 takes place in the opposite direction from that of drive gear 131. This rotates the cross pins 137 in the same direction as timer drive shaft 36 and causes pinions 136 to move in an identical fashion to pinions 135 since the adjustable ring gear 145 is restrained from rotation during this period by means of the friction material 151 pressing against the inside face of adjustable member 145. This causes sleeve 45 to rotate in the same direction and at the same speed as timer drive shaft 36 with the result that no relative rotation takes place between the main dry cams 42 and 41 and their respective adjustable cams 54 and 55.

During the setting operations when lever 78 is moved, for example, from the position shown in FIGURE 1 back to a 15 minute dry time position, the positions of the secondary cams 54 and 55 relative to main dry cams 41 and 42 are identical in both embodiments even though lever 78 would have to be moved only half as far in FIGURE 1 as in FIGURE 10 of U.S. 2,959,646 to achieve this change of dry time setting. This is due to the illustrative gearing ratios selected for the embodiment of FIGURE 2. Assuming gear 131 and 133 to have 24 teeth, pinions 135 and 136 to have 12 teeth and the ring gears 141 and 145 to have 48 teeth, the reason for this angular variance between the two embodiments will be readily understood.

For example, a counterclockwise movement of lever 78 in FIGURE 1 will cause a rotation of planetary pinions 136 about the cross pins 137 since the nonrotatable ring gear 141 and stationary drive gear 131 (since the timer drive shaft 36 is always stationary for all practical pur-

poses during the setting operations) prevents planetary pinions 135 and cross pins 137 from rotating around the axis of the timer drive shaft 36. The rotation of the planetary pinions 136 produces a rotation of the driven gear 133 proportional to the ratio of the number of teeth on the adjustable ring gear 145 to those on driven gear 133. Since this ratio is two to one, it will be seen that a 90° movement of setting lever 78 in FIGURE 1 will produce a 180° movement of the auxiliary cams 54 and 55 about the timer drive shaft 36. By merely compressing the dry time setting scale to a 90° arc, therefore, the same basic operation can be achieved with the device shown in FIGURES 1-3 as in the device illustrated in FIGURES 1-10 of U.S. 2,959,646. It should therefore be apparent that all other remarks pertaining to the circuitry, cam positioning and general operation of the device illustrated in FIGURES 1-10 of U.S. 2,959,646 also apply to the device illustrated in FIGURES 1-3. This includes the means by which the line switch 95 may be opened by axial movement of timer knob 86 since the entire planetary gear package is movable with timer shaft 36 during this presetting operation.

While lever 78 has been directly attached to the adjustable ring gear 145, it should be readily apparent that the dry time setting scale, or indicia 149, as indicated in FIGURE 1, may be expanded to 180° merely by incorporation of a further gear change mechanism between lever 78 and the adjustable ring gear 145. For example, a gear engageable with the periphery of the adjustable ring gear 145 and movable by arcuate movement of a gear segment mounted on lever 78 could be made to produce such a mechanism in case it was desired to eliminate the separate dry time setting indicia 149 and rely entirely upon the dry time portion of indicia 122 for both setting and indicating functions. Such a modification is considered to be an extension of the teaching of the instant invention.

The operation of the machine controlled by this timer mechanism is terminated whenever the reference arrow 121 moves to a position opposite to that portion of the dry time indicia 122 which corresponds to the dry time setting appearing opposite lever 78 in indicia 149.

It will be seen that while a fundamental operation of the devices shown in FIGURES 1-10 of U.S. 2,959,646 and FIGURES 1-3 hereof are basically identical, a much more compact unit is produced in the device shown in FIGURES 1-3. The overall timer assembly is capable of regulating the programming of one or more groups of circuits with respect to the programming of one or more other groups of circuits. While the preferred selection of the stationary or relatively stationary reaction members for the differential gear mechanism is shown in the accompanying drawings, it is within the scope of this invention to select other reaction members to perform the same function of adjusting the relative angularity between the primary and secondary cams controlling the separate groups of control circuits.

I claim:

1. In a timer mechanism having a plurality of coaxially rotatable cam members having predetermined cam profiles thereon for controlling the programmed actuation of switch members, the combination of a first cam means; a second cam means coaxially and rotatably mounted with respect to said first cam means; and a planetary differential means interconnecting said first and second cam means including a drive gear, means operatively connecting said drive gear to said first cam means, a driven gear, means operatively connecting said driven gear to said second cam means, carrier means, a first planetary pinion rotatably mounted on said carrier means and meshing with said drive gear, a second planetary pinion rotatably mounted on said carrier means and meshing with said driven gear, a stationary ring gear meshing with said first planetary pinion, and an adjustable ring gear means meshing with said second planetary pinion whereby said

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rotation of the drive gear provides for rotation of said first and second cam means in unison and angular movement of said adjustable ring gear means changes the angular relationship between said first and second cam means.

2. The invention in accordance with claim 1 further including a panel member, indicia means on said panel member, and said adjustable means being in cooperative relationship with said indicia means for indicating the relative angular relationship between said first and second cam means.

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