

[54] TIME SWITCHING APPARATUS WITH CONTROLLABLE STEP-BY-STEP TIME DURATIONS

[75] Inventor: Walter K. Holzer, Meersburg, Germany

[73] Assignee: Holzer Patent AG, Zug, Switzerland

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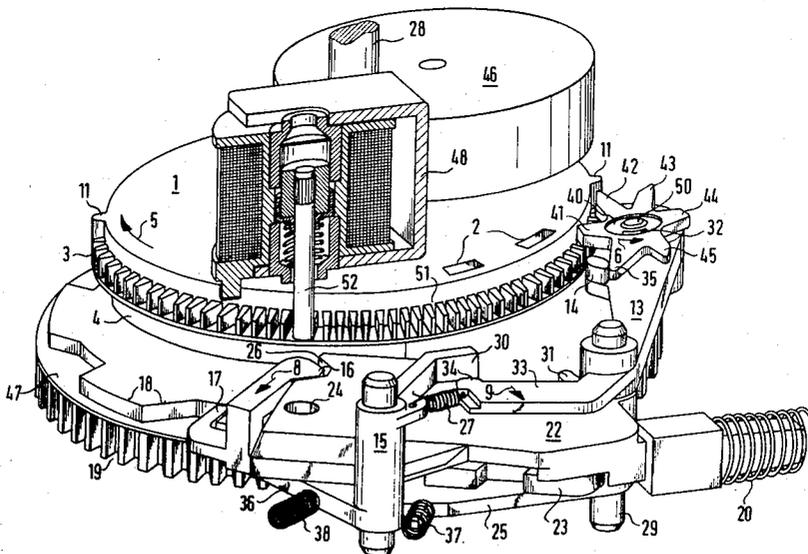
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Primary Examiner—Milton Kaufman  
Attorney—Watson, Cole, Grindle & Watson

[57] ABSTRACT

A tensioned cam surface operates a conveying device and is mounted concentrically with respect to a cammed program disk which carries timing gear teeth scanned by a time lever with which the conveying device can be locked or unlocked. Time metering apparatus is operated by at least one of the timing gear teeth on the continuously revolving cammed program disk and at the end operating position of the conveying device is reversed in direction. The time metering apparatus comprises a counter wheel lever and supported in a counting position by a front surface of the cammed program disk. The release of a cocking lever is simultaneous with a time when one of a number of special timing gear teeth engages with the counter wheel. The cocking lever is actuated by a time metering lever in the time metering apparatus and a locking latch locks the cocking lever in response to a timing cam mounted on the cammed program disk. The tension cam surface is shaped so that the unlocking of the cocking lever by the time metering lever is delayed and that delayed release is variable for any desired length of time either by a magnetically operated locking device or by a variation of the RPM of the main drive of the cammed program disk.

8 Claims, 3 Drawing Figures



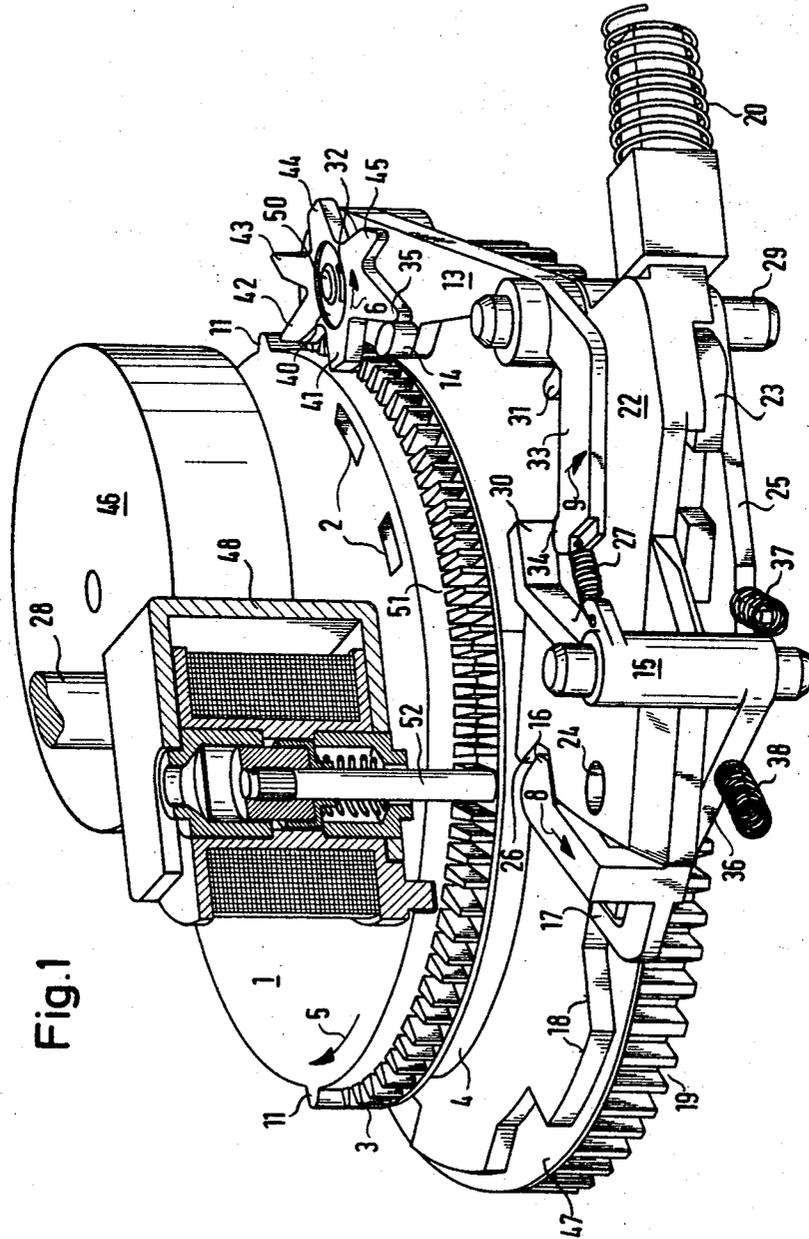


Fig. 1

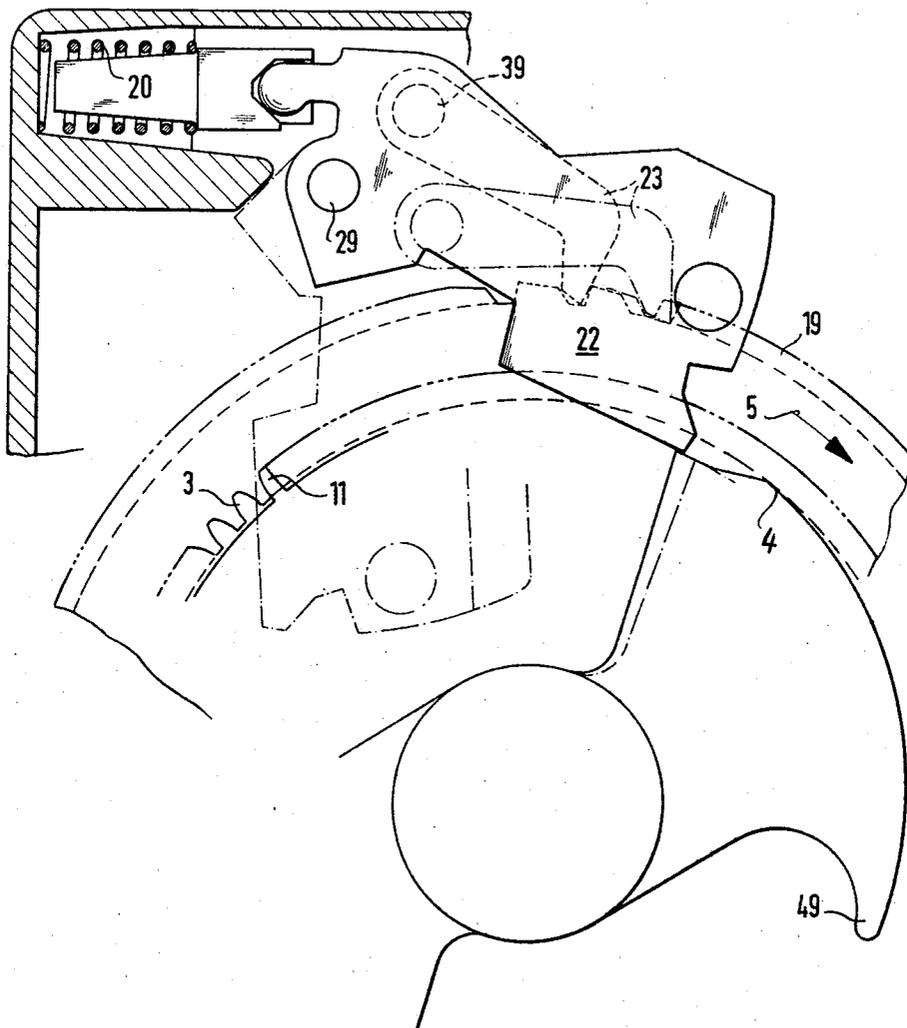
INVENTOR:

WALTER K. HOLZER

BY: *Watson, Cole, Sunde & Winton*



Fig.3



INVENTOR:

WALTER K HOLZER

BY: *Watson, Cole, Grindle & Watson*

## TIME SWITCHING APPARATUS WITH CONTROLLABLE STEP-BY-STEP TIME DURATIONS

This invention relates to apparatus for timing switching operations with controllable step-by-step time deviations for program control devices, and more particularly to such time switching apparatus for the control of washing and dishwashing machines.

Timed switching apparatus of the above mentioned type are well known. Thus, for example, in German Pat. No. 1,260,008 a switching apparatus is described having two gears which can revolve at different speeds around a cam axle and which are of different diameters but have the same number of gear teeth, whereby the larger gear has spaces between the gear teeth positioned at certain intervals to retain a feed latch for engaging both gears simultaneously at certain positions. The disadvantage of such timed switching apparatus is that a relatively considerable complex mechanical means are necessary for obtaining different timed switching operations. A storage of different switching times is possible only to a limited degree with such a gear arrangement. The delay times of such known switching apparatus can be changed only by opening and rearranging the entire device.

It is an object of the invention to provide an improved time switching apparatus with changeable switching times for a variety of different programs, and wherein the sequence of sort and long timing steps is variable over a wide range.

It is a further object of the invention for the type of time switching apparatus described to alter the spaced timing steps by exchanging as few parts as possible.

The previously mentioned objects are obtained according to the invention by a conveying arrangement carrying out steps on a programmed switch at fixed time intervals which is retarded from time to time in dependence on the programmed switch for the purpose of extending the timing operation of the apparatus. A mechanical time metering system driven by a cam disk, which rotates faster than the programmed switch, releases the conveying device after completion of several fixed time intervals.

The timed switching apparatus has various advantages as compared to known time switching apparatus. Thus, it is possible to carry out relatively quite different spaced timing operations step-by-step, whereby the sequence of short and long timing operations can be selected at will in dependence on the desired program. The long timing operations can be changed simply by substituting a counter wheel. The ratio of short and long times can be extended over a wide range, for example, it is possible to select a ratio of 1:7. Another advantage results from the return of the time metering system to zero after every conveying step. Furthermore, the short timing operations can very easily be changed by exchanging a few parts.

A tension cam surface operates an conveying device and is dispersed concentrically with respect to the programming switch which may comprise, for example, a cammed programming disk. The cammed programming disk carries timing gear teeth which can be scanned by a time lever with which the conveying device, such as a cocking lever, can be locked or unlocked. The time metering apparatus is operated by at least one of the timing gear teeth on the continuously

revolving cammed program disk. The time metering apparatus is released to be reversed by the conveying device in its end operating position. The time metering apparatus comprises a counter wheel which has been mounted rotatably on a counter wheel lever and which is supported in its counting position by a front surface on the cammed program. A return spring for the return of the counter wheel is wound up during the time counting process.

The tension cam surface is formed on the cammed program disk in such a way that the release of the cocking lever takes place precisely at the time when one of the special timing gear teeth engages with the counter wheel of the time measuring apparatus. A time metering lever operated by the time metering apparatus activates the cocking lever and a locking latch locks the cocking lever in response to a timing cam mounted on the cammed program disk. The time metering lever, cocking lever and locking latch are mounted on one shaft. The tension cam surface is shaped so that the unblocking of the cocking lever by the time metering layer is delayed. The delayed release of the blocked conveying device is variable for any desired length of time, for example by operation of a magnet which pushes a bolt into a corresponding bore of the cocking lever to prevent it from moving. The short time can be modified by corresponding alteration of the main drive disk and its r.p.m. to accommodate widely different program sequences.

The invention will be explained on the basis of an embodiment by way of example and with the help of the drawings, wherein:

FIG. 1 shows a perspective view of the switching apparatus,

FIG. 2 is a detailed top view of the switching apparatus with a cocked counter wheel,

FIG. 3 shows an additional top view of the switching apparatus illustrating a detail of the step-by-step conveying apparatus.

The invention is described on the basis of a program control device for washing machines with the individual elements characteristic for such a control device. It is to be understood that the timed switching apparatus may also be used in other program control apparatus, for example in the case of the control of dishwashing machines, automatic machine tools, etc.

Control devices for washing machines essentially contain an arrangement for the control of reversing process of the washing drum and an arrangement for the control of the overall program. Naturally, the spaced timing of the step-by-step reversing controls are essentially shorter according to the continuous change of rotational direction of the washing drum than the spaced timing of the step-by-step controls which occur in carrying out the overall program. The means which produce the short switching times for the reversing operation are utilized for producing various spaced timing of the step-by-step operation of the entire program. The longer spaced timing operations are developed by addition of several shorter spaced timing operations or by addition of several integral fractional parts of the shorter spaced timing operations.

A driving wheel 46 (FIG. 1) drives reversing cam disk 1 with gear teeth 3 in the direction of arrow 5. Naturally, instead of reversing cam disk 1, some other

mechanism, for example, a control disk provided with grooves, can also be used. A carrier for the program cams, for example, a cammed and toothed program disk 47, is rotated step-by-step by the engagement of gear teeth 19 with conveying latch 23. Conveying latch 23, together with cocking lever 22, constitutes a toggle lever joint. Cocking lever 22 is cocked by a tension cam surface on cam disk 1 in opposition to the force of compression spring 20. The configuration of cocking lever 22 and conveying latch 23 is best illustrated in FIG. 3. If tension cam surface 4 moves from the position shown in the direction of arrow 5, then cocking lever 22, mounted rotatably on shaft 29, can move promptly under the pressure of spring 20 into the position indicated by a dashdot line. Through this movement conveying latch 23, mounted rotatably on cocking lever 22 on shaft 39, will advance programming cam disk 47 by one step in the direction of arrow 5. As soon as projection 49 again seizes the cocking lever 22, the next cocking cycle starts. The parts described above make possible a periodic step-by-step movement of the programming cam disk 47 which is dependent on the rotational speed of the reversing cam disk 1 and the number of tension cam surfaces. Instead of a single tension cam surface 4 (FIG. 3) there indeed can also be a number of such cam surfaces attached to the more rapidly moving control disks such as reversing cam disk 1. If, for example, two tension cam surfaces are accommodated on reversing cam disk 1 and if the time for one revolution of the reversing cam disk is 30 seconds, then every 15 seconds a conveying step of the programming cam disk occurs. If there were only a single tension cam surface on the reversing cam disk, then a conveying step of the programming cam disk would take place at every revolution of the reversing cam disk 1.

A second longer time for the movement of the programming cam disk can be produced in addition to the time dependent directly on the reversing cam disk 1. Counter wheel lever 13 is mounted rotatably on shaft 29 and on one of its ends is mounted counter wheel 40 (FIGS. 1 and 2). Counter wheel 40 is illustrated as having five counter wheel teeth 41, 42, 43, 44 and 45 and one longer tooth 35 for the purpose of describing its operation. Additionally, there also is return spring 32 fixed on shaft 50, on which counter wheel 40 has been rotatably mounted, and spring 32 forces counter wheel 40 opposite to the direction indicated by arrow 6 so that longer tooth 35 abuts against stop 14 attached to the counter wheel lever 13. In this starting position, counter wheel teeth 41 and 42 abut against front surface 51 located above drive teeth 3 on reversing cam disk 1.

Time lever assembly 15 is essentially a two-armed lever having on one side holding arm 30 and on the other side arm 36, which carries scanning cam 17 as well as locking cam 16. Scanning cam 17 moves along timing surface 18 attached to the programming cam disk 47. Compression spring 38, which acts via arm 36 on the scanning cam 17, causes scanning cam 17 to ride on timing surface 18 and to drop into the depression of timing surface 18.

Whenever scanning cam 17 lies against a tooth of timing surface 18, every revolution of reversing cam disk 1 will be followed by a conveying step on the programming cam disk 47. If, however, scanning cam 17

drops into a depression of time curve 18, then locking cam 16 will prevent the cocking lever 22 from uncocking by means of engagement with recession 26. In this position of time lever assembly 15, tension spring 27 does not force time counter wheel 40 against reversing cam disk 1, rather, time counter wheel 40 is pressed against it by the force to compression spring 38 via holding arm 30 and scanning arm 33. Time counter tooth 11 attached to the reversing cam disk 1 engages with counter wheel tooth 42 and thereby rotates counter wheel 40 one tooth further. Counter wheel 40 cannot return to its starting position despite the cocked return spring 32 because it is pressed against front surface 51 by compression spring 38. The engagement of time counter tooth 11 with the individual counter wheel teeth takes place approximately at the time at which cocking lever 22 is about to slide along the steep flanks of tension cam surface 4 in the direction of the concentric shafts of control disks 1 and 47 (position as shown in FIG. 3).

After completion of the next revolution of the reversing cam disk 1, counter wheel 40 is again rotated by one tooth in the direction of the arrow 6. The process described is repeated until counter wheel tooth 45 comes into engagement with time counter tooth 11 and until the longer tooth 35 assumes the position shown in FIG. 2.

The longer tooth 35 deflects counter wheel lever 13 to such an extent that the movement of its arm 33 is sufficient to move scanning lever assembly 15 in the direction of arrow 8, by which arm 33 and projection 34 thereof press against arm 30. The locking cam 16 is lifted out of recess 26 of cocking lever 22 and the cocking lever is free to operate as described above which results in conveying latch 23 (FIG. 3) rotating programming cam disk 47 further by one step by the force of spring 20.

Tension cam surface 4 can be formed so that cocking lever 22 will be lifted up somewhat prior to its release by locking cam 16 to provide a minimum of wear and tear on the surface of cocking lever recess 26 which engages the locking cam. At the same time, the withdrawal of the locking cam from recess 26 will not be impeded by friction.

At the end of the movement cocking lever 22 carries out for the conveyance of latch 23, driver 31 attached to the cocking lever, lifts up counter wheel lever 13 so that there is a certain delay between the engagement of counter wheel teeth 41-45 and front surface 51. Now counter wheel 40 returns to its rest position under action of the return spring 32. As a result, the timing apparatus has been returned to zero. With the described system it, therefore, is possible to realize in any desired sequence long and short timed intervals dependent on the requirements of a given program, which timed intervals lie between the individual movements of the steps dictated by programming cam disk 47.

Counter wheel tooth 41 does not participate in the actual time counting process but it serves merely as a support of the counter wheel in the position shown in FIG. 1. In the case of the aforescribed exemplary embodiment, the counter wheel was provided with five counter wheel teeth and a longer tooth 35. With such a counter wheel, a four-fold time delay relative to the short step-by-step timed intervals can be achieved.

Therefore, the time delay can be varied by the use of counter wheels with different numbers of counter wheel teeth. For example, with a counter wheel equipped with four counter wheel teeth and a longer tooth, which must always be present, a time delay of 1:3 is obtained.

In order to vary the timed delays, several time counter teeth 11 can be provided on reversing cam disk 1 (FIG. 1) and two counting processes of counter wheel 40 will occur for every revolution of reversing cam disk 1. If, for example, the time of revolution of the reversing cam disk is 60 seconds, then with two counter wheel teeth 11, two tension cam surfaces 4, and one counter wheel with four counter wheel teeth, a time delay of 90 seconds can be achieved. In the case of only a single time counter tooth 11, a time delay of 1:3 will result, therefore of 180 seconds duration. From the above description it is apparent that the timing apparatus has a great deal of versatility in the range of its step-by-step timing functions.

In addition to the execution of various step-by-step timing functions, it will be necessary sometimes—especially for the control of washing and dishwashing machines—to stop the conveyance of programming cam disk 47 for prolonged time intervals. For example, it is presently customary for most control devices for washing and dishwashing machines to be stopped, for example, for the time required to heat the washing liquid or until the liquid reaches a desired level. As soon as the desired temperature or the desired level has been achieved, the programming cam conveyance is again put into action. The stopping of the programming switching apparatus from time to time, uses plunger magnet 48 (FIG. 1) having a plunger carrying bolt 52 which engages with bore 24 of cocking lever 22 as soon as the latter is cocked. The uncocking of cocking lever 22 will then be prevented for such a length of time as plunger magnet 48 is energized. As soon as the pertinent temperature or the pertinent level is reached, the plunger magnet is switched off, as a result of which cocking lever 22 is unlocked. Naturally other mechanisms can also be used instead of plunger magnet 48.

A further particular advantage of the described time switch apparatus results in that locking latch 25 and counter wheel lever 13 are mounted on common shaft 29, which affords relatively high reliable operation of the entire apparatus with only customary manufacturing tolerances.

What is claimed is:

1. Time switching apparatus for generating step-by-

step control outputs, comprising  
a rotatable output disk for providing said step-by-step control output,  
means for retarding the rotation of said output disk in accordance with a specified program,  
means for controlling said means for retarding in accordance with fixed time intervals corresponding to said specified program,  
means for driving said means for retarding and said means for controlling, said means for driving includes a rotating disk having a supporting surface thereon and timing teeth selectively positioned around its circumference, said means for controlling includes a rotatable counter wheel, said counter wheel including a predetermined number of counting teeth for engaging said timing teeth, and said means for retarding includes a cocking lever mounted to engage said output disk and controlled by said counter wheel.

2. Time switching apparatus as in claim 1 wherein said means for controlling includes means for returning said counter wheel to a starting position.

3. Time switching apparatus as in claim 1 wherein said rotating disk includes tension cam surface means for releasing said cocking lever to advance said output disk step-by-step.

4. Time switching apparatus according to claim 3 wherein said means for retarding further includes a locking cam for engaging said cocking lever to prevent it from advancing said output disk, and said rotating disk includes cam means for engaging and disengaging with said locking cam and said cocking lever to respectively stop and release the step-by-step rotation of said output disk.

5. Time switching apparatus as in claim 4 wherein said means for controlling further includes a lever interconnecting said counter wheel and said locking cam for actuating said locking cam, and said cocking lever and said lever are mounted on a single shaft.

6. Time switching apparatus as in claim 3 wherein said tension cam surface is formed to delay the release of said cocking lever by said counter wheel.

7. Time switching apparatus according to claim 6 further comprising means for additionally delaying the operation of said cocking lever.

8. Time switching apparatus according to claim 7 wherein said means for delaying comprises a magnetically operated solenoid mounted on said input rotating disk and having an extendable armature, said cocking lever includes means for engaging said armature to prevent said cocking lever from operating.

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