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(54) Method for the discontinuous advance of the cam unit in timers for domestic appliances and relative device

(57) Method for the discontinous advance of the cam unit (13) in timers (10) for domestic appliances, the cam unit (13) cooperating by means of a toothing (12) with a transport lever (11) associated with an eccentric (14) connected to a continuously rotating motor (15), each single advance step of the cam unit (13) being correlated to a rotation of 360° of the eccentric (14), the advance steps of the cam unit (13) causing the opening/closing of electrical contacts so as to generate radio disturbances, each single advance step (16) of the cam unit (13) being sub-divided into at least three semi-steps, respectively the first semi-step in advance (16a) and the second semi-step in advance (16c) being functionally correlated to the presence of electric contacts in cooperation with the cam unit (13), the third, intermediate semi-step in advance (16b) being carried out at a reduced speed compared with the semi-steps (16a, 16c) and such that the cam unit (13) does not perform any switching of electric contacts while the third intermediate semi-step (16c) is being carried out.

Device for the discontinuous advance of the cam unit (13) achieving the method as above, the eccentric (14) being associated with means (19, 21) to accelerate/decelerate the transport lever (11) which intervene for at least one segment of each individual advance (16) of the cam unit (13) so as to define at least three semi-steps in advance at differentiated speeds, a first semi-step in advance (16a), a third, intermediate semi-step (16b) and a second semi-step in advance (16c), wherein the third, intermediate semi-step (16b) has a reduced speed compared with the first (16a) and second (16c) semi-steps in advance.

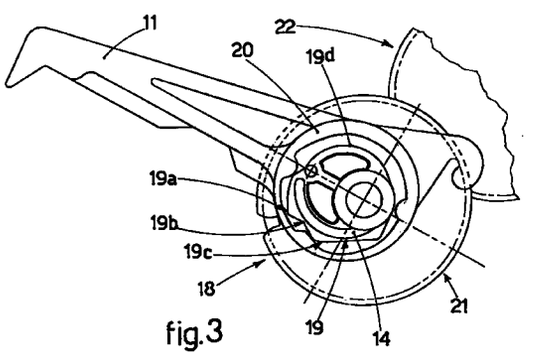

fig.3

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Description

This invention concerns a method and the relative device for the discontinuous advance of the cam unit in timers for domestic appliances, as set forth in the respective main claims.

The invention is applied to programming and timing devices (timers) in domestic appliances such as washing machines, dishwashers or similar, where the working cycle includes a plurality of working steps which have different characteristics, times and devices in operation.

The state of the art covers programming and timing devices (timers) for domestic appliances comprising a cam unit with a differentiated profile which cooperates with contact means suitable to open or close a relative electrical circuit to activate/de-activate the operational devices of the domestic appliances according to the requirements of the working cycle.

The cam unit is usually made to rotate by a transport lever, moved by an electric motor which is in continuous rotation; this lever normally acts on a toothing associated with or entirely made on the cam unit itself.

Usually, the electric motor acts on the transport lever through an eccentric which causes an alternate movement of the lever which is suitable to engage with, move and subsequently release the teeth of the toothing; this causes a step-by-step advance of the cam unit.

The rotation of the cam unit, in some steps of the cycle, can cause radio disturbances, which derive from the opening and closing of the electrical contacts and from the consequent activation/de-activation of particular devices of the domestic appliance, for example of the induction devices; these radio disturbances can cause imbalances and alterations in the working of those apparati which are sensitive to this type of disturbance and are located near the domestic appliance.

Within one advance step, the electrical contacts associated with the different devices are normally arranged in two packets which are distanced from each other; the first packet is usually arranged in correspondence with a first segment of advance of the cam unit and the second packet is usually arranged in correspondence with a second segment of advance of the cam unit.

Certain laws have recently introduced limits (for example the European legislation CEI EN 55014) concerning the maximum continuous duration allowed for signals of radio disturbance, and also the minimum period of time which must elapse between two consecutive disturbances so that the disturbances can be considered separate.

These new regulations have obliged those operating in the field to introduce new configurations of timers suitable to meet the restrictions imposed by the said regulations.

Some of the solutions proposed have attempted to perfect the systems of electrical contact so as to make them substantially immune to phenomena of radio disturbances.

In other cases, the action of the transport lever has been accelerated, so as to render the displacement and therefore the action of the cam unit on the contact elements more rapid, thus containing the duration of the radio disturbances within the times prescribed by the regulations.

In particular, one solution which is widely used is to include an advance step wherein the first segment is performed by the cam unit at a substantially constant speed; in this first segment there is a limited number of contacts so that the duration of the radio disturbance is limited to the maximum duration prescribed by the regulations.

The last segment of the step, where there is a larger number of contacts, is performed accelerating the cam unit, in this case too so as to limit the duration of the radio disturbance within the maximum time allowed by the regulations.

This solution not only requires mechanical accumulation systems to provide the acceleration of the cam unit in the final segment of the advance step, but also it involves a reconfiguration of the electrical contacts, which is not always possible over the whole range of timers and for all the functions which the timers have to perform. Moreover, solutions known to the state of the art have shown themselves, in general, to be expensive, and cannot always be applied to timers with different uses; this causes problems because these solutions are complex to achieve and difficult to adapt to the different models of domestic appliances on the market.

The present applicants have designed, tested and embodied this invention to overcome the shortcomings of the state of the art, and to obtain further advantages.

The invention is set forth and characterised in the respective main claims, whereas the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to achieve a method to advance the cam unit in timers for domestic appliances which will contain the radio disturbances generated within the limits as prescribed by current legislation.

A further purpose of the invention is to achieve a device which will achieve the aforesaid method without causing great modifications to be made to the structure of state-of-the-art timers, so that it will be possible to apply the invention substantially to every type of timer which has an advance system including a transport lever.

In the method according to the invention, each advance step of the cam unit, caused by the transport lever, is sub-divided into two distinct semi-steps, with an intermediate third semi-step performed at a lower speed than the two other semi-steps.

In one embodiment of the invention, the cam unit remains stationary in the third intermediate semi-step, thus substantially achieving a pause in the advance of the cam unit.

During the two semi-steps in advance, the cam unit cooperates with the electrical contacts which activate/de-activate the devices of the domestic appliance.

According to the invention, the semi-steps in advance are performed at such a speed that the action of the cam unit on the contacts, and therefore the possibility of radio disturbances, is limited to a period of time which is less than the limits imposed by legislation, for example, less than 200 milliseconds.

In a similar manner, the cam unit performs the third intermediate step at a reduced speed, or even at zero speed, so that in the third intermediate step there is no switching of the contacts for a period of time at least greater than the limit established by current legislation, for example, more than 200 milliseconds.

In a first embodiment of the invention, the method is achieved by shaping in the appropriate manner a segment of the profile of the eccentric which is associated with the transport lever which, when it rotates through 360°, makes the cam unit advance by an angular value mating with one tooth of the toothing associated with the cam unit.

According to this embodiment, during each single advance step, in correspondence with the segment of the shaped profile of the eccentric, the transport lever acts with an action of two times separated by a pause, or separated by an advance step at a reduced speed, during which the cam unit stops or slows down. Once this segment of shaped profile has been passed, the further rotation of the eccentric serves to complete the cycle of release of the same tooth and to reposition the transport lever on the following tooth.

According to another embodiment, the eccentric associated with the transport lever cooperates with two gears with different transmission ratios.

As the cam unit is displaced, according to the different transmission ratio between the two gears, the eccentric gives motion to the transport lever so that the latter, with every single advance step, makes a thrust step, a pause or an intermediate slow-down and a second thrust step.

Therefore, the invention makes it possible to contain the radio disturbances emitted by the timers within the limits imposed by current legislation without acting on the motor, without requiring the use of auxiliary components such as clutches or other devices and without modifying in any way the normal configuration and arrangement of the electrical contacts.

The attached Figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:

Fig. 1 shows in simplified diagrammatic form the advance mechanism for the cam unit of a timer for domestic appliances to which the invention is applied;

Fig. 2 shows a comparative graph of two drive systems of a cam unit with the method according to the invention compared with a drive system using a conventional method;

Fig. 3 shows a first embodiment of the device according to the invention;

Fig. 4 shows a second embodiment of the device according to the invention.

The reference number 10 denotes a timer for domestic appliances with an advance system adopting a transport lever 11. The transport lever 11 is moved by an eccentric 14 rotating by means of a motor 15 and acts, in this case, on a toothing 12 associated with the cam unit 13.

The toothing 12 can be formed entirely on the cam unit 13, or there can be an auxiliary toothed wheel associated with the cam unit 13, arranged coaxially or disaligned therewith.

In this case, the eccentric 14 is solidly associated with a first gear 21, or driven gear, which is made to rotate by a second gear 22, or driving gear, associated directly with the motor 15.

The step-by-step advance of the cam unit 13 takes place in this case due to the effect of the thrust given by the transport lever 11 on each individual tooth 12a of the toothing 12.

With each rotation through 360° of the eccentric 14, the transport lever 11 is first moved forwards, exerting an action of thrust on the tooth 12a, and then moved back again, performing a movement of release with which it comes into cooperation with the following tooth 12a.

The cam unit 13, during each rotation of one step, acts peripherically on a plurality of contacts, which are not shown here, which open/close the relative circuits to activate/de-activate the various devices of the domestic appliance.

In the method according to the invention, each single advance 16 of the cam unit 13 is sub-divided into two distinct semi-steps in advance 16a, 16c separated by an intermediate semi-step 16b in which the cam unit 13 remains stationary, or rotates at a reduced speed compared with the speed of rotation during the semi-steps 16a, 16c.

In the graph shown in Fig. 2, the line of dashes 17 shows the situation which normally exists in the state of the art, where the cam unit 13 is moved for a first segment at a substantially constant speed, in this case as far as the point indicated by E, and is then accelerated in the last segment of the advance step where the majority of the contacts which are to be opened/closed are found.

With the method according to the invention, shown in two possible solutions respectively by the continuous lines "I" and "I_1", the radio disturbances generated by the activation of the devices as a consequence of the opening/closing of the relative electrical circuits are limited within the first 16a and the second 16c semi-steps in advance, whereas they are not generated at all during

the intermediate semi-step 16b, since during the semi-step 16b the cam unit 13 either remains stationary or rotates at a slower speed through such an angle that there is no switching of the contacts.

The graph shown in Fig. 2 refers to the case when every single step involves a rotation of 6° of the cam unit 13 plus 1° of extra-step which is then recovered by inverse rotation; the x coordinates show the duration of each individual advance 16, 17 expressed in milliseconds and the y coordinates show the values in sexagesimal degrees of the relative angular rotation of the cam unit 13.

It should be noted that normally the electrical contacts associated with the cam unit are not present in correspondence with the first and last segment of each individual advance since, as we have said, they are confined within two packets arranged substantially astride the intermediate zone of every advance step. In the graph, the presence of the contacts has been shown diagrammatically inside the segments "M" and "N".

In the case of the solution identified by the line "I", the first semi-step in advance 16a takes the cam unit 13 from the starting position "A" to position "B", which corresponds to a rotation of 3.5°. This action is performed at such a speed that the switching of the contacts along the segment "M", and therefore the possibility of radio disturbances, is confined to a period of time which is less than that established by current legislation, in this case, less than 200 milliseconds.

In a similar manner, the second semi-step in advance 16c, or the segment CD, is likewise performed at such a speed that the contacts in the segment "N" are switched during a period of time which respects current legislation, in this case less than 200 milliseconds.

In this solution, between the two semi-steps in advance 16a, 16c, there is an intermediate pause 16b, identified by the segment BC, wherein the cam unit 13 remains stationary. The duration of this intermediate pause 16b is such that it respects the regulations concerning the distance between two consecutive radio disturbances, in this case above 200 milliseconds.

According to the variant identified by the line "I_1", the first semi-step 16a takes the cam unit 13 from position A to position B'; during the intermediate semi-step 16b, the cam unit 13 is made to rotate at a reduced speed, so as to cover a segment B'C' wherein there is no switching of the contacts, and therefore there are no radio disturbances, for a time of more than 200 milliseconds.

The further advance to cover the segment C'D is performed in this case too at such a speed as to confine the possibility of radio disturbances to a period of time less than 200 milliseconds.

Both these solutions respect the regulations concerning the duration of radio disturbances and the distance between two consecutive radio disturbances without intervening on the functioning of the motor 15 and without modifying the configuration and the arrangement of the electrical contacts.

Figs. 3 and 4 show two possible embodiments which achieve the method according to the invention.

The advance device 18 shown in Fig. 3 provides that the eccentric 14 associated with the driven gear 21 and cooperating with the transport lever 11 has a shaped profile 19.

With every cycle of rotation imparted by the motor 15, the shaped profile 19 of the eccentric 14 comes into contact with the ring 20 which is solid with the transport lever 11, causing the transport lever 11 to thrust on a tooth 12a to advance the cam unit 13 or to release and re-position the cam unit 13 on the following tooth 12a.

In this case, when the segment 19a of the shaped profile 19 acts on the ring 20, it causes a first acceleration of the transport lever 11 caused by the increase in the peripheral speed of the eccentric 14 with the same angular speed, which generates the first semi-step in advance 16a of the toothing 12.

The subsequent segment 19b of the cavity-shaped profile 19 causes the transport lever 11 to stop or at least slow down; it therefore also causes the intermediate semi-step in advance 16b of the cam unit 13.

The second acceleration and therefore the second semi-step in advance 16c, obtained by a new increase in the peripheral speed, takes place when the ring 20 cooperates with the segment 19c of the shaped profile 19; the subsequent segment 19d of the shaped profile 19 causes the movement of release and re-positioning of the transport lever 11 in correspondence with the subsequent tooth 12a.

In the advance device 18 shown in Fig. 4, the driven gear 21 with which the eccentric 14 is associated consists of a larger toothed wheel 21a and a smaller toothed wheel 21b, mounted coaxially.

For simplicity of illustration, the device shown here is able to perform a single acceleration with respect to normal advance; two accelerations are performed by substantially duplicating the solution shown here.

The driving gear 22 comprises in turn a first toothed wheel 22a through which motion enters; coaxially to it, a second toothed wheel 22b and a third toothed wheel 22c are mounted, the second 22b being larger than the third 22c.

The smaller toothed wheel 21b and the second toothed wheel 22b have a smaller number of teeth, in this case both have three teeth respectively 121b and 122b.

According to the invention, the normal drive of the transport lever 11, associated with the eccentric 14 and not shown here, takes place with the larger toothed wheel 21a engaged in the third toothed wheel 22c, whereas the accelerations during the semi-steps in advance 16a and 16c take place when the smaller toothed wheel 21b engages with the second toothed wheel 22b.

In this situation there is a variation in the transmission ratio between the two gears 21, 22 which, only dur-

ing the segment caused by the engagement between the teeth 121b and 122b, increases the speed of rotation of the eccentric 14.

In the event that the intermediate semi-step 16b includes a pause in the advance of the cam unit 13, there is a blocking mechanism, which is not shown in the Figures, which takes the driven gear 21 into an idler condition with respect to the driving gear 22 which is in continual rotation.

Claims

1. Method for the discontinous advance of the cam unit (13) in timers (10) for domestic appliances, the cam unit (13) cooperating by means of a toothing (12) with a transport lever (11) associated with an eccentric (14) connected to a continuously rotating motor (15), each single advance step of the cam unit (13) being correlated to a rotation of 360° of the eccentric (14), the advance steps of the cam unit (13) causing the opening/closing of electrical contacts so as to generate radio disturbances, the method being characterised in that each single advance step (16) of the cam unit (13) is subdivided into at least three semi-steps, respectively the first semi-step in advance (16a), a third intermediate semi-step (16b) and the second semi-step in advance (16c), the first semi-step in advance (16a) and the second semi-step in advance (16c) being functionally correlated to the presence of electrical contacts in cooperation with the cam unit (13), the third, intermediate semi-step in advance (16b) being carried out at a reduced speed compared with the semi-steps (16a, 16c) and such that the cam unit (13) does not perform any switching of electric contacts while the third intermediate semi-step (16c) is being carried out.

2. Method as in Claim 1, in which the speed of advance of the cam unit (13) during the semi-steps of fast advance (16a, 16c) is correlated to the containment of the duration of the radio disturbances to a period of time of less than 200 milliseconds.

3. Method as in Claim 1, in which the duration of the third intermediate semi-step (16b) is more than 200 milliseconds.

4. Method as in Claim 1 or 3, in which during the third intermediate semi-step (16b) the cam unit (13) remains substantially stationary.

5. Device for the discontinuous advance of the cam unit (13) in timers (10) for domestic appliances, the cam unit (13) cooperating with a transport lever (11) associated with an eccentric (14) connected to a continuously rotating motor (15), each individual advance step of the cam unit (13) being correlated to a rotation through 360° of the eccentric (14), the steps in advance of the cam unit (13) causing the opening/closing of electrical contacts such as to generate radio disturbances, the device being characterised in that the eccentric (14) is associated with means (19, 21) to accelerate/decelerate the transport lever (11) which intervene for at least one segment of each individual advance (16) of the cam unit (13) so as to define at least three semi-steps in advance at differentiated speeds, a first semi-step in advance (16a), a third, intermediate semi-step (16b) and a second semi-step in advance (16c), wherein the third, intermediate semi-step (16b) has a reduced speed compared with the first (16a) and second (16c) semi-steps in advance.

6. Device as in Claim 5, in which in the third intermediate step (16c) the cam unit is substantially stationary.

7. Device as in claim 5 or 6, in which the acceleration/deceleration means associated with the eccentric (14) consist of a shaping of one segment of the profile of the eccentric (14), the shaping (19) comprising at least three consecutive segments (19a, 19b and 19c) respectively defining the first semi-step in advance (16a), the third intermediate step (16b) and the second semi-step in advance (16c).

8. Device as in claim 5 or 6, comprising a driving gear (22) associated with the motor (15) and a driven gear (21) associated with the eccentric (14), characterised in that the acceleration/deceleration means associated with the eccentric (14) consist of a toothed wheel with a reduced diameter (21b) associated with the driven gear (21) cooperating with a toothed wheel with a reduced diameter (22b) associated with the driving gear (22), the toothed wheels (21b, 22b) including a reduced number of respectively mating teeth (121b, 122b) so as to obtain, exclusively during their action of engagement, an acceleration in the rotation of the eccentric (14).

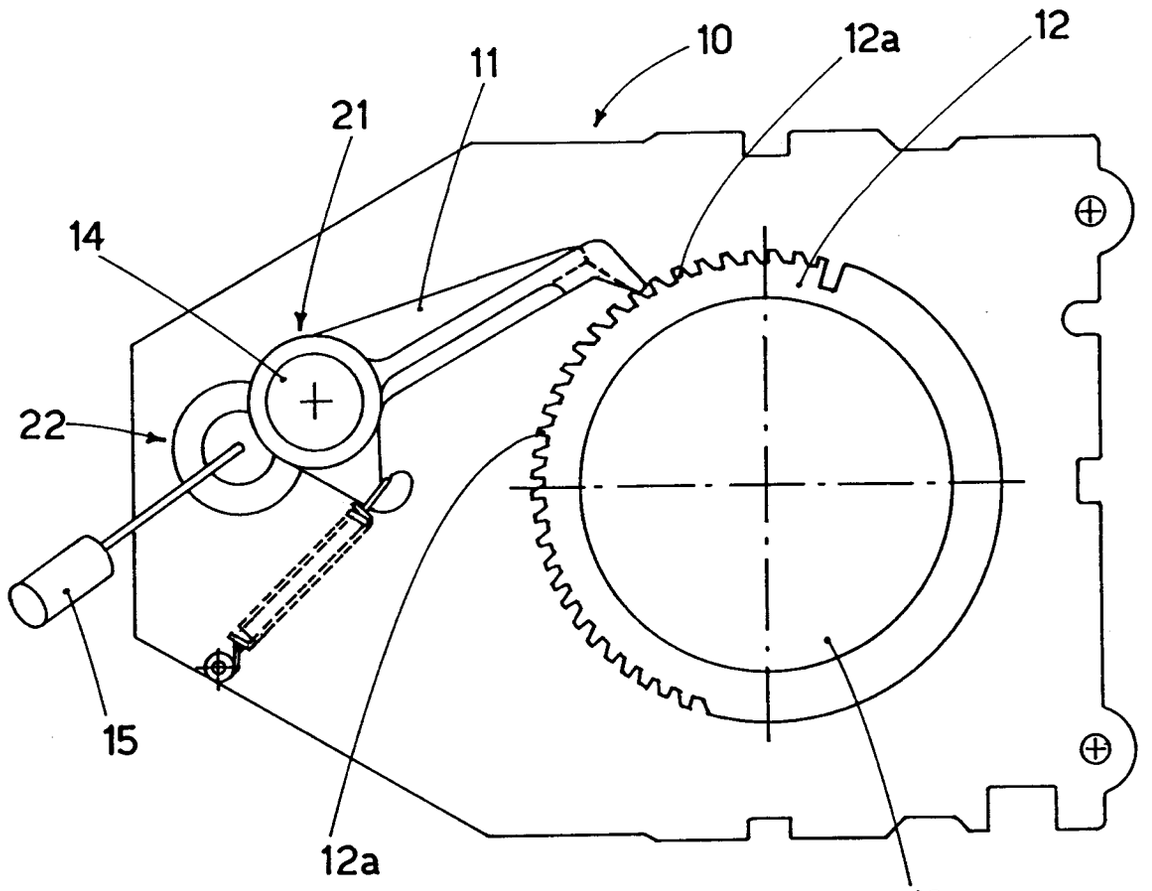
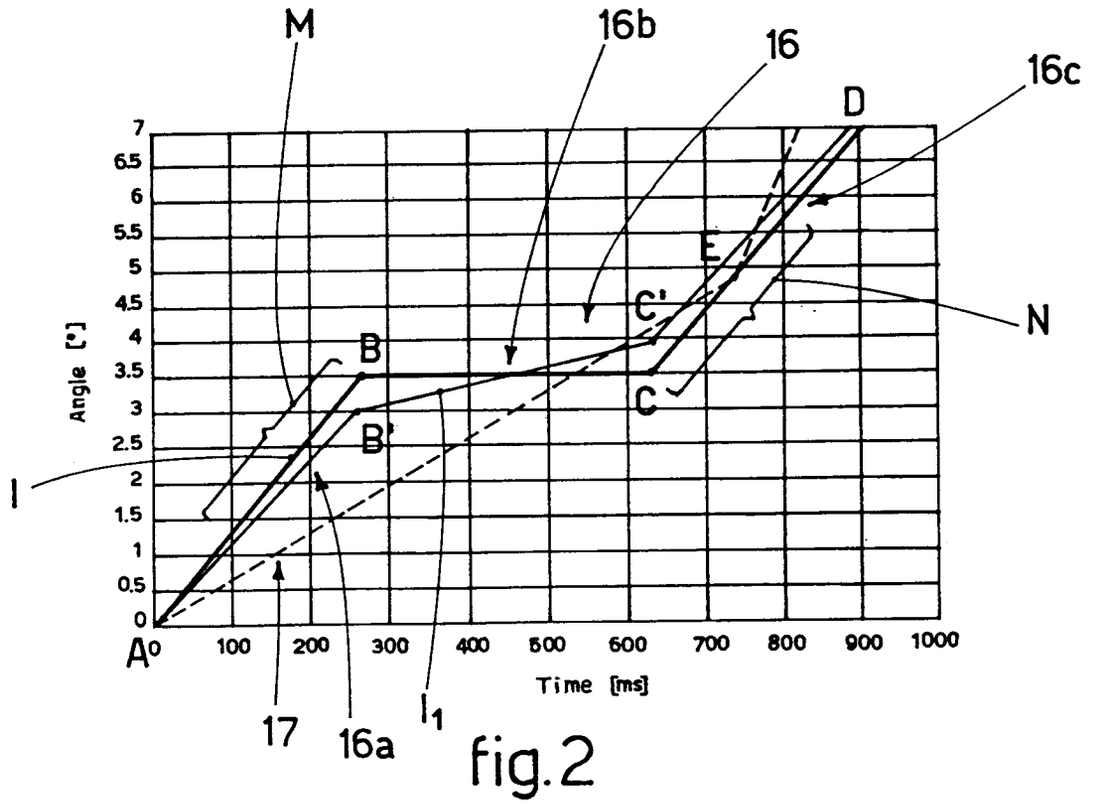

10
11
12
12a
21
14
22
15
12a
13

fig.1


M
16b
16
16c
D
E
C'
N
B
B'
C
I
Angle [°]
7
6.5
6
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4.5
4
3.5
3
2.5
2
1.5
1
0.5
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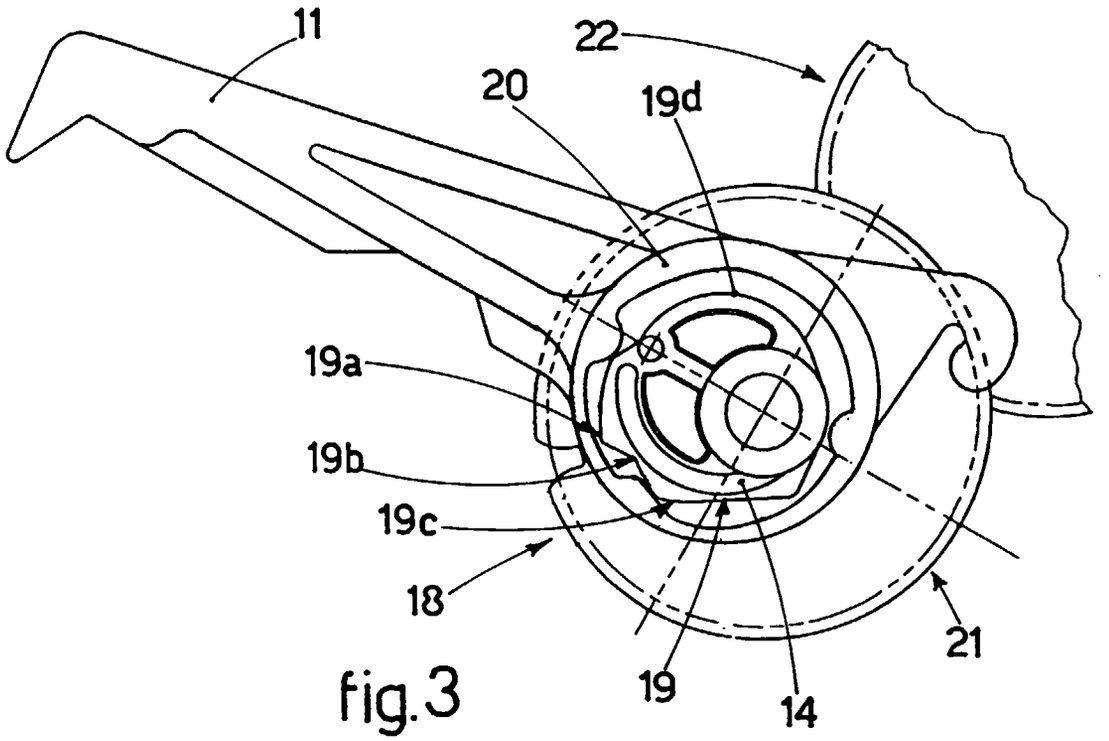
900
1000
Time [ms]
17
16a
I1

fig.2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22
20
19d
19a
19b
19c
18
21
19
14

fig.3

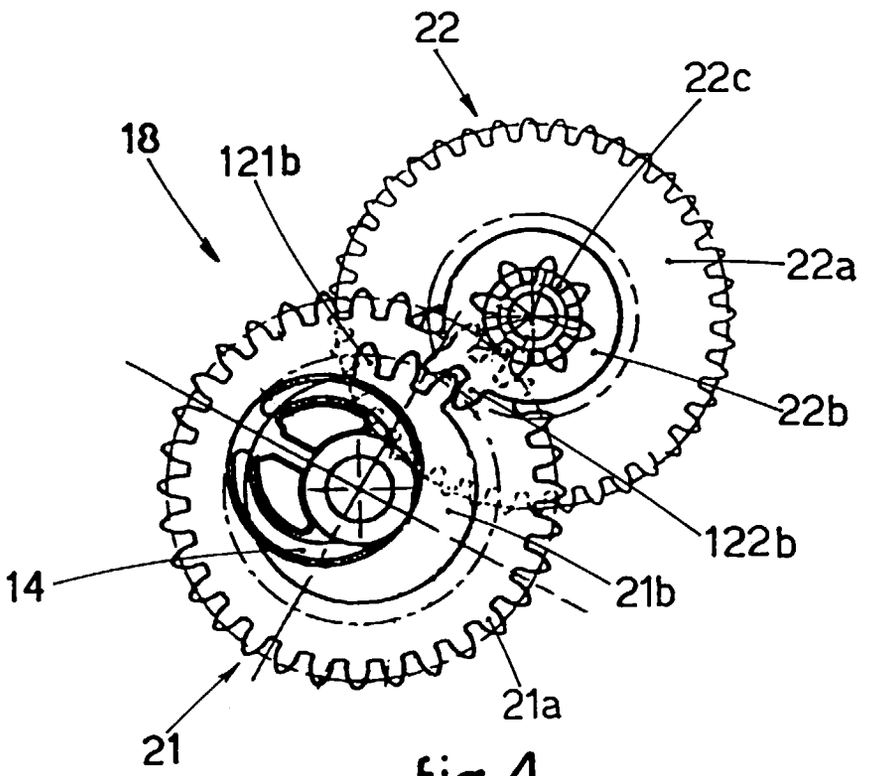
22
22c
18
121b
22a
22b
122b
14
21b
21a
21

fig.4