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Solari

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[54] **ROTARY-DRUM PROGRAMMING TIMER DEVICE**

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[52] **U.S. Cl.** ..... **200/38 CA,** 200/27 B, 200/33 B, 200/37 A, 200/38 D, 200/153 LB

[51] **Int. Cl.** **H01h 43/22**

[58] **Field of Search** .... 200/33 R, 33 B, 33 D, 35 R, 200/35 EQ, 37 R, 37 A, 38 R, 38 CA, 38 D, 38 DA, 38 DB, 38 DC, 27 B, 27 R, 153 LB

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Primary Examiner—James R. Scott
Attorney, Agent, or Firm—Eric H. Waters

[57] **ABSTRACT**

A revolving-drum programming device is disclosed, which essentially comprises a grooved intermittently driven main drum, a comblike member in which a few teeth are left unaltered and others are suppressed, said comblike members being inserted in the drum grooves, a spatial cam rotated so as to make a revolution at every stepwise movement of the drum, said cam cooperating with a first cam follower, a second follower being provided, mechanically connected to the first follower so as to positively or negatively engage the teeth of said comblike members, the second follower being connected to a signal generating device. The apparatus can be supplemented by additional main drums and one or more auxiliary drums, so as to provide a wide range presetting for the cases in which certain points of the programme are to be suppressed or repeated. The advantage is to provide a compact assembly along with an accurate presetting of programmes, which can be set, even minute by minute, for periods as long as an entire week. The programming device can be used, for example, for controlling the lighting of luminous signs, for periodically actuating sound signalling devices and for many other like uses.

8 Claims, 11 Drawing Figures

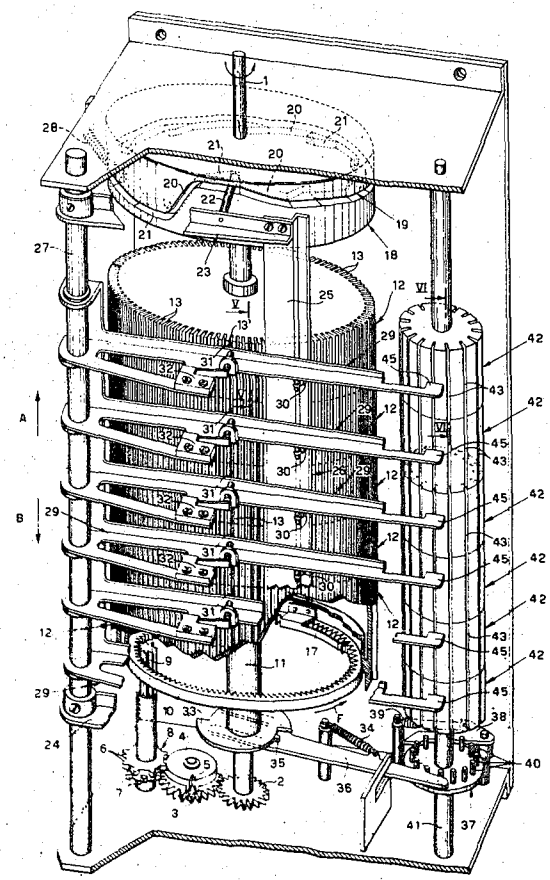

Fig. 1

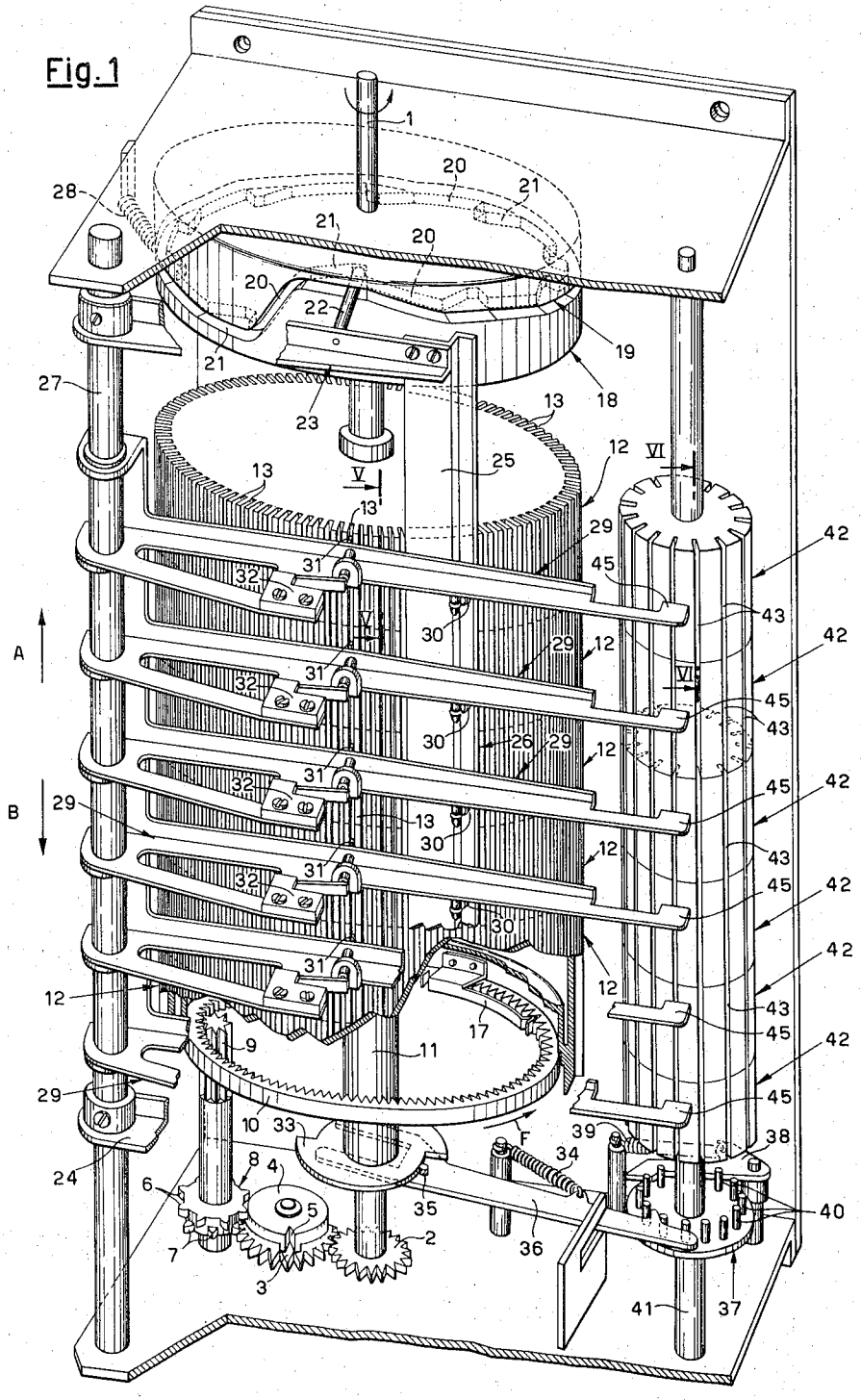
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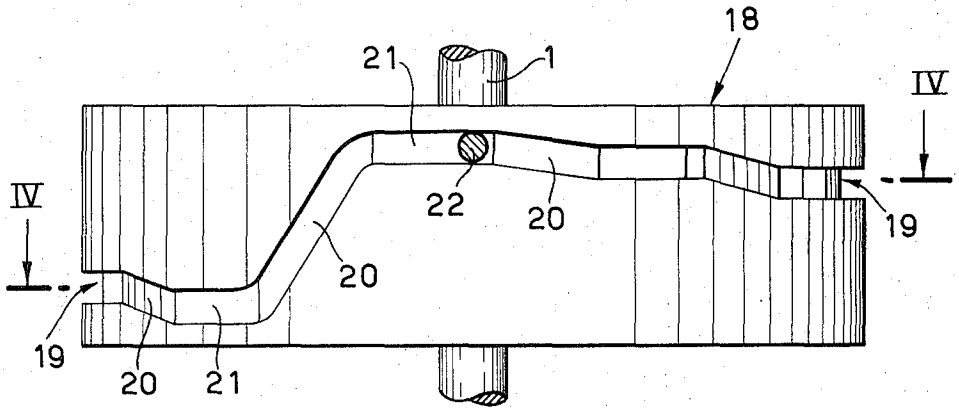
Fig. 2



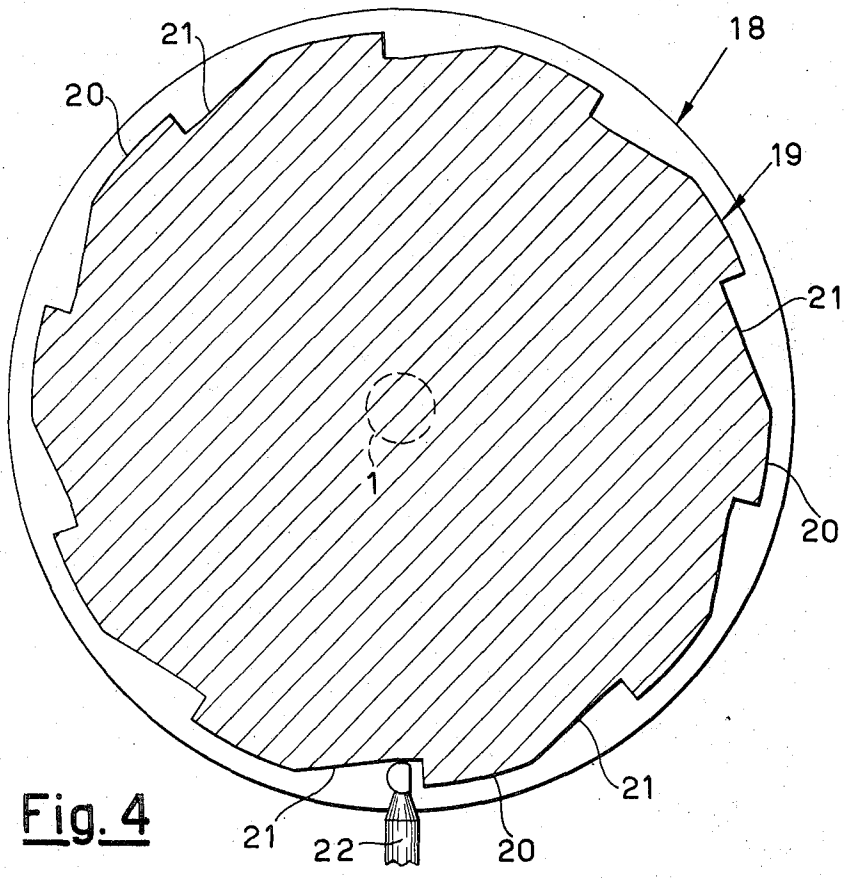


Fig. 4

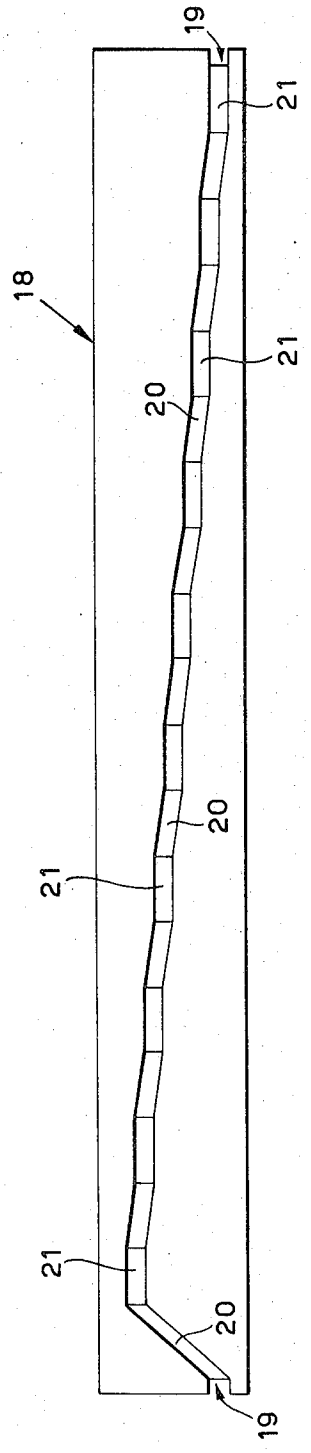


Fig.3

Fig.6

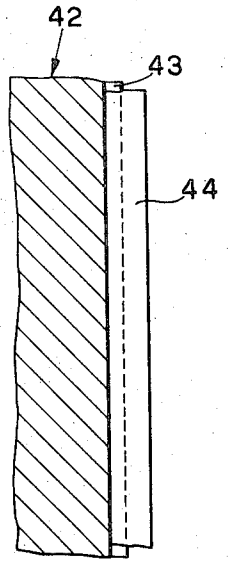
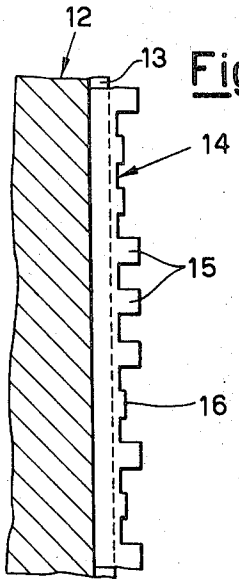


Fig.5



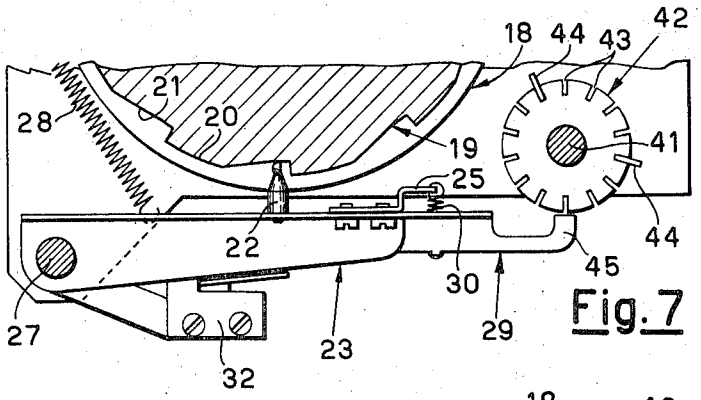


Fig.7

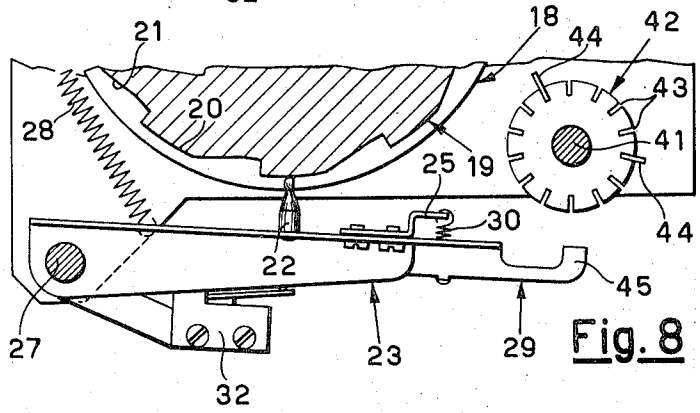


Fig.8

Fig. 9

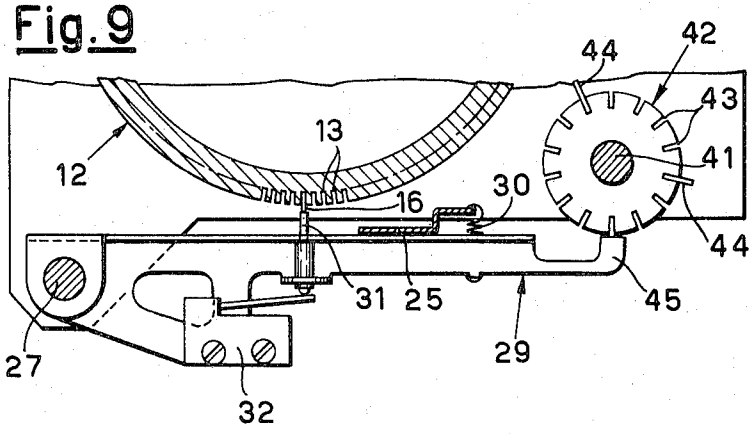


Fig. 10

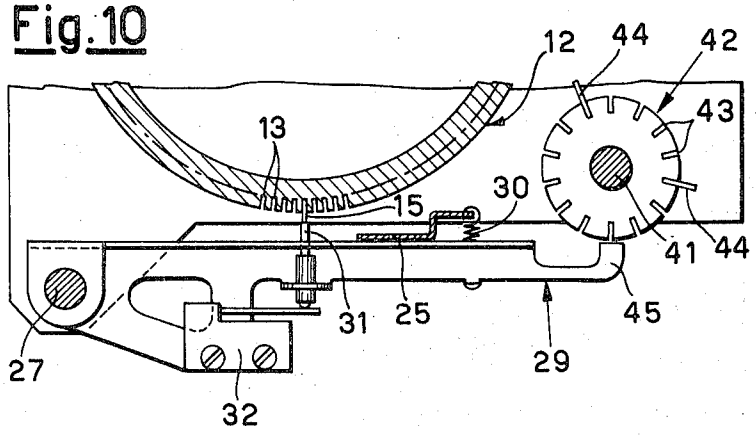
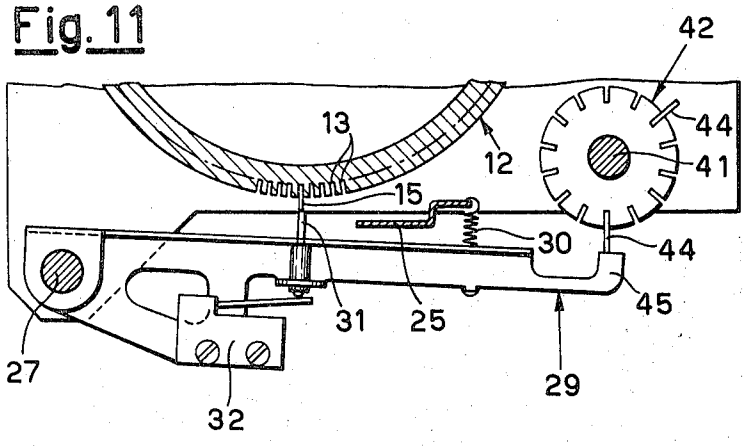


Fig. 11



ROTARY-DRUM PROGRAMMING TIMER DEVICE

This invention relates to a rotary-drum programming device, which is particularly intended for the timed control of luminous signs, lighting appliances, sound signalling devices and the like.

A few rotary-drum programming devices are known, in which an appropriate feeling member is maintained in engagement with the cam surface of a rotary drum, the latter being driven, stepwise so as to be enabled to have as many different commands as there are steps of the drum.

The defect of the known programming devices of this kind is that, if a program during a long time is desired, or, as an alternative , a program which is divided into many fractions is desired, it becomes necessary to equip the programming device with a drum having a comparatively large diameter, the result being an increase of both the bulk and the cost of the programming device as such, otherwise, the user should content himself with a programming capacity which is sometimes undesirably narrow.

The principal object of the present invention is thus to provide a programming device which happily combines a comparatively limited bulk and cost with a high programming capacity. More particularly, it is desired to provide a programming device having a restricted bulk and a low cost and which is capable of covering the entire 24-hour span with a fractioning of the program which can attain 1 minute, that is, having as many as 1,440 programming positions.

Another object of the present invention is then to provide a programming device which combines, with the above mentioned favourable qualities, also that of being able to develop a number of different programs simultaneously, and this, obviously, in order to enable it to be used for the simultaneous monitoring of a number of utilization devices having different programming requirements.

A further object of the present invention is, lastly, to provide a programming device which, in addition to the fabourable properties enumerated above, is capable of permitting the periodic suppression of one or more programmes during preselected time intervals, this suppression being capable of repetition for several performances of the same programme. More particularly, it is desired to be enabled to exclude a daily program during a preselected number of hours, such as 12 or 24 hours, while being enabled to program the possible repetition of the suppression of the program during more than one day of a week.

Having these objects in view, the programming device according to this invention, is essentially characterized in that it comprises at least a main rotatable drum which is rotated stepwise about its own axis, on whose cylindrical surface there are formed as many axial circumferentially evenly spaced apart grooves as there are steps, equal to one another, as performed by the drum during one revolution thereof, a comblike member longitudinally inserted in each of said grooves with its teeth directed towards the outside of the drum and projecting therefrom, said comblike member being equipped with a plurality of longitudinally evenly spaced apart teeth, a few of which are removed so as to define a preselected or optionally variable sequence of either maintained or suppressed teeth, a cam controlled so as to be rotated through an entire revolution for every step by which the drum is caused to advance, said cam being so shaped as to define, for a first follower maintained in engagement therewith, as many work stations as there are teeth, either maintained or removed, of each comblike member, at least a second follower connected to said first follower so as to be shifted from the engagement with one tooth to the engagement with the following tooth out of said maintained or removed teeth of each comblike member and, then, in combination with a forward step of the drum, into engagement with the first tooth of the next comblike member at every shift of the first follower from the one to the other of said work stations, and signal-generating means associated to the second follower so as to emit signals of different value consistently with the engagement of said second follower either with a maintained tooth or a removed tooth of a comblike member.

It is apparent that a so devised programming device permits the operation of a program divided into a number of steps which equals the product of the number of the axial grooves (and thus of the forward steps) of the drum by the number of the teeth, either maintained or removed, of the comblike members (and thus of the work positions of the first follower), that which is equivalent to permit the performance of a programme which is much extended in time and/or divided into many fractions, while maintaining both the bulk and the cost of the programming device within an acceptable range. More particularly, by using a drum having 144 grooves with comblike members having 10 teeth each and by controlling the cam so as to have it to make a complete revolution every eleventh minute, a programming device cam be obtained, which is capable of performing a complete 24-hour programme whose operation has the accuracy of one minute, that is, a programming device capable of monitoring in the best possible way the daily sequence of actuation of a luminuous sign, a lighting appliance or a sound signalling device. It should also be noticed that the mere replacement of the comblike members by other members having a different sequence of maintained and removed teeth makes a programme change both very easy and quick.

Another important feature of the programming device according to the invention is then the fact that it comprises at least an auxiliary drum which is rotated stepwise about its own axis, which is matched to the main drum so as to be driven a step forward at each revolution (or fraction of revolution) of the main drum aforesaid, the auxiliary drum having a plurality of circumferentially evenly spaced apart axial grooves whose number is the same as that of the steps, which are all equal, gone through by said auxiliary drum during a complete revolution thereof, each of said grooves housing a shaped plate which is engaged by an extension of the second follower so as to remove the engagement of the second follower with the comblike member which has been selected at that instant of time.

The provision of said auxiliary drum with the relative plates for disengaging the second follower from the comblike members of the main drum, obviously permits to preselect an instantaneous respite, which can be possibly repeated, of the present programme. More particularly, by associating to a main drum having 144 grooves and 10-tooth comblike members, an auxiliary drum equipped with seven grooves and driven so as to

go a step forward at every complete revolution of the main drum (or equipped with 14 grooves and driven to go a step forward for each half-revolution of the main drum) an entire weekly programme, which is controlled minute for minute can be preset. The sequence of periodical respited of the programme as preselected by the auxiliary drum can, of course, be also varied in a simple and quick manner by changing the shape and-/or the arrangement of the shaped plates with which the auxiliary drum is equipped.

The adoption of the basic principles of the present invention permits, in addition, that the programming device as described may be extended to an embodiment which is capable of carrying out a number of different programmes simultaneously. This object can be achieved, in fact, by merely adding to the main drum aforementioned additional main drums equal thereto, which are coaxially arranged and integrally mounted therewith, and by adding to the second follower aforesaid, additional second followers connected to the first one and/or to the second follower mentioned above so as to engage the comblike members of said additional main drums simultaneously and just in the same way in which the second follower engages the comblike members of the first main drum. Likewise, if it is desired to have also the possibility of presetting a periodical respite for the additional programmes, the auxiliary drum mentioned above should be implemented with additional similar drums equipped with grooves into which further plates can be inserted for the disengagement of the additional followers aforementioned.

The features of the present invention, along with the advantages stemming therefrom, will be better understood from the scrutiny of the ensuing detailed description of an embodiment which is shown by way of example only in the accompanying drawings, wherein :

FIG. 1 is a perspective view, with parts shown in section, of a programming device according to the invention, which has been provided for carrying out a 24-hour programme divided to the minute, it being possible to exclude, either partially or as a whole, the programme for one or more days of a week.

FIG. 2 is an elevational view of the follower actuating cam with which the programming device of FIG. 1 is equipped.

FIG. 3 is a showing of the cam aforesaid, as developed on a planar surface.

FIG. 4 is a cross-sectional view, taken along the line IV—IV of FIG. 2, of the cam mentioned above.

FIG. 5 is a cross-sectional view, taken along the line V—V of FIG. 1.

FIG. 6 is a cross-sectional view taken along the line VI—VI of FIG. 1.

FIGS. 7 and 8 are plan views, partly in section, which show two different stages of the engagement of the cam of FIGS. 2 to 4 with the relative first follower.

FIGS. 9 and 10 are horizontal cross-sectional views which show two different stages of the engagement of either main drum with the relevant second follower.

FIG. 11 is a horizontal cross-sectional view which shows the effects of the engagement of either auxiliary drum and its relative second follower.

The programming device as shown in the drawings comprises, in the first place, a driving shaft 1 driven to rotation in a continuous or a stepwise run at a rate of one revolution every 11th minute by an appropriate clockwork (not shown). To either end of the shaft 1 is keyed a gear 2, which is in mesh with another gear 3 integral with a wheel 4 fitted with a hollow space 5 which is adapted to engage, at every revolution of the wheel 4, either of two staggered crown gears 6 and 7, which equip a gear 8 integral with a pinion 9, the latter being in mesh with a crown gear 10. The gear ratio as produced by the gears 2 and 3, the gears 4 and the pinion 9 and the crown gear 10 is such as to cause the latter to go through a step forward which is equal to one one-hundred forty-fourth of a revolution at every complete revolution of the drive shaft 1.

The shaft 1 idly carries, with the intermediary of a hub 11, an assembly of six equal main drums, which are coaxial and integral with one another, 12, each of which has 144 axially oriented and circumferentially equally spaced apart grooves 13, in each of which a comblike member 14 is inserted (FIG. 5), equipped with a plurality of longitudinally evenly spaced apart teeth, a few of which have been removed so as to provide a preselected sequence which is anyhow variable, of retained teeth 15 and of removed teeth 16. The set of six drums 12 is matched with the crown gear 10 by means of a leaf spring 17, which allows the drums 12 to be driven in the direction of the arrow 7 (also showing the direction of rotation of the crown gear 10) with respect to the crown gear 10, but not in the opposite direction.

To the opposite end of the drive shaft 1 a cam 18 is keyed, in whose cylindrical surface a hollow space 19 is formed, which is divided into ten sectors having all the same circumferential span (FIG. 4), each sector being composed by a cylindrical portion 20 and a portion 21 with decreasing radius. Nine of these sectors have the portion 21 which is evolved by remaining at a constant level relative to the axial development of the cam and the portion 20 which goes downwards towards the lower end of the cam, whereas the 10th sector has the portion 21 at a constant level and the portion 20 which rises to become connected with the portion 21 of the first sector (FIGS. 2 and 3).

The hollow space 19 of the cam 18 engages a timing mechanism 22 which is a part of a first follower 23, which, together with another arm 24 and a cross-piece 25, makes up a frame 26 which is rotatable about the axis of a supporting shaft 27 and is axially slidable therewith. Due to the engagement existing between the timing mechanism 22 and the hollow space 19 of the cam 18 (such an engagement is maintained by a spring 28) and due to the specially provided trend of the hollow space 19, the follower 23 and, generally, the frame 26, are driven so as to go through a first clockwise rotary movement (timing mechanism 22 in correspondence with a portion 21, FIG. 7), a second axial displacement movement in the direction of the arrow A (timing mechanism 22 in correspondence with a portion 20, FIG. 8), and a third anticlockwise rotary movement (timing mechanism in correspondence with a connecting step between a portion 20 and the subsequent portion 21) for each of the first nine sectors enumerated above and a first movement of axial displacement in the direction of the arrow B and a third movement of rotation in the counterclockwise direction for the tenth sector.

To the shaft 27 are keyed, to be supported thereby, six second followers 29, every one of which is pulled towards the cross-piece 25, and thus towards the grooved surface of a respective drum 12, by a spring

30. On each of the followers 29 there is slidably mounted a pin 31, which is kept in engagement with the teeth of the comblike member 14 as selected at the appropriate times, by the stepwise forward movement of the drums 12 and is active upon a microswitch 32 which is the control signal generating means for the utilizing appliance controlled by the relative drum 12.

To the hub 11 of the drum assembly 12 there is then keyed a twin cam 33 (FIG. 1), with whose shaped outline is kept engaged, by a spring 34, a stud 35 projecting from a pawl 36, the latter being engaged by a rotatable plate 37, which also engages a lever held at 38 upon which a spring 39 is active. The plate 37, having a fourteen pins 40, circumferentially evenly spaced apart, is keyed to an idle shaft 41, to which there is also keyed a set of six auxiliary drums 42 arranged in correspondence with the respective drums 12 and having the same axial length thereof. Each of the auxiliary drums 42 has fourteen circumferentially equally spaced apart axial grooves 43, in a few of which there are introduced (according to a preselected number and sequence) rectangular plates 44 having a length equal to that of the grooves aforesaid (FIG. 6). The plates 44, which protrude from the grooves in which they have been inserted, are intended for engagement by external projections 45 of the followers 29 so as to disengage the studs 31 of the followers from the comblike members 14 as selected each at the appropriate time.

In operation, the drive shaft 1 controls, as outlined above, the drum set 12 to make a step forward equal to one one-hundred forty-fourth of a revolution for every revolution of the shaft 1, so as to offer, each time, a different comblike member to be engaged by the followers 29. Simultaneously, the cam 18 is rotated and causes the follower 23 to go through nine groups of movement of clockwise rotation, translation in the direction of the arrow A and anticlockwise rotation; along with a tenth group of movements of clockwise rotation, translation in the direction of the arrow B and anticlockwise rotation. Correspondingly, as they are bound to the frame 26 by means of the shaft 27 and the springs 30, the followers 29 are displaced from one to another of the several retained and removed teeth of the comblike members 14 of the respective drums 12, and then, as they reach the last tooth of the respective comblike member, they are shifted so as to engage the first tooth of the next comblike member, by exploiting the combination of a step forward of the drums 12 and a shift of the timing device 22 of the follower 23 from one end to the other of the tenth sector having a rising portion 20 of the hollow space 19 of the cam 18. By so doing, during an entire revolution of the respective drum 12, each of the followers 29 scans 1440 teeth of comblike members, thus carrying out a programme as long as 24 hours, which is divided into one-minute intervals. During progress of the performance of such a programme, obviously, the microswitches 32 will deliver signals of different values (corresponding to actuation and de-energization of the respective utilizing devices) as a function of the engagement of the followers 29 either with retained teeth or removed teeth of the comblike members which are sequentially being scanned. FIGS. 9 and 10 show the operation of the studs 31 and the microswitches 32 in the two different conditions of engagement of the followers 29 with removed teeth 16 and retained teeth 15 of the comblike members.

At every half revolution of the drums 12, that is, every thirteenth hour, the twin cam 33 meanwhile controls first a slow lift and then an abrupt drop of the pawl 36, which thus causes the gear 37 to go a step forward concurrently with the drums 42. As one of the plates 44 engages the extension 45 of the relative follower 29, the latter, by staying lifted (FIG. 11), prevents its pin 31 from engaging the comblike member which has been selected at that instant of time. This fact involves the suppression of the programme during a period of time which, on account of the shape of the plates 44 and lhe rate of forward feed of the rotary plate 37, lasts as long as 12 hours. Since each drum 42 has 14 grooves 43 which can be fitted with plates 44, it becomes thus possible to provide one or more respites of a programme during 12 hours in the entire week span.

It should also be noticed that the particular unidirectional match obtained between the leaf spring 17 and the crown gear 10 permits to displace the drums 12 relative to the crown gear 10 and thus relative to the drive shaft 1, so as to preset the initial points of the several programmes.

What is claimed is:

1. A programming device comprising at least one cylindrical main drum, means for imparting incremental stepwise rotation to said drum about its longitudinal axis, said drum having formed on its outer cylindrical surface a plurality of circumferentially equi-distantly spaced apart axially extending longitudinal grooves corresponding to the number of rotational steps imparted to said drum during each complete revolution thereof; an elongate comblike member longitudinally extending in respectively each of said grooves and having teeth pointing radially outwardly of said drum and projecting therefrom, each said comblike member including a plurality of said teeth in longitudinally equally spaced apart relationship, at least some of said teeth being removed so as to provide preselective variable sequence of teeth and tooth gaps, a rotary cam operatively to said main drum; means for rotating said cam one revolution about its rotational axis for each incremental rotational forward step of said drum; a first cam follower in operative engagement with said cam; said rotary cam having a camming sequence defining as many work positions different from each other in correspondence with the maintained teeth and tooth gaps in each of said comblike members; at least one second follower engageable with the teeth of each said comblike member; means operatively connecting said second follower to said first follower so as to be movable from engagement with one teeth to engagement with a following one of said maintained teeth and tooth gaps of each said comblike member and, subsequently in conjunction with a forward incremental step of said drum into engagement with a first tooth of an adjacent following comblike member at each shift of said first follower from one to another of said work positions on said rotary cam; and signal generating means operatively connected to said second follower and adapted to emit signals of different values responsive to engagement of said second follower with either a maintained tooth or tooth gap of the comblike member being engaged thereby.

2. A programming device according to claim 1, said rotary cam including a peripheral groove extending thereabout, said groove being formed into a plurality of contiguous groove sectors conforming in number to the

teeth of one each of said comblike members, each but a last one of said groove sectors being formed by a first portion having an increasing radius and a constant height with respect to the cam rotational axis and by a second portion having a constant radius and a height which is variable with respect to the cam rotational axis, the last groove sector being formed by a first portion with increasing radius and a constant height with respect to the cam rotational axis and a second portion having a radius constant and a height variable in an inverse relationship with respect to the cam rotational axis so as to be connected with a first end of a first groove sector, the further end of each successive groove sector communicating with a first end of each subsequent contiguous groove sector by a step having a decreasing radius; said first follower comprising a timing mechanism maintained in engagement with said cam groove.

3. A programming device according to claim **2**, comprising an arm rotatable about an axis parallel to the axis of said main drum; means for translating said arm along said drum; said timing means being fastened to said arm; said second follower comprising a pin for actuating said signal generating means; a lever rotatable about an axis parallel to that of the drum slidably supporting said pin; resilient means connecting said lever to said arm so as to urge said lever into a condition of engagement of said pin with the teeth of the comblike member being selected from time to time, and said resilient means simultaneously impressing on said lever a rotation so as to be resiliently responsive to the rotation of said arm while fastened to said arm so as to follow the translational motions thereof.

4. A programming device according to claim **1**, comprising at least one auxiliary drum adapted to be incrementally rotated stepwise about its longitudinal axis; means operatively connecting said auxiliary drum to said main drum so as to be driven thereby through a forward incremental step for at least every fraction of revolution of said main drum, said auxiliary drum having on its outer cylindrical surface a plurality of circumferentially equidistantly spaced apart axially extending longitudinal grooves corresponding to the number of rotational steps imparted to said auxiliary drum during each full revolution thereof; a shaped plate being located in each of said grooves; an extension on the second follower being adapted to engage said plate so as to lift said second follower from engagement with the comblike member selected at that instant of time.

5. A programming device according to claim **1**, said main drum comprising **144** axial grooves, and each of said comblike members having **10** teeth including said maintained teeth and said tooth gaps.

6. A programming device according to claim **4**, said auxiliary drum having **14** axial grooves, said means operatively connecting said auxiliary drum to the main drum so as to impart to the former an incremental step forward at each half-revolution of said main drum.

7. A programming device according to claim **4**, comprises a plurality of further main drums; said further main drums being coaxial and integrally fastened to said main drum; and additional second followers being operatively connected to said first follower and said second follower adapted to simultaneously engage the comblike members of said additional main drums and in the same manner in which said first-mentioned second follower engages the comblike members of said main drum.

8. A programming device according to claim **7**, comprising additional auxiliary drums in coaxial relationship with and integrally fastened to said auxiliary drum, said additional auxiliary drums having grooves adapted to house additional shaped plates for disengaging said additional second followers.

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