

[54] PROGRAMMER

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[58] Field of Search 74/568 R, 568 M,
74/568 T; 66/50 A, 50 B, 156; 200/38 CA

[56] References Cited

UNITED STATES PATENTS

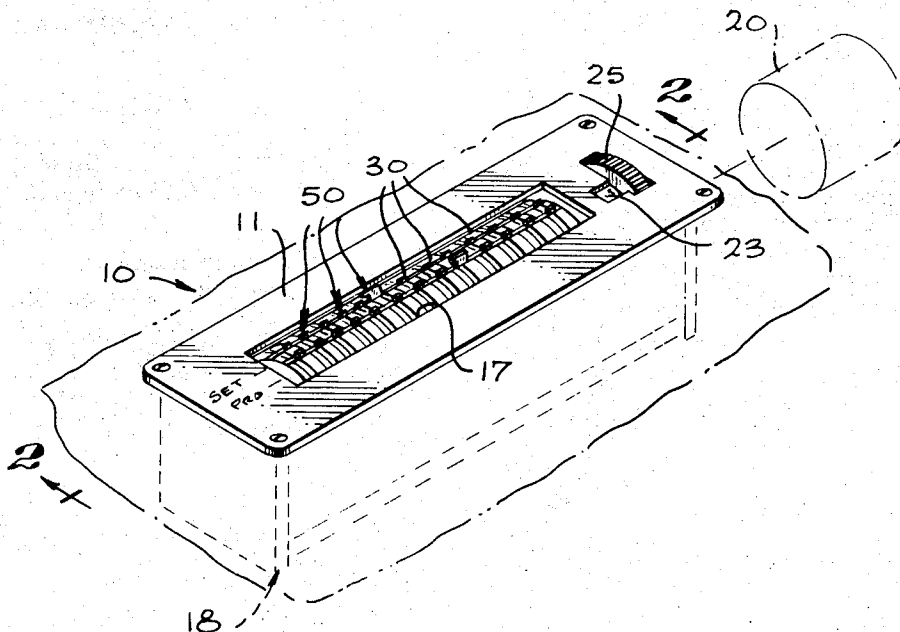
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[57] ABSTRACT

A drum programmer includes a plurality of individual cylindrical drum segments. Each drum segment is adapted to selectively engage an actuating device as a preplanned function of the rotated position of the segment. For this purpose each segment has a plurality of spaced grooves formed in the peripheral surface of the segment parallel to the axis of the cylinder. Each groove has an actuating tab rotatively positioned therein. The tab is adapted to engage an actuating device when its peripheral surface portion is proximate the device in a first stable rotated tab position. Means are also provided for supporting each tab in its respective groove in a second non-engaging stable rotated position. Any number of individual drum segments may be mounted in a coaxial manner to provide a programmer adapted to activate any desired number of actuating devices.

13 Claims, 8 Drawing Figures



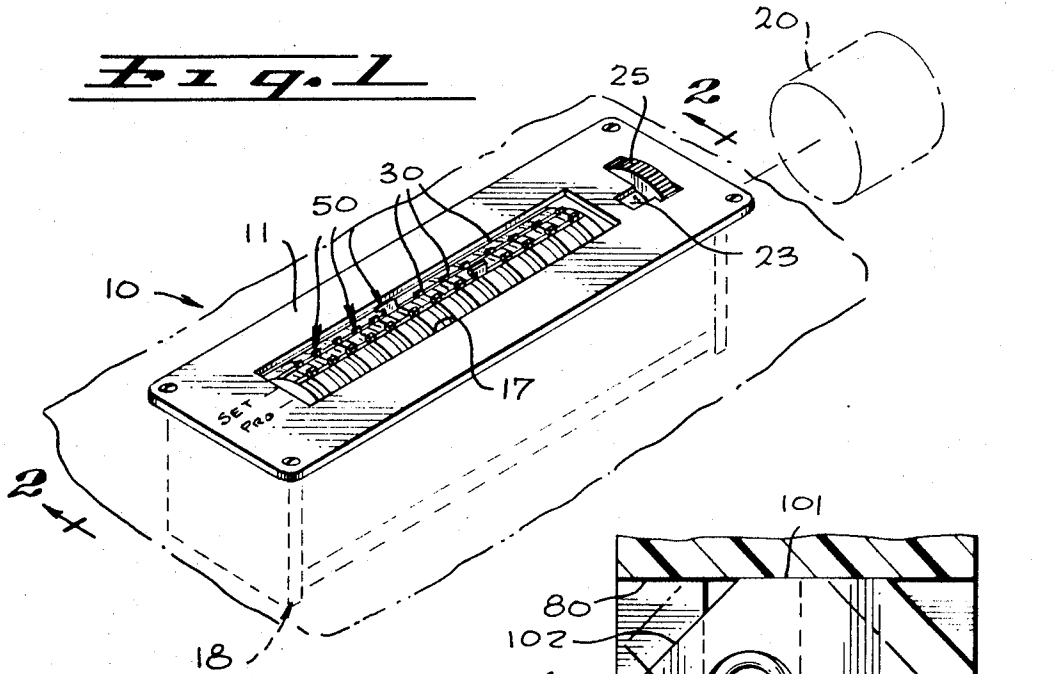
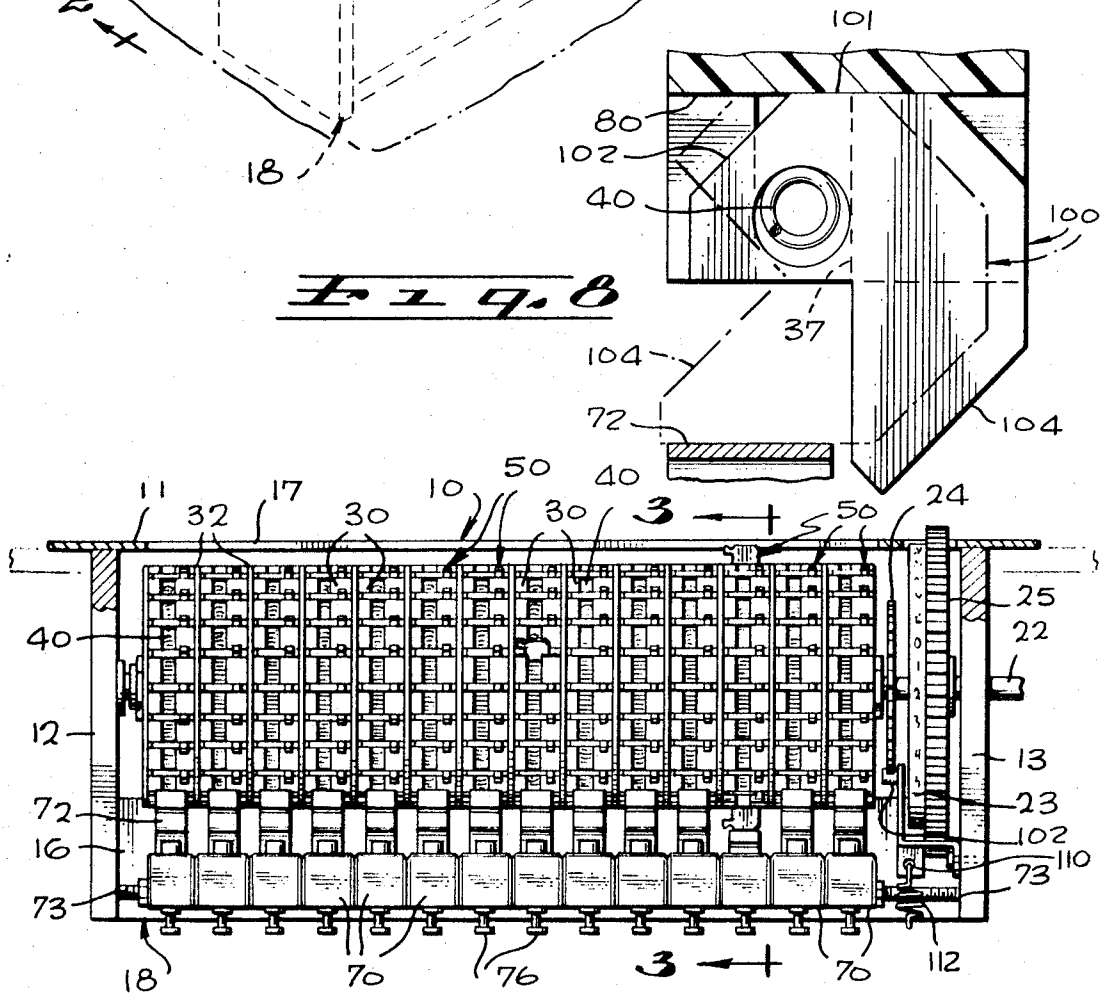


Fig. 2

Fig. 3

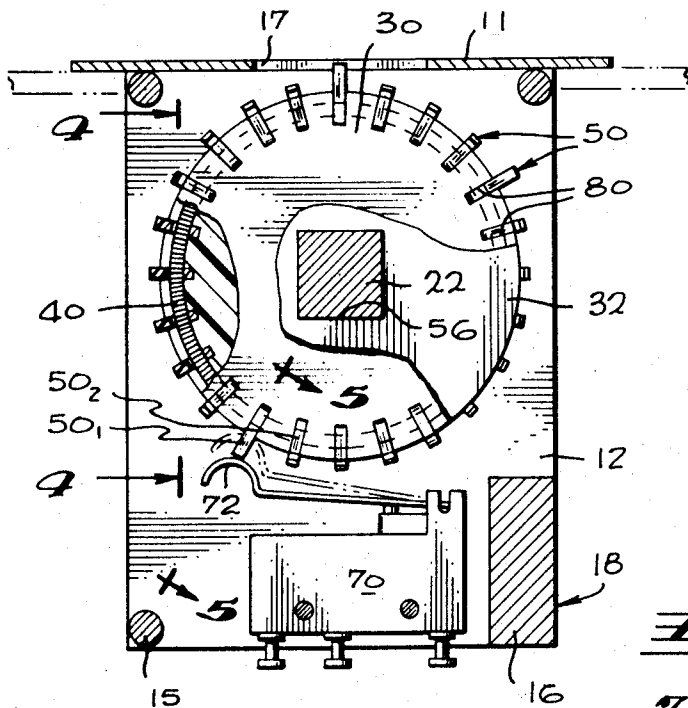


Fig. 4

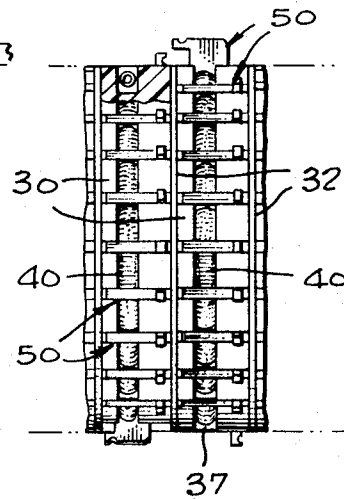


Fig. 5

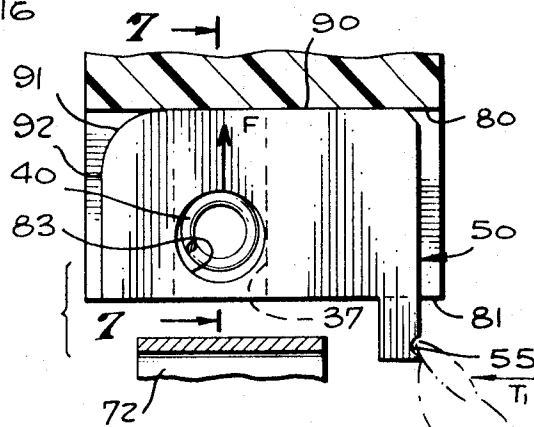


Fig. 6

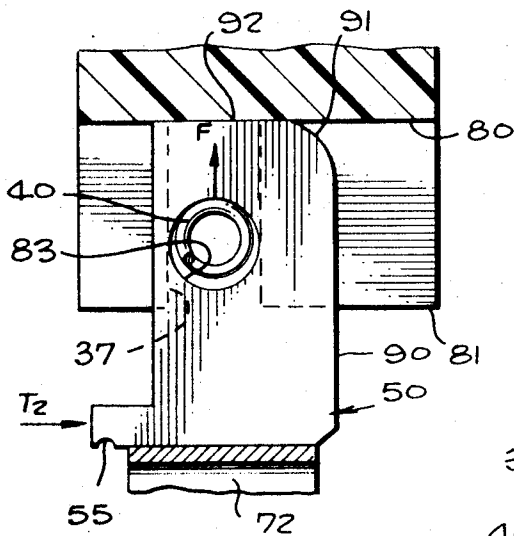
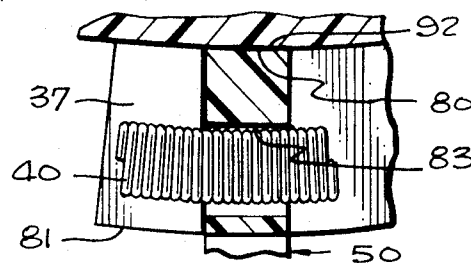


Fig. 7



PROGRAMMER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of this invention is programmers and, more particularly, drum-type programmers adapted to engage, in actuating relationship, one or more switches and the like as a selective function of the rotated position of the drum.

2. Description of the Prior Art

Programmer switches of the drum type find increasing use whenever timing and/or sequencing control is required. Typically, in the drum type of programmer, a cylindrical member is placed with its surface portion adjacent a linear array of switches or the like. The peripheral drum portion associated with each switch has a plurality of grooves formed in the surface. Actuating tabs are selectively positionable in each groove. The tabs are configured such that a tab portion extends beyond the surface of the drum. When the drum segment containing the tab passes proximate a corresponding switch, the tab engages and actuates the switch in accordance with a preplanned function of the angular drum position.

In most prior-art drum programmers the drum is formed from a single continuous section of cylindrical configuration. Therefore, a customized drum is required for each application requiring other than a standard drum length (as where one wishes to increase or decrease the number of switches utilized).

Typically, in prior-art devices, when setting up a desired program it is necessary to insert an individual actuator tab into each groove designated by the program for switch actuation. For this purpose special tab insertion and/or removal tools have been required. This procedure is undesirable since it is time consuming to insert individual tabs and requires access to a special tool. Further, not infrequently tabs are dropped and find their way into the associated equipment where they could interfere with the operation of such equipment. Also, known programming drums suitable for operating, for example, snap action switches are generally not suitable for applications where pneumatic switches or valves are utilized. This is so because the axial placement of the actuator tabs for the snap action switch applications generally do not correspond with axial tab placement requirements for other applications as when pneumatic switches are utilized. Accordingly, in such prior-art devices, special drums have been required to be fabricated for each special application.

A drum programmer capable of rapid program setting and modification and requiring neither special tools to effect the programming operation nor specialized drums for each application is highly desirable.

SUMMARY OF THE INVENTION

In accordance with the present invention a drum-type programmer is disclosed which is highly flexible in adapting to varying requirements and which does not require special programming tools.

The programming drum includes a plurality of individual, coaxial drum segments. Each segment is adapted to selectively engage an associated actuating device as a preplanned function of the rotated position of the segment. Each segment comprises a cylindrical drum unit having a plurality of spaced grooves formed

about the peripheral portion. The grooves are preferably parallel to the axis of the cylinder.

A plurality of actuator tabs are provided. One each is rotatably positionable in each groove selectively in either a first or second stable rotated position. Each actuator tab is adapted, in the first rotated position, to engage the actuating device when its associated peripheral drum portion is proximate said device. In the second rotated position the tab will not engage the actuating device.

In one described embodiment each drum segment has a circumferential groove formed in the peripheral surface of the segment. Each actuator tab is provided with an aperture passing therethrough adapted to align with the circumferential groove when positioned in the axial aligned grooves. A garter spring or the like is positioned in the circumferential groove. The spring is threaded through all of the tab actuator apertures to hold the actuators within their respective grooves. The actuators are configured so that they may be rotated between the above described first and second positions. The peripheral configuration of the actuator tabs are such that they remain stable in the groove in either position.

Programmers comprising any desired number of coaxially mounted individual drum units positioned in any desired linear relationship may be constructed by mounting each drum segment in a side-by-side manner. Spacers between each drum unit function to position the segments in the desired relative linear placement.

To set a program it is only necessary to rotate each actuator tab to the desired position by hand. A programming plate is provided which presents a single line of grooves to the programmer collatable with a desired program number and pattern. The programmer may be rotated in a thumb wheel fashion through 360° to effect rapid programming of the entire drum.

Still other features and attendant advantages of the present invention will be apparent to those skilled in the art from a reading of the following detailed description of several embodiments constructed in accordance therewith taken in conjunction with the accompanying drawings wherein like reference numerals indicate like and corresponding parts throughout the several views and wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a programmer constructed in accordance with the principals of the present invention;

FIG. 2 is an expanded sectional view taken along line 2—2 in FIG. 1 showing interior detail of the programmer switch constructed in accordance with the principals of the present invention;

FIG. 3 is an enlarged sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a sectional view taken along line 4—4 in FIG. 3;

FIG. 5 is an enlarged sectional view taken along line 5—5 of FIG. 3 and shows an exemplary actuator tab operatively located in a drum groove in a first position wherein it will not engage a switch actuating lever;

FIG. 6 shows the tab of FIG. 5 in a second position wherein it is adapted to engage a switch actuating lever position;

FIG. 7 is an enlarged sectional view taken along line 7—7 in FIG. 5;

FIG. 8 is an enlarged sectional view of an alternate embodiment of an actuator tab constructed in accordance with the principals of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1 there is shown a generalized perspective view of an exemplary programmer switch 10 constructed in accordance with the principals of the present invention. Among the features of the programmer shown in FIG. 1 is the presentation of collated drum segments at a window 17 of face panel 11 to allow programming of the entire switch from the face panel side in a manner to be hereinafter described.

Referring now additionally to FIGS. 2 through 4 programmer 10 includes a chassis 18 within which the working components are mounted. Chassis 18 comprises end plate members 12 and 13 interconnected by elongated support frame members 15 and 16. A plurality of side by side mounted rotor drum units 30 are coaxially mounted on a central shaft 22. Shaft 22 is in turn rotatively mounted and supported between end plates 12 and 13 as shown. Each rotor drum unit is preferably axially spaced from adjacent drum units by means of circular spacers 32. As shown best in FIG. 3 each drum unit has a noncircular aperture 56 adapted to have a correspondingly configured portion of shaft 22 pass therethrough so that each drum unit rotates with the shaft.

A bank of snap action switches 70 are mounted in a side-by-side relationship on chassis 18 between end plate members 12 and 13. The bank is supported on the end plates by means of switch mounting screws 73. One switch is associated with each drum segment. Each switch 70 has an actuating member shown as a switch actuating lever 72 positioned proximate the peripheral cylindrical surface portion of its associated drum segment 30. Each switch has a plurality of electrical terminals for connection to external utilization means as is well known in the art.

Referring now more particularly to FIGS. 3 through 7 there is shown the structure of an exemplary drum unit and the structure for coaction with an associated switch 70. It should be understood that each drum unit-switch configuration, for a given embodiment, is similar so that only one need be described in detail.

As shown each cylindrical drum segment 30 has a plurality of mutually spaced transverse grooves 80 spaced about the periphery of the drum. The embodiment of FIG. 3 illustrates a drum structure wherein 24 such grooves are employed. However, it will be appreciated that, within obvious physical limitations, any desired number of such grooves may be utilized. In addition to the transverse grooves 80 each drum segment has a circumferential groove 37 formed in the surface of the drum. Each transverse groove 80 is adapted to have a switch actuating tab 50 positioned therein.

Each tab has an aperture 83 positioned to align with circumferential drum groove 37 when the tab is positioned in transverse groove 80. A force exerting member such as garter spring 40 is positioned in circumferential groove 37 and passes through each tab aperture 83. The garter spring exerts a radial force F which tends to maintain tabs 50 stably within grooves 80.

Actuator tab 50 is adapted to rotate within groove 80 about an axis generally defined by tab aperture 83. Each tab is preferably configured to rotate between at

least two stable positions. Two exemplary stable positions are illustrated respectively in FIGS. 5 and 6. As shown in FIG. 5 tab 50 has an elongated edge portion 90 and a substantially perpendicular edge portion 92 which are joined together by an arcuate edge portion 91. In the position shown in FIG. 5 edge 90 rests on the bottom of groove 80 where it is stably maintained, as above described, by force F . In this position the tab does not extend beyond the outer peripheral surface 81 of drum 30 except for a lift notch portion 55 which is out of alignment with switch actuating lever 72. Therefore, in this position tab 50 will not actuate lever 72 when the drum portion containing tab 50 is proximate the lever.

To rotate tab 50 to its second stable position a force T_1 is applied, as by the illustrated finger, to the lift notch 55. This causes tab 50 to rotate clockwise about aperture 83 along the curve defined by arcuate portion 91 until it assumes a second stable position as shown in FIG. 6. In the position shown in FIG. 6 edge portion 92 rests on the bottom of groove 80. A portion of tab 50 extends sufficiently beyond the peripheral surface 81 of drum 30 so that the tab will engage switch actuating lever 72 when the surface portion of drum 30 containing tab 50 is rotated proximate the actuating lever.

To return tab 50 from the position shown in FIG. 6 to that shown in FIG. 5 it is only necessary to apply a force T_2 to the tab lift notch portion whereupon tab 50 will be rotated counterclockwise along the curve defined by arcuate portion 91 until tab edge 90 engages the bottom of drum groove 80 as shown in FIG. 5.

Many suitable actuator tab configurations may be utilized in accordance with the teachings of the present invention. It is only necessary that a tab configuration allow a tab to be positioned within a drum segment in two stable positions. In one position the tab should have a portion extending beyond the peripheral surface of the drum in engaging relationship with a related switch actuating lever for a given rotated position of the drum. In the other tab rotated position no portion of the tab should be engagable with the switch actuating lever regardless of the rotated position of the drum. A suitable exemplary alternate actuating tab configuration is illustrated in FIG. 8.

Referring now to FIG. 8 a tab 100 is shown in a first stable position in solid lines and in a second rotated stable position in dashed lines. In the first stable rotated position tab 100 has an edge portion 101 which rests upon the bottom of groove 80. In this position the tab has a tab portion 104 which, although it extends beyond the periphery of drum 30, is offset along the axis of the drum so that it will not engage switch actuating lever 72. However, if a force is applied to tab portion 104 so as to rotate tab 100 in a clockwise direction the tab will assume a second stable rotated position wherein edge portion 102 is adjacent the bottom of groove 80. This position is illustrated by the dashed lines in FIG. 8. In this position tab portion 104 will engage switch actuating lever 72 when its peripheral related drum portion is adjacent thereto.

Thus, for each drum unit and an associated switch any desired pattern of switch actuation as a function of the rotated position of the drum may be selected by simply rotating each actuator tab to the desired rotated position, that is either in a switch actuating lever engaging or nonengaging position. Thus, as best shown in FIG. 3, tab 50₁ has been rotated so that it will engage

and depress switch actuating lever 72 when its peripheral drum portion is adjacent the lever. In this position switch 70 will be operated. Rotating drum 30, one twenty-fourth of a revolution in a clockwise direction will remove tab 50₁ from engagement with lever 72 and move tab 50₂ into the closest position proximate lever 72. Tab 50₂, as shown, is in a nonactuating position. Thus, when tab 50₂ is proximate actuating lever 72 it will not engage the lever. Lever 72 will assume the position shown in dashed lines in FIG. 3 and will not actuate switch 70.

As above described and as more particularly shown in FIG. 2 a separate drum unit 30 is provided for each switch 70. A spacer 32 is preferably positioned between each contiguous pair of drum units. Spacers 32 may be used to vary the axial placement of each drum unit and also aid in retaining each tab properly positioned in its associated groove. Thus, where a programmer constructed in accordance with the principals of the present invention is desired to operate with switches having different physical and/or operating characteristics than those shown in FIG. 2 (as, for example, pneumatic switches) each drum unit may be placed further apart from or closer to contiguous drum units by varying the width of spacers utilized.

To accurately index the rotated drum assembly a detent wheel 24 is affixed to drive shaft 22. The wheel 24 has a plurality of notches positioned about the periphery one each in alignment with each desired rotated position of the drum assembly (24 such detents would be provided in the specific embodiments as described herein). A spring-urged detent engaging assembly 110 includes a roller 102 adapted to move about the outer periphery of the detent wheel when sufficient torsional force is applied to shaft 22 to overcome the spring-applied forces of spring 112. The wheel 102 will, in the absence of such torsional forces, prevent the shaft from rotating and it thus functions to align the drum assembly in a precise rotated position in a manner well known in the art.

As shown, referring now particularly to FIGS. 1 and 2, thumb wheel 25 and an indicia strip 23 are also mounted upon shaft 22. Torsional forces may be applied to shaft 22 by means of the thumb wheel. Shaft 22 and the entire drum assembly may thus be manually rotated from the front of the programmer. For each rotated position of the drum assembly a given row of actuator tabs will be presented at the center of window 17. The left most drum unit is preferably provided with indicia (not shown) indicating the particular rotated tab line being displayed. The indicia strip 23 adjacent the thumb wheel preferably indicates the tab line at that moment closest to the switch actuating levers.

By means of the thumb wheel 25 the entire drum assembly may be rotated in either a clockwise or counterclockwise direction providing access for an operator to the entire programmer assembly from the front. This enables rapid set up, or modification of the drum program.

In operation the programmer switch can be manually operated as by utilizing thumb wheel 25. If desired, power drives as indicated by motor 20 in FIG. 1 may be utilized. Power drives may be continuous or intermittent motor operated including timing or feedback functions as desired and as known in the art. Various types of mechanically actuated switches or valves may be utilized so long as the actuating mechanism is com-

patible with an actuator tab. Although the described embodiments show a bank of 14 snap action switches, obviously the programmer may be modified to utilize any desired number of sensors. The programmer of the present invention may be made extremely compact and light weight. Further, no special tools or separate actuating tabs are required to set or modify a program.

I claim:

1. A programmer drum structure adapted to engage an associated sensor as a function of the rotated position of the drum, comprising:

- a cylindrical drum segment having a plurality of spaced transverse grooves and a circumferential groove formed in the peripheral surface thereof;
- a plurality of sensor actuator tabs positionable one each in each transverse drum groove, each tab being configured to assume at least first and second stable rotated positions, each tab having an aperture therethrough alignable with said circumferential groove; and

means for rotatively supporting said tabs in said grooves.

2. The structure of claim 1 wherein said supporting means comprises:

- a force exerting member positioned within said circumferential groove and threaded through said tab apertures, said member applying a force to each tab in a radial direction toward the center of the drum segment whereby the force exerting member will retain each rotatable tab within its respective transverse groove.

3. The structure of claim 2 wherein said force exerting member is a garter spring.

4. The structure of claim 2 wherein each tab is configured so that in said first rotated position it remains substantially wholly within its transverse groove and in said second rotated position it has a portion extending sufficiently beyond the peripheral surface of the drum segment to engage the associated sensor when the tab is proximate the sensor.

5. The structure of claim 4 wherein each tab is further configured so that in said first rotated position a lift notch portion of the tab extends beyond the peripheral surface of the drum segment sufficient to allow manually applied torsional forces to be applied to the tab to cause rotation thereof, said lift notch portion remaining out of engagement with the sensor when said tab is in its first rotated position.

6. The structure of claim 5 wherein said drum segment has an aperture passing through the center thereof, said programmer further comprising a rotatable shaft passing through said drum segment aperture and adapted to rotate the drum segment in association therewith.

7. A programming device including a plurality of coaxial drum segments for selectively engaging associated actuating devices as a preplanned function of the rotated position of the segments, said device comprising:

- a plurality of cylindrical drum segments each having a plurality of spaced transverse grooves and a circumferential groove formed in the peripheral surface thereof;

a plurality of actuator tabs, one each rotatably positionable in each transverse groove in first and second stable rotated positions, each actuator tab adapted in said first rotated position to engage its associated actuating device when its peripheral sur-

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face portion is proximate the actuating device, each actuator tab having an aperture therethrough alignable with said circumferential drum groove; and

means for rotatively supporting said tabs in said 5 grooves in said first and second stable rotated positions.

8. The device of claim 7 wherein said supporting means comprises a force exerting means positioned in the circumferential groove and passing through each 10 tab aperture for exerting a radial force on said tabs in the direction towards the center of the drum.

9. The device of claim 8 wherein each drum segment has a central aperture passing therethrough, said device further comprising a rotatable shaft passing through 15 each drum segment central aperture and engaging each segment in a non-relative rotatable relationship whereby each segment will rotate with said shaft.

10. The device of claim 9 further comprising:
a plurality of spacers positioned on said shaft be- 20
tween each pair of drum segments.

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11. The device of claim 10 further comprising:
a support assembly including end plates and at least one support member interconnecting said end plates;

means for rotatively mounting opposite ends of said shaft between said end plates;

means for mounting the actuating devices proximate the drum segments on the support assembly.

12. The device of claim 11 wherein each transverse groove on each drum segment is aligned with corre- 10 sponding transverse grooves on adjacent drum segments to form rows of aligned transverse grooves.

13. The device of claim 12 further comprising:

a face plate mounted between said end plates and having a longitudinal aperture therethrough of width sufficient to display at least one row of trans- 15 verse drum grooves; and

means attached to said shaft for rotating said shaft to display consecutive rows of transverse drum grooves at said face plate aperture.

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