

Sept. 30, 1969

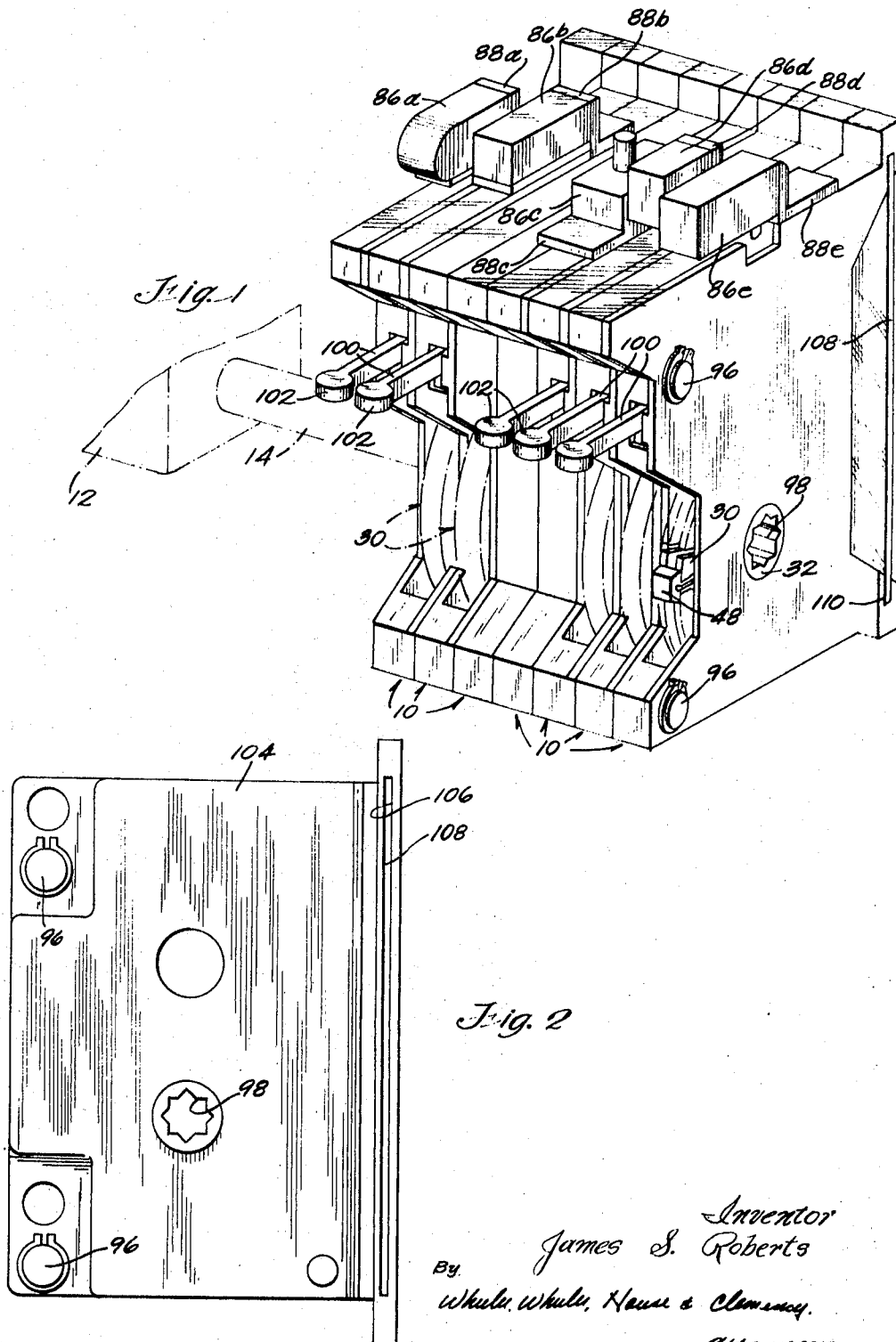
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3,470,335

STEPPING CAM CARTRIDGE ASSEMBLY

Filed July 27, 1967

3 Sheets-Sheet 1



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3 Sheets-Sheet 3

Fig. 4

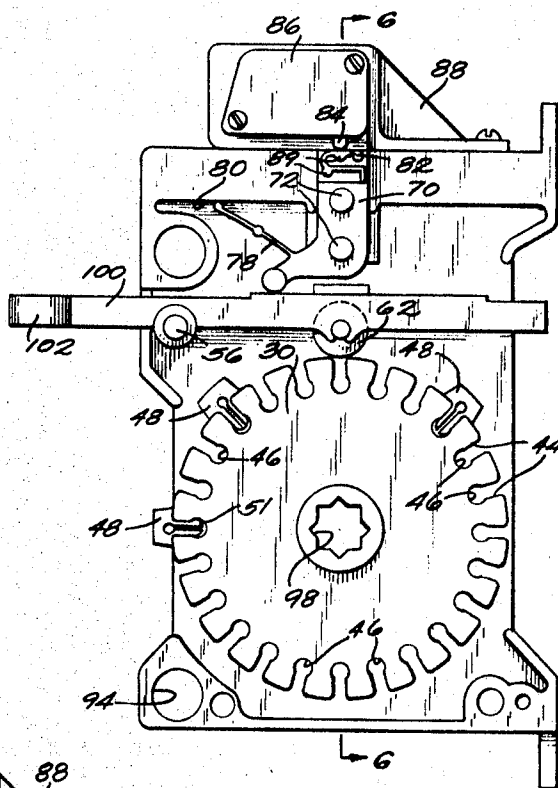
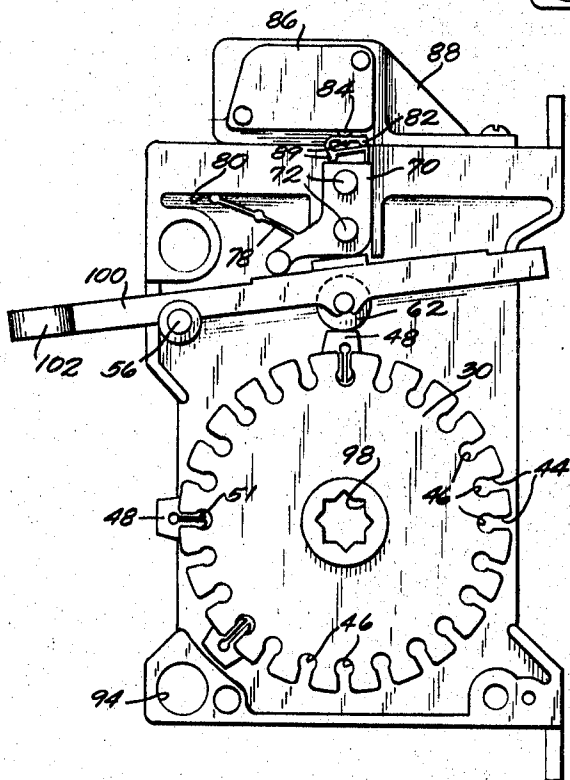


Fig. 5



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1

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STEPPING CAM CARTRIDGE ASSEMBLY

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9 Claims

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a stepping cam cartridge which includes a rotatable cam disc having selectively removable cam plugs positioned on the outer periphery of the disc to activate a switch in a sequence through an overriding lever and a switch actuator. The cartridge is stackable with any number of similar cartridges with the cam disc in each cartridge aligned with the other cam discs in the stack so that they can be driven by a common drive motor.

BACKGROUND OF THE INVENTION

This invention relates to an automatic program controller of the rotatable drum or adjustable cam type and more specifically to a stackable stepping cam cartridge.

Drum or cam type programmers presently available have a single drum or row of cams located in close proximity to a row of switches separately mounted on a common bracket independent of the drum or cams. The drum has a number of circumferential rows of holes or slots into which switch activating cam plugs are inserted in accordance with the program of operation desired for the switches. Since the switches and drum are separately mounted it is not uncommon for the switch bracket to become misaligned with the drum. This is also true of specially cut or adjustable cams. Under these circumstances the separate switches may become misaligned with the respective switch actuator buttons in the drum or lobes of the cams, thus disrupting the proper actuation of the switches. Also, since the drums are provided in standard lengths the controller can only be adapted to a smaller number of switch functions by disconnecting or failing to use certain switches and eliminating plugs in the corresponding holes in the drum. This often results in the purchase of a piece of equipment having more switches and a greater drum length than necessary to control the number of functions in the system to be controlled.

SUMMARY OF THE INVENTION

To overcome this problem, the present integrated programmable switch cartridge was designed to be stacked with similar cartridges to provide the exact number of function switches for a particular system. As more or less switches are required in the system cartridges can be added or removed from the stack. Each cartridge has a cam disc mounted for rotary motion within a case with a number of equally spaced radial slots or sockets provided about the periphery of the cam disc. One or more cam plugs can be inserted into the slots or sockets on the periphery of the disc according to the number of times a switch is to be actuated in each revolution of the cam disc. On rotation of the cam disc the cam plugs will engage a roller mounted on a manual override and signal lever pivotally mounted in the case. The motion of the override lever is transferred to a switch actuator which is mounted for reciprocal motion in the case and actuates a switch mounted on the outside of the case. When the cartridges with the cam discs are stacked in axial alignment a single drive shaft may be

2

inserted through the cam disc in each cartridge so that they will rotate as a unit. With this arrangement each cam disc and its switch are spatially integrated in the same cartridge and will always be in alignment regardless of external conditions.

Other objects and advantages will become apparent from the following detailed description when read in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of a number of cartridges shown in a stacked relation.

FIG. 2 is a side view of an end plate or spacer.

FIG. 3 is an exploded view of one of the cartridges.

FIG. 4 is a side view of a cam cartridge with the cam roller riding on the surface of the cam drum disc.

FIG. 5 is a side view showing the switch in the actuated position.

FIG. 6 is a cross-section taken on line 6—6 of FIG. 4, added stacked cartridges being indicated in broken lines.

Referring to the drawings, particularly FIG. 1, a number of stepping cam cartridges 10 are shown stacked to provide a programmer. A single drive motor 12 is mounted on the end of the stack with the step type drive shaft 14 extending through each cartridge to drive the timer.

Each cartridge with integrated cam disc and switch is the equivalent of a self-contained complete segment of a drum controller. Each cartridge 10 in the programmer has a case 24 and a cover 26 held together by a number of screws 28. A cam disc 30 is mounted for rotary motion within the case and cover by inserting hub 32 into aperture 34 in the cover and hub 36 in aperture 38 in the case. A groove is formed in the outer periphery of the cam disc to define radially directed flanges 42 on each side of the periphery of the disc. Paired key-hole slots or sockets 44 are formed in the flanges 42 and terminate in arcuate recesses 46.

Cam plugs 48 having a split shank 50 are removably mounted on the cam disc by inserting the shank into a selected pair of said slots. The cam plugs are made of a plastic material having an inherent resiliency and the shank is made slightly wider at the end 51 than the width of the slot. When the shank is inserted into a slot, it will be squeezed together and will expand when the enlarged end seats in the recess 46 at the bottom of the slot. A flange 52 on the plug matingly engages groove 40 on the periphery of the cam disc to hold the cam plug in alignment on the disc. One or more plugs may be inserted in the slots on the cam disc depending on the number of times the switch is to be actuated in each revolution of the disc.

As the cam disc rotates the cam plugs on the disc will engage a roller 62 mounted on an override lever 54. The roller has a through axle 64 (FIG. 6) that snaps into arcuate recesses 66 on the bottom of lever 54 to allow the roller to rotate freely on the lever. The override lever is pivotally mounted on an integrally molded bearing boss 56 which is seated in aperture 58 in the case and aperture 60 in the cover. Lever 54 is biased toward the cam disc by a plastic switch actuator 70 mounted for reciprocating motion between shoulders 74 on the cover and complementary shoulders 76 on the case. Two knobs 72 are provided on each side of the switch actuator and are positioned between the shoulders on the case and cover to hold the actuator in alignment for reciprocating motion. A spring arm 78 is molded as an integral part of the actuator 70 and projects outward from the actuator into engagement with a flat surface 80 on the case. The arm is made of resilient plastic and will bend each time the actuator is moved by the override lever 54, thus providing a return bias for the actuator and lever.

A switch 86 is integrated with the cam disc 30 in its

cartridge by mounting it on bracket 88 which is secured to the top of the cartridge case to be actuated by the switch actuator 70 each time the actuator is moved by the cam plug 48. The switch has a switch button 85 that extends into an opening 87 in the top of the case so that it is aligned with the switch actuator 70. A serpentine plastic spring member 82 molded integral with the top of the actuator acts to cushion the engagement of the actuator with the switch button. This member is sufficiently flexible to provide an initial cushion but small tabs 89 are provided at the turns of the member 82 to assure positive actuation of the switch.

The switch bracket 88 shown in the drawing is held in position by a single screw 90 which is secured into a nut 92 located in one of the multiple mounting recesses 91 in the case. A pin 93 molded on the bottom of the bracket is aligned in another of the recesses 91 to hold the bracket in alignment. With this arrangement any number of different shaped brackets 88a, 88b, 88c, etc. (FIG. 1) can be mounted in the top of the case to hold any of the conventionally available switches 86a, 86b, 86c, etc. in position for engagement by the switch actuator. Switches 86a, 86b, etc. can be identical or different, depending on the function controlled thereby. They can be electrical, pneumatic, hydraulic, etc., they can be large, small or with the same or different mounting center requirements. Regardless of size or type, each switch and respective cam disc are spatially referenced to the common cartridge in which they are mounted ensuring perfect alignment at all times.

A number of apertures 94 are provided in both the cover and the case of each cartridge and properly aligned rods 96 can be inserted through the apertures to hold the cartridges in stacked relation. Step type driving motor 12 or any other common drive mechanism having drive shaft 14 is desirably mounted on the end of the stack with the shaft extending through the apertures 98 in the cam discs to drive the discs to a common time base. The cam discs are yieldingly held in each switch position by one or more ball detents 99 positioned in openings 101 in the surface of the disc. Each ball is biased into engagement with a circle of recesses 103 on the surface of the cover or case by a cantilever type arm 105 molded integral with the disc. The ball is free to roll in the opening and will roll into each recess as the disc is rotated in a step-by-step manner.

An extension 100 is provided on one end of the override lever 54 to indicate the momentary status of the switch and to enable control personnel to actuate the switches manually. A similar extension 101 is provided on the other end of lever 54. This allows for the manual actuation of a function switch out of the preset sequence of operations established by the location of the cam plugs in the discs. Extensions 100, 101 project beyond the edge of the cartridges. Extension 100 has an actuating button 102 on the end and when depressed will pivot the arm and move the switch actuator against the switch button. The override lever may be omitted from the cartridge and the cam plugs allowed to engage the actuator directly if an override lever is not considered necessary.

The stack of cartridges may be provided with an end plate 104 (FIG. 2) on each end of the stack. A groove 106 is formed in the plate to hold a clear plastic panel 108 in grooves 110 on the back of the cartridge cases.

Although only one embodiment of the present invention has been shown and described it should be apparent that various changes and modifications can be made.

What is claimed is:

1. A stepping cam cartridge assembly to be stacked with other assemblies to form a multi-channel programmer comprising
 - a plurality of self-contained cartridges each having a case,
 - a cam disc mounted for rotary motion in the case,

and adapted to be driven with other discs in other cartridges by a common drive, selectively positionable cam plugs mounted on the cam disc,

and a function switch mounted on the case in spatially referenced relation to the disc.

2. The stepping cam cartridge assembly of claim 1 in which each said cartridge also has actuating means to actuate the switch each time one of the cam engages the actuating means.

3. A stepping cam cartridge assembly according to claim 2

wherein said actuating means comprises

a molded plastic member having an arm projecting outward from the member into engagement with the case, said arm being bent on movement of said member toward said switch means to provide a return bias toward said cam disc.

4. A stepping cam according to claim 3 wherein said molded plastic member includes

a serpentine contact arm for engaging said switch means,

said contact arm providing a cushion between the molded plastic member and the switch means.

5. An assembly according to claim 1 including an override lever pivotally mounted in the case and positioned to transfer the cam motion to the switch whereby said function switches may be manually actuated out of the programmed sequence.

6. An assembly according to claim 1 wherein said disc includes a number of radially directed sockets and said cam plugs having a split shank which provides an outward bias when the shank is inserted in one of the sockets.

7. A stepping cam cartridge comprising

a case,

a cam disc mounted for rotary motion within said case and adapted for connection to a common drive, said cam being socketed at equally spaced intervals about its periphery,

at least one cam plug positioned in one of said sockets,

an override lever mounted in said case,

and a plunger mounted for reciprocating motion in said case and including means to bias the plunger against the lever arm and the lever arm toward the cam disc,

and a switch mounted on the case in spatially integrated relation to said cam disc and with its actuator positioned for engagement with the plunger,

whereby on each complete revolution of the cam the switch will be actuated each time a cam plug engages the lever.

8. In a rotary multi-channel programmer having a step type drive means, the combination therewith of cam switch cartridge assemblies adapted to be driven by said drive means each of said assemblies comprising

a case and a cover,

a cam disc mounted for rotary motion within said case and cover,

said cam disc having a number of equally spaced sockets about its outer periphery,

at least one cam plug means positioned in a predetermined socket in said cam disc,

switch actuating means toward the cam disc,

tion within said case and cover, biasing means integral with said switch actuating means to bias the switch actuating means towards the cam disc,

and a switch mounted on said cartridge in spatially integrated relation to said cam disc in a position to be actuated by said actuating means,

said cartridge assemblies being stacked together to form the multi-channel programmer with the step type drive means connected to drive the cam discs in each of the assemblies.

5

9. In a multi-channel programmer according to claim 8 wherein each cartridge assembly includes a pivotally mounted override lever, said lever being positioned to respond to engagement by a cam plug on the cam disc and to move the switch actuating means to actuate a switch, each lever manually movable to move the switch actuating means and achieve a switch independent of the cam plug.

5

6

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HERMAN O. JONES, Primary Examiner

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,470,335 Dated September 30, 1969

Inventor(s) James S. Roberts (Milwaukee Chaplet & Mfg. Company, Inc.)

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, Line 25, "hydraulic" should read --hydraulic--

Column 4, Line 64, DELETE "toward the cam disc," INSERT
CLAIM 8, -- mounted for reciprocal mo- --

Column 4, Line 71, "assembiles" should read --assemblies--
CLAIM 8,

SIGNED AND
SEALED

FEB 17 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents