

[54] **ROTARY PROGRAMMER WITH DECLUTCHABLE CAMS AND TOOL OPERATED ADJUSTABLE MOUNTING MEANS**

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[58] Field of Search **74/568 R, 568 T; 200/38 R, 200/38 B, 38 BA, 38 C, 38 CA, 153 LB, 27 R, 27 B, 31 R, 293**

[56] **References Cited**

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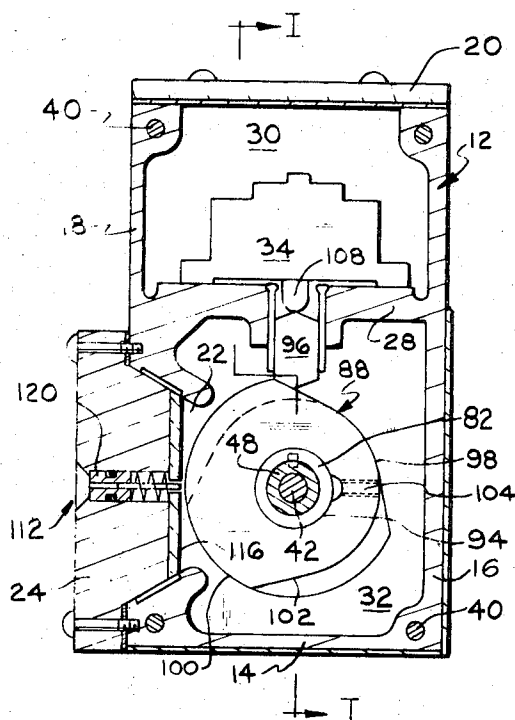
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[57] **ABSTRACT**

A rotary programmer utilizing rotating cams actuating control members such as electric limit switches or valves, wherein the programmer is driven by a rotating shaft concentric with the shaft upon which the cams are mounted. A clutch mechanism externally located of the cam enclosing housing selectively clutches the driven shaft to the cam shaft to permit rotation of the cam shaft and cams relative to the driven shaft for adjustment purposes. The clutch mechanism is so constructed as to present no safety hazard as the same rotates, and an axial displacement of the clutch member produces clutching and declutching of the cam shaft to the driven shaft. A further feature of the invention utilizes exteriorly operated cam adjustment means permitting adjustment of the cams on the cam shaft by the use of the clutch mechanism without entering the cam housing.

12 Claims, 10 Drawing Figures



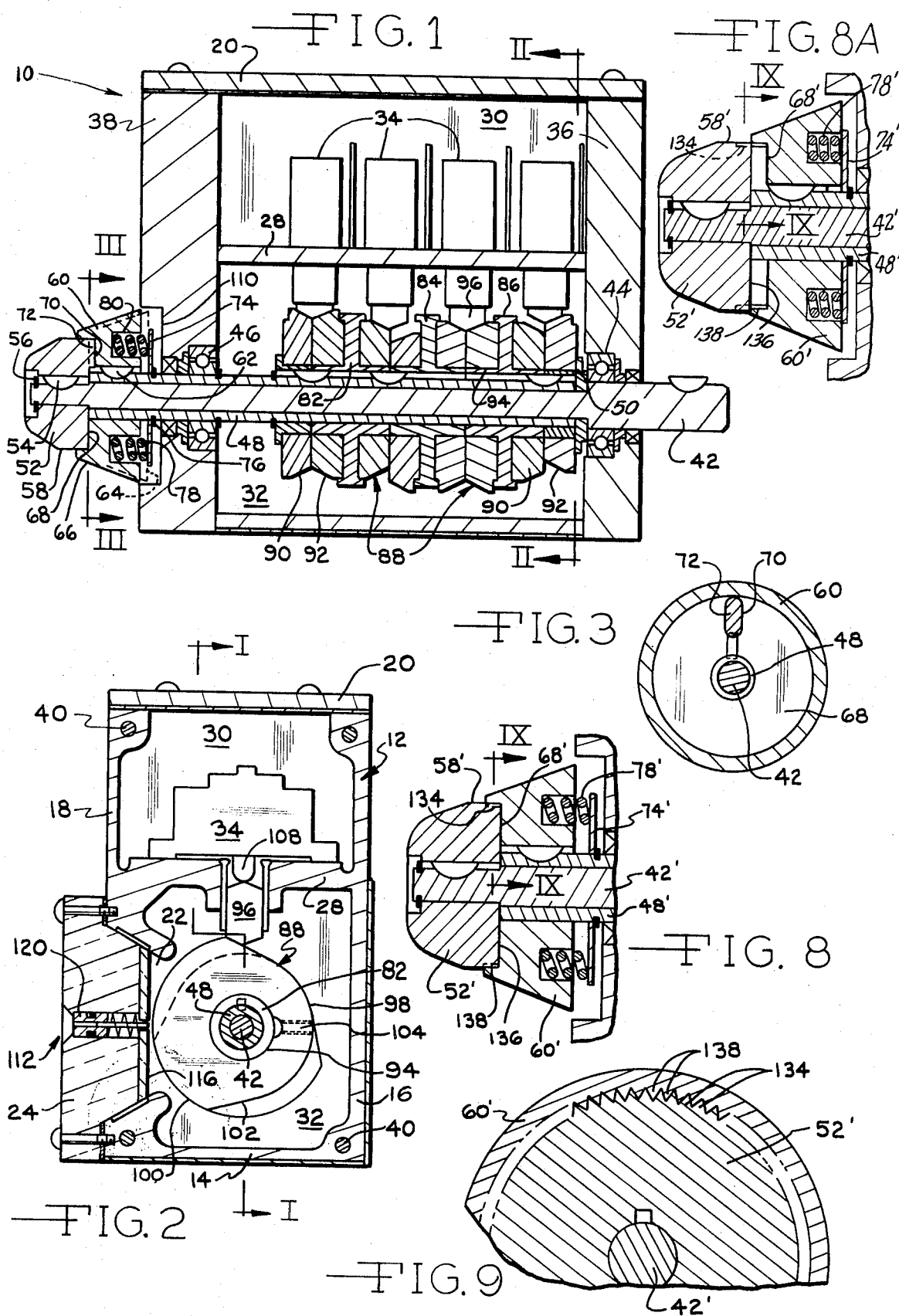


FIG. 4

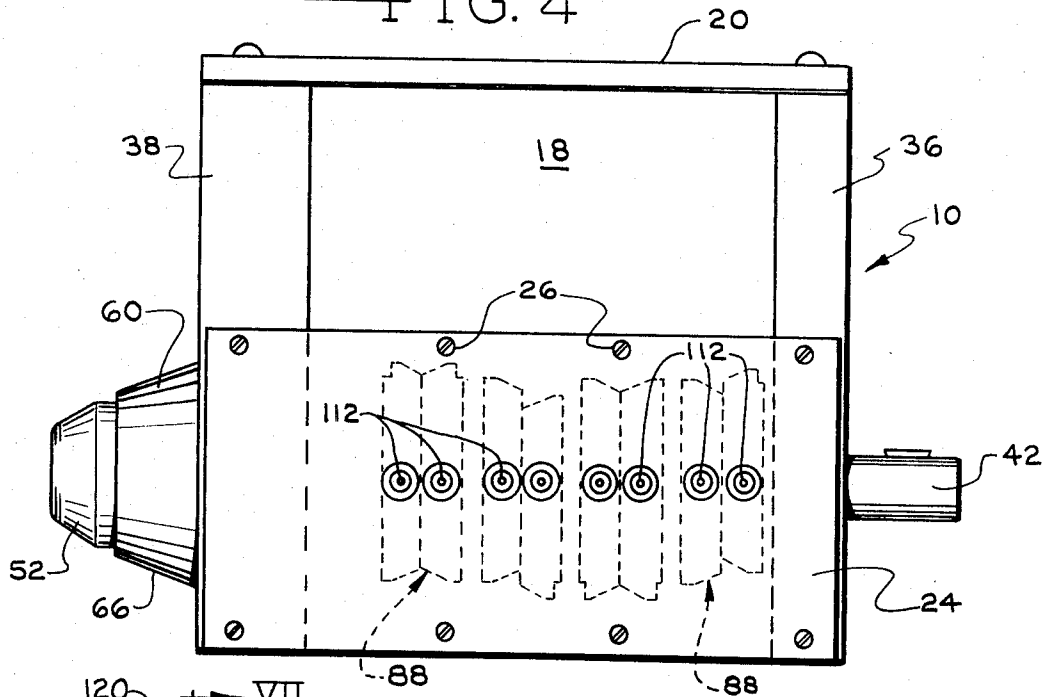
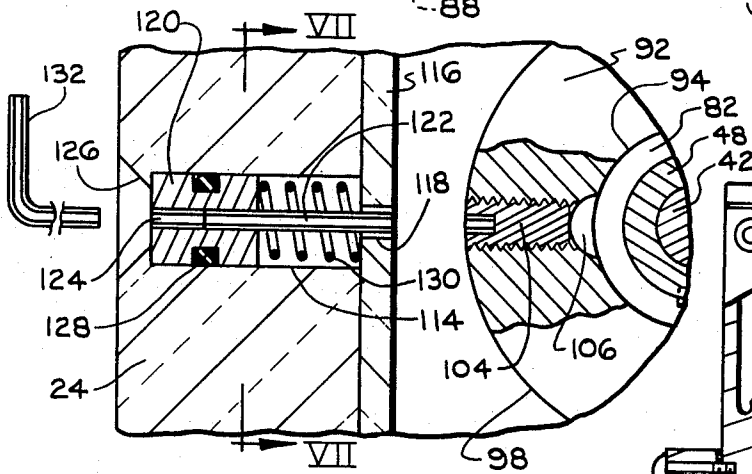


FIG. 6

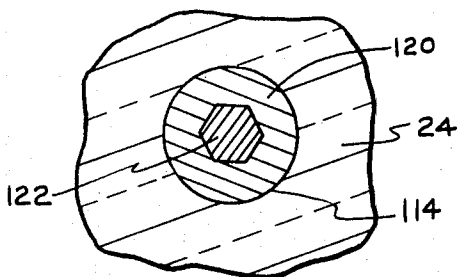


FIG. 7

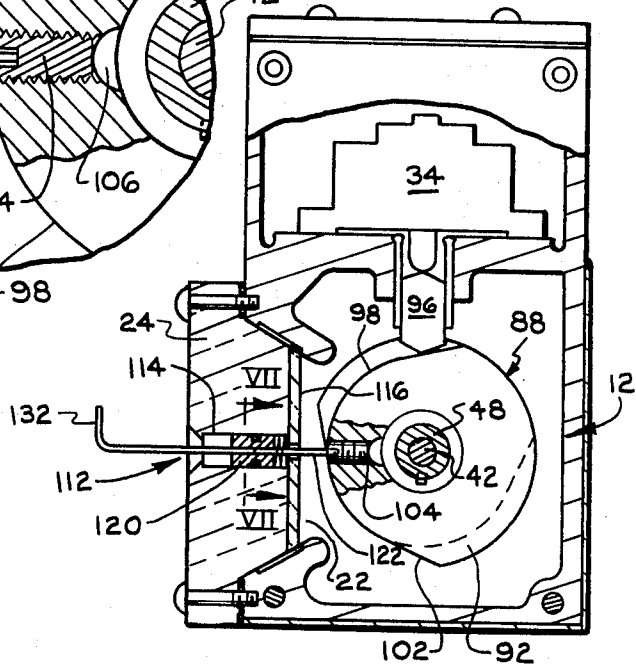


FIG. 5

ROTARY PROGRAMMER WITH DECLUTCHABLE CAMS AND TOOL OPERATED ADJUSTABLE MOUNTING MEANS

BACKGROUND OF THE INVENTION

The invention pertains to rotary programmers of the cam type wherein the shaft upon which the cams are mounted may be selectively disengaged from the cam rotation power source.

Rotary programmer devices are used to control the sequential cyclic operation of machine tools, or other apparatus, wherein sequential operation of control elements is required. Such rotary programmers include a driven shaft rotated by the machine being controlled, or a timing mechanism, such as a timing motor. Usually a plurality of cams are mounted upon the driven shaft for rotation thereby, and the periphery of the cams is engaged by a control member, such as a limit switch or a valve actuator. As the cams rotate the difference in the radial peripheral dimension actuates the control member as desired producing a cyclic operation of the control members during each rotation of the driven shaft.

The duration between the operation of the various control members is determined by the angular position of the controlling cam on the driven shaft. Thus, adjustment of the timing of the rotary programmer is made by rotating the cam with respect to its driven shaft, and the various cams of a common programmer are adjusted relative to their driven shaft, and each other, to produce the desired sequence of operation.

Various types of devices have been used to adjustably mount the cams upon the associated driven shaft, and reference is made to U.S. Pat. Nos. 3,221,117 and 3,364,317. It will be appreciated that it is necessary to very accurately adjust the cams upon their driven shaft in order to produce an accurate sequence of operation, and the most common apparatus employed to adjustably affix the cams of rotary programmers to their driven shaft is by a threaded set screw. Such set screws normally radially extend through the cam, and may bear directly upon the shaft or upon a wear plate or shoe which engages the cam shaft.

The cams and control members are normally mounted within a housing, and the presence of the housing limits access to the cams, and the adjustment means therefor. Usually, the housing includes an access door or panel, and it is necessary for the access panel to be removed from the housing and the cams to be oriented to the housing access opening in a predetermined manner in order to provide access to the adjustment means. Thus, it is necessary to rotate the shaft upon which the cams are mounted in order to permit adjustment of the cams on their shaft, and the machine driving the driven shaft must be "jogged", or the timing motor must be started and stopped, in order to properly locate the cam adjustment means to the housing access. Such rotation of the cams is very troublesome and time consuming, and has been a major objection to rotary programmer devices. Cam adjustment mechanisms have been proposed whereby adjustment means other than set screws are used, but such devices are expensive to manufacture and usually require considerable space resulting in unduly large programmer housings.

Another disadvantage of prior art programmers results from the necessity of removing an access panel to permit access to the cam adjustment means. If frequent adjustments are required the operator often will not replace the panel permitting dust, oil and other foreign matter to enter the cam housing, and for optimum performance the programmer housing should be oil tight to prevent an accumulation of oil, dust, etc., on the cams and other operating parts. It is most difficult to insure that the access panel will be replaced each time a cam adjustment is made.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a rotary programmer device using a plurality of rotating cams actuating control members wherein the cams are mounted upon a cam shaft selectively clutchable to the programmer driven shaft whereby the cams may be selectively rotated independently of the driven shaft permitting the cam adjustment means to be easily oriented to predetermined portions of the programmer housing, and also permitting the cams to be quickly changed with respect to their rotational orientation to the driven shaft.

Further, it is an object of the invention to provide a rotary programmer having a cam clutch mechanism which may be safely used and the clutch mechanism is free of any projections or surfaces which may tend to snag the operator's clothing, or harm fingers.

Another object of the invention is to provide programmer cam adjustment means which may be operated exteriorly of the cam housing without breaking the "seal" of the housing and wherein the cam clutch mechanism permits such cam adjustments to be easily, quickly and accurately made.

In the practice of the invention the rotary programmer includes a housing in which a shaft driven by the machine being controlled, or a timing motor, is rotatably mounted. A cam shaft is concentrically rotatably mounted upon the driven shaft and a plurality of cams located within the housing are mounted upon the cam shaft having set screw adjustment means for varying the angular relationship of the cams to the cam shaft. Free ends of the driven shaft and cam shaft extend exteriorly of the housing, and a clutch mechanism is mounted upon the shafts' free ends permitting selective driving engagement and disengagement between the driven and cam shafts. The clutch mechanism includes a movable clutch member keyed to the cam shaft and selectively engageable by axial movement with a dog or splines defined upon a key member fixed on the driven shaft. Spring biasing means bias the clutch member toward the key member tending to engage the cam shaft clutch member with the key member, and this biasing force may be readily overcome by manual force permitting rotation of the cam shaft, and cams, independently of the driven shaft.

In the disclosed embodiment the key member mounted upon the driven shaft is in the form of a knob having a smooth surface concentric with the axis of driven shaft rotation. Likewise, the clutch member comprises a component having an exterior surface concentric with the coincident axis of the driven and cam shafts, and this exterior surface is tapered to facilitate the application of an axial force thereto for declutching purposes. The smooth configuration of both the key and clutch members prevents these members, even

when rotating, from snagging or otherwise harming the operator.

Integrity of the sealing of the programmer housing during cam adjustment is maintained by using cam adjusting means which is operated exteriorly of the cam housing. The cams use radial set screws for fixing the cam in the desired rotational position on the cam shaft. A transparent panel mounted on the housing includes a set screw actuator for each cam which is movable into and out of engagement with a cam set screw and is sealed with respect to the panel, and housing. The set screw actuators include an Allen wrench extension mounted in an axially movable plunger sealed to a transparent plastic panel. The outer end of the plunger is exteriorly accessible and includes an Allen wrench socket. When the cam associated Allen socket cam set screw is axially aligned with the plunger and extension the plunger is axially displaced to insert the extensions into the set screw socket and rotation of the plunger by the wrench rotates the set screw. The declutching of the cams from the driven shaft permits this type of exterior set screw adjustment to be practical and the afore-described apparatus eliminates the problems arising from failure to replace the housing access panel after cam adjustment.

Clutching between the key and clutch members, in one embodiment, occurs upon the entrance of a key member mounted axially extending dog into a recess defined in the clutch member. By employing a single dog, and a single recess, the angular relationship between the driven and cam shafts during operation of the programmer will be insured. In another embodiment of clutch mechanism, a spline tooth configuration is employed between the key and clutch members permitting mutual engagement in a driving relationship in a variety of relatively angular positions between the key and clutch members permitting the cam assembly and cam shaft to be very easily and quickly changed in their angular orientation with respect to the driven shaft such that all cams maintain a constant relationship to each other and the timing of actuation can be advanced or retarded.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of a rotary programmer in accord with the invention will be appreciated from the following description and accompanying drawings wherein:

FIG. 1 is an elevational, sectional view of a rotary programmer in accord with the invention as taken along section I—I of FIG. 2,

FIG. 2 is an elevational, transverse, sectional view of the programmer as taken along section II—II of FIG. 1,

FIG. 3 is an elevational, sectional view taken through the clutch member along section III—III of FIG. 1,

FIG. 4 is an elevational side view of a programmer in accord with the invention illustrating the transparent cover panel.

FIG. 5 is a detail, sectional view of the set screw actuator and cam in the set screw adjusting position,

FIG. 6 is an enlarged, detail, diametrical, sectional view of the set screw actuator,

FIG. 7 is a sectional, detail view of the set screw actuator as taken along VII—VII of FIG. 6,

FIG. 8 is an elevational, sectional view of another embodiment of clutch mechanism in accord with the invention with the clutch member engaged,

FIG. 8A is similar to FIG. 8 and illustrates the clutch member disengaged, and

FIG. 9 is an elevational, sectional view as taken along section IX—IX of FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 and 2 the basic construction of a rotary programmer in accord with the invention will be appreciated. The programmer includes a housing 10, which is preferably formed of an aluminum extrusion 12. The extrusion 12 includes a bottom surface 14, a rear sidewall 16 and a front sidewall 18. The upper housing cover 20 is removably attached to the extrusion by screws to provide access to the limit switches, as will be described, and the front sidewall 18 includes an access opening 22 which is normally closed by a transparent cover panel 24. Screws 26, FIG. 4, attach the cover panel to the housing 10.

The housing 10 also includes a horizontally extending partition 28 separating the housing into an upper chamber 30, and a lower chamber 32. A plurality of limit switches 34 are mounted in the upper chamber 30 in side by side relationship, FIG. 1, and the cam assembly mechanism is mounted within the housing lower chamber 32.

The ends of housing 10 are enclosed by the end caps 36 and 38 of a generally rectangular configuration, and tie rods 40 extend between the end caps to maintain the same upon the ends of the housing extrusion in a fluid tight relationship.

A driven shaft 42 extends through the lower chamber 32 and is rotatably mounted in end cap 36 by ball bearing 44 and is indirectly rotatably mounted in housing end cap 38 by ball bearing 46. The right end of the driven shaft 42, FIG. 1, is provided with a key, whereby the shaft may be keyed to its rotative power source. Such power source may consist of the machine being controlled by the programmer, not shown, or the shaft 42 may be rotated by a timing motor or similar mechanism as is well known in the art. The programmer illustrated is most widely used with machine tools, and similar industrial applications, and in most installations the driven shaft 42 will be drivingly connected to the power takeoff of the machine tool being controlled.

A cam shaft 48, which is of a tubular configuration, is rotatably mounted upon the driven shaft 42 having a right end which terminates at 50, FIG. 1, and the free left end of the cam shaft extends exteriorly of the housing end cap 38, as will be appreciated from FIG. 1. The left end of the driven shaft 42 constitutes a free end of the driven shaft and extends beyond the left end of the cam shaft, and a key member knob 52 is keyed to the driven shaft by key 54 and axially fixed thereon by ring 56. As will be appreciated from FIG. 1, the knob 52 is of a smooth exterior surface configuration wherein the exterior surface is concentric with the axis of the driven shaft, and includes a cylindrical portion 58 for cooperation with the cam shaft clutch member as will be described.

The free end of the cam shaft 48 includes a clutch member 60 concentrically mounted upon the cam shaft and keyed thereto by a key 62. The clutch member includes an elongated key slot for cooperating with the

key 62, and the clutch member is axially slidably mounted upon the cam shaft 48 for movement between the full line position shown in FIG. 1, and the dotted line position 64 of FIG. 1 wherein the clutch member is shifted to the right.

The clutch member 60 includes a conical exterior surface 66 converging toward the knob 52 to the left, FIG. 1, and the outer end of the clutch member is provided with a circular recess 68 of a diameter to closely receive the key member knob surface 58. In the embodiment of FIGS. 1 through 3 an axially extending recess 70 is defined in the recess 68, and cooperates with the axially extending dog or projection 72 defined upon the inner end of key member knob 52 whereby engagement of the dog 72 and the recess 70 locks the key member knob 52 and clutch member 60 together for mutual rotation.

An annular thrust washer 74 is mounted upon the cam shaft 48 and axially positioned thereon by snapping 76 received within an annular groove defined in the cam shaft. A plurality of compression springs 78, four in number in the preferred embodiment, bear against the thrust washer 74, and are received within axially extending spring receiving recesses 80 defined in the clutch member. The springs 78 impose a biasing force on the clutch member 60 to the left, FIG. 1, to maintain the dog 72 within the clutch member recess 70.

Decutching of the clutch member 60 from the key member 52 is accomplished by the operator placing his fingers upon the conical surface 66, and axially displacing the clutch member to the right, FIG. 1, compressing springs 78, and disengaging dog 72 from the clutch member recess 70. Upon release of the clutch member the springs 78 again bias the clutch member toward the key member knob 52, and upon relative rotation between the clutch member and key member occurring to align the dog 72 with the recess 70 the recess will receive the dog and permit the clutch member to be moved fully to the left as shown in FIG. 1 clutching the cam shaft 48 to the driven shaft 42.

A plurality of cams are mounted upon the cam shaft 48 within the housing chamber 32. The cam assembly includes metal cam holders 82 keyed to the cam shaft 48 for rotation therewith. The cam holders include radially extending portions 84 separating adjacent cams and each has a rim 86 on which indicia, not shown, is located which permits a visual indication of the relative rotational position of the cams 88 to the cam shaft.

Each cam 88 consists of two cam portions 90 and 92 located between the adjacent cam holder portions 84. Each cam portion is of an annular configuration mounted upon the cam holder cylindrical hub surface 94 and includes an outer periphery preferably of an oblique configuration inclined to the axis of the cam shaft toward the adjacent cam portion. The surface of the adjacent cam is inclined in the opposite direction to its mate producing a "V" shaped groove throughout at least a portion of the cam periphery in which the control member spool 96 is received. The periphery of the cam portions include a minor circular radius, as represented at 98, and a maximum radius as represented at 100. Transitional surfaces 102 occur between the radii 98 and 100.

The cam portions 90 and 92 are rotatably adjustably mounted upon the holders 82 by radially disposed Allen socket set screws 104, FIG. 2, received within

threaded holes within the cam portions. The set screws 104, in the illustrated embodiment, bear upon brass shoes 106, which engage the cam holder hub surface 94, and upon tightening the set screws the cam portions will be rigidly attached to their associated cam holder. By loosening the set screws 104 the cam portions may be rotated upon their associated surface 94, and relative rotation of the cam portions of a set permits the "dwell" periods of a cam 88 to be infinitely varied between maximum and minimum durations. Also, angular adjustment of the cams 88 to the associated holder 82 controls the operation of the associated limit switch 34 with respect to the angular position of the cam shaft 48.

The limit switches 34 illustrated are each operated by a sensing button 108 engaging the upper end of the associated spool 96. The spools 96 are slidably mounted in partition 28 and on a spool being moved sufficiently toward the associated limit switch by a cam 88, the button 108 is displaced sufficiently to open or close the limit switch, depending upon the type of switch, and as the limit switches are selectively connected to the various clutches and other control members of the apparatus being controlled, the desired programming is achieved.

As will be appreciated from FIGS. 1 and 2, the lower end of the spools 96 is of a conical configuration, as is the upper end, and this conical configuration of the spool lower end will cause a rotational movement of the spool as it engages portions of the associated cam 88 wherein only a single cam portion 90 or 92 is being engaged, and this rotation of the spool prevents localized wear from occurring, producing accurate limit switch operation over long periods of time.

In the illustrated embodiment four cam sets 88 and limit switches 34 are illustrated. Of course, a greater or lesser number of cams and limit switches may be used, depending upon the length of the housing 10.

Access to the cam portions' set screws 104 is through the access opening 22, and thus the cams 88 must be rotated such that a set screw to be adjusted is adjacent the access opening. Thus, it will be appreciated that it is usually necessary to rotate the cam assembly relative to the housing 10 in order to permit adjustment of the cams.

Such rotation of the cams is readily accomplished by displacing the clutch member 60 to the right to remove the recess 70 from the dog 72. As the operator moves the clutch member to the right against the biasing force of the springs 78 the cam shaft 48 is disengaged from the driven shaft 42 and the cam shaft and cams may be rotated as described by member 60 to permit access to the cam portions' set screws 104. Also, such rotation of the cams permits the cams to be visually inspected with respect to the indicia on the cam holder rims 86. The conical configuration of the clutch member exterior surface 66 facilitates shifting of the clutch member to the right, and the rightmost end, FIG. 1, of the dog 70 engaging upon the recess surface 68 will keep the cam member 60 shifted to the right at all relative rotational positions between the key and clutch members except when the dog aligns with the recess 70. The cam shaft, and cams, may be thus easily rotated as desired to permit adjustment of the cams quickly and easily.

After cam adjustment has been completed, the operator will then rotate the clutch member 60 until the dog 72 aligns with the recess 70, and the springs 78 will insure a positive engagement between the dog and recess

positively keying the driven shaft to the cam shaft for normal operation of the programmer.

The smooth exterior configuration of the key and clutch members 52 and 60 prevents harm to the operator should these components, while rotating, be engaged by the fingers, or engaged by clothing. It will be noted that the housing end cap 38 includes a recess 110 into which the clutch member 60 is depressed during de-clutching, and snagging of clothing or fingers on the clutch apparatus is virtually impossible.

The access to set screws 104 could be accomplished by removing cover panel 24. However, removal of cover panel 24 is time consuming, and more importantly, as adjustment of the cam portions may be made regularly, the operator may choose not to replace the cover panel after each adjustment thereby exposing lower chamber 32 to the entrance of dirt, oil and other foreign matter through access opening 22. In many installations it is necessary for the housing 10 to be oil-tight and the accumulation of foreign matter on the cam assembly produces inaccurate operation and makes adjustment difficult.

In accord with the invention, set screw actuating means are incorporated into the cover panel 24 to permit adjustment of the cam portion set screws without removal of the panel 24 from the housing, and thus the integrity of the housing oil-tight seal can always be maintained.

A set screw actuator 112 is mounted in transparent cover panel 24 for each set screw 104 of the cam assembly, thus eight actuators are mounted in the panel, FIG. 4, the axis of each actuator intersecting the axis of the driven and cam shafts such that when the axis of a set screw 104 is perpendicular to the plane of panel 24, it will be in alignment with the axis of its actuator.

The panel 24 is formed of a synthetic plastic transparent material so that the cam assembly and interior of chamber 32 can be clearly observed and a cylindrical bore 114 is formed in the panel to receive each set screw actuator assembly. A retainer panel 116, also of transparent plastic, is bonded to the panel 24 with transparent adhesive and includes an opening 118 coaxial with the bore 114 and of a smaller diameter.

The set screw actuator includes a steel cylindrical plunger 120 axially slidably received within bore 114. The plunger 120 has a coaxial Allen wrench extension 122 mounted therein extending toward chamber 32 through opening 118, and the plunger also includes a hexagonal socket 124 exteriorly accessible through conical guide passage 126 formed in panel 24 intersecting and coaxial with bore 114. An "O" ring 128 received in a circumferential groove seals plunger 120 to panel 24. A coil compression spring 130 interposed between retainer panel 116 and plunger 120 biases the plunger to the left to the position shown in FIG. 6.

The ability of the cam assembly to be declutched from the driven shaft 42 makes the use of the set screw actuators feasible as once the clutch member 60 is shifted to permit free rotation of the cams 88 by the clutch member, the cam shaft 48 may be accurately rotated to align the set screw 104 of the cam portion to be adjusted with the axis of the associated actuator 112. Upon such alignment being achieved, the operator inserts a conventional Allen wrench 132 into the plunger socket 124 and pushes inwardly on the wrench 132 to axially displace plunger 120 to the right, FIG. 5,

until the inner end of the wrench extension 122 engages the socket of the aligned set screw 104.

The operator then unscrews the engaged cam set screw 104 to loosen the associated cam portion on the hub surface 94 and then rotates clutch member 60, and the cam shaft, while observing the indicia on the rim 86 adjacent the cam portion being adjusted. The cam shaft is rotated the desired degree while the cam portion is immobilized and then the set screw 104 is retightened and the adjustment is completed. As the inward force on the wrench 132 is released the spring 130 moves the plunger 120 back to the position of FIG. 2 and the wrench 132 is removed from socket 124.

From the above it will be appreciated that the use of the set screw actuators 112 eliminates any possibility that the oil-tight condition of the housing will be lost, and the set screw actuator provides a quick and reliable manner for adjusting the cam portions 90 and 92 upon the cam shaft 48.

FIGS. 8, 8A and 9 illustrate a variation in the clutch mechanism wherein splines are used to interconnect the key and clutch members. In this embodiment various rotational orientation between the key and clutch members is possible, as compared with the single rotational orientation of the previously described embodiment.

In FIGS. 8 and 9 components similar to those previously described are indicated by primed reference numerals.

The driven shaft 42' includes the key member knob 52' which is of an outer configuration similar to that of the previously described embodiment, except that a plurality of spline teeth 134 are defined about the circumference of the cylindrical portion 58' adjacent the knob right end 136. It will be appreciated that no dog member is formed on the key member 52'.

The clutch member 60' includes a circular recess 68' concentric with the cam shaft axis, and a plurality of spline teeth 138 are formed upon the axially extending surface of the recess 68'. No dog receiving recess is defined in the recess 68'. As in the previously described embodiment, the clutch member 60' is axially movably mounted upon the cam shaft 48', and is biased outwardly by the springs 78'.

The key member spline teeth 134, and the clutch member spline teeth telescopically slidably engage. Preferably, the spline teeth 134 and 138 are disposed about the periphery of their associated surfaces at 3° intervals, and it will therefore be appreciated that by shifting the clutch member 60' to disengage the spline teeth 138 as in FIG. 8A from the spline teeth 134, the clutch member, cam shaft 48', and cams 88 mounted thereon, may be rotated in increments of 3° with respect to the previous rotational adjustment to the driven shaft 42', and removal of the axial force on the clutch member as imposed by the operator's fingers permits the springs 78' to cause the splines 134 and 138 to telescope and intermesh as in FIG. 8. Thus, a positive driving interconnection between the cam shaft and driven shaft is accomplished by this embodiment, but it is also possible to change the orientation of the cam shaft to the driven shaft during operation. Such adjustment permits the entire control cycle to be shifted "forward" or "backward" with respect to the rotation of the driven shaft 42', which is often a desirable control feature with many devices controlled by rotary programmers.

It will therefore be appreciated that the rotary programmer disclosed permits the cams thereof to be rotated relative to the programmer driven shaft by means of a clutch mechanism which is safe and easy to use. In addition to the safety aspects of the concentric exterior surfaces of the key and clutch members, a pleasing appearance results commensurate with the exterior appearance of the programmer housing. The disclosed clutching and declutching of the cams with respect to the driven shaft permits the cams to be quickly and accurately adjusted on the cam shaft by the set screw actuators with a minimum of effort and without breaking the seal of the housing and the clutch mechanism and the transparent panel permits rapid inspection of the periphery of the cams, and cam holders for trouble shooting purposes.

It is within the scope of the invention to locate the set screw actuators in the wall 16 of the housing, or locate a transparent window in the housing and use an opaque cover panel 24. Also, indicia could be located on the exterior of clutch member 60 to indicate the extent of cam adjustment without observing the indicia on rims 86.

Where the set screws 104 are small, so as to require only a small size Allen wrench, the plunger 120, spring 130 and extension 122 can be replaced by a rubber or similar elastomer plug sealed within bore 114. The plug is axially pierced such that an Allen wrench may be inserted therethrough for engagement with an aligned cam set screw 104, and upon withdrawing the wrench from the plug the wrench opening will be self sealing. The softer the plug material the larger the size Allen wrench that may be used and still maintain the plug self sealing and this type of set screw actuator is more economical to manufacture than that illustrated. When using a self sealing elastomer plug the plate 116 is not required as the plug may be cemented or otherwise affixed within bore 114.

It is appreciated that other modifications to the inventive concept may be apparent to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A rotary programmer apparatus comprising, in combination, a housing, a driven shaft rotatably mounted on said housing, a cam shaft coaxially mounted upon said driven shaft relatively rotatable thereto and having a cam mounting portion located within said housing, at least one cam mounted upon said cam shaft cam mounting portion, adjustable mounting means adjustably mounting said cam upon said cam shaft, control means mounted on said housing engaging said cam and controlled thereby, a key member mounted upon said driven shaft for rotation therewith, a clutch member mounted upon said cam shaft for rotation therewith and located adjacent said key member, means mounting one of said members for relative axial displacement upon its associated shaft, axially extending torque transmitting means defined on said members, said torque transmitting means intermeshing at a first axial position of said one of said members relative to the other of said members to lock said driven and cam shafts for simultaneous rotation and disengaging at a second axial position of said one of said members permitting rotation of said cam shaft upon said driven shaft and rotation of said cam relative to said driven shaft and housing.

2. In rotary programmer apparatus as in claim 1, biasing means biasing said one of said members toward said first axial position.

3. In a rotary programmer apparatus as in claim 2, wherein said clutch member comprises said axially displaceable member, a thrust member axially fixed on said cam shaft adjacent said clutch member, said biasing means comprising at least one compression spring interposed between said thrust member and said clutch member biasing said clutch member toward said key member.

4. In a rotary programmer apparatus as in claim 1 wherein said driven and cam shafts each include a free end located exteriorly of said housing, said key and clutch members being mounted on said free ends of said driven and cam shafts, respectively, said members each having a smooth uninterrupted exterior surface concentric with the axis of said shafts for safety purposes.

5. In rotary programmer apparatus as in claim 3 wherein said key member comprises a knob having a convex exterior surface and said clutch member exterior surface is of a conical configuration converging in a direction away from said housing and toward said knob.

6. In rotary programmer apparatus as in claim 5 wherein said clutch member includes a concentric recess disposed toward said knob adapted to receive a portion of said knob, said torque transmitting means including a dog receiving recess defined in said concentric recess and a dog defined on said knob receivable within said dog receiving recess.

7. In rotary programmer apparatus as in claim 4 wherein said key and clutch members each include axially extending telescopically engaging surfaces concentric to the axis of said shafts, and said torque transmitting means comprise intermeshing spline teeth defined on said telescopically engaging surfaces.

8. A rotary programmer apparatus comprising, in combination, a housing, a driven shaft rotatably mounted on said housing, a cam shaft rotatably mounted upon said housing having a cam mounting portion located within said housing, at least one cam mounted on said cam shaft mounting portion, wrench operated adjustable mounting means adjustably mounting said cam upon said cam shaft, control means mounted on said housing engaging said cam and controlled thereby, clutch means selectively interconnecting said cam shaft to said driven shaft, means manually rotating said cam shaft upon said shaft being disconnected, and sealed wrench receiving means for said wrench operated adjustable mounting means mounted on said housing selectively receiving a wrench for operating said adjustable mounting means.

9. In rotary programmer apparatus as in claim 8, wherein said wrench receiving means is selectively movable between first and second positions disengaging and engaging said adjustable mounting means respectively, and biasing means biasing said wrench receiving means from said second to said first position.

10. In rotary programmer apparatus as in claim 9 wherein said adjustable mounting means adjustably mounting said cam comprises a set screw mounted on said cam radially disposed to the axis of said cam shaft, said wrench receiving means being movably mounted on said housing in a linear direction radial with respect to said cam shaft.

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11. In rotary programmer apparatus as in claim 10, a transparent panel defined on said housing, a bore defined in said panel having an axis radially disposed to the axis of said cam shaft, a plunger axially and rotatably received within said bore and sealed with respect thereto, a set screw wrench coaxially mounted on said plunger extending toward the axis of said cam shaft, spring means biasing said plunger away from said cam shaft to said first position, and a wrench receiving socket defined in said plunger exteriorly accessible of said housing for rotating said plunger upon said set screw wrench engaging said set screw when said plunger is axially translated to said second position.

12. A rotary programmer apparatus comprising, in combination, a housing, a driven shaft rotatably mounted on said housing, a cam shaft rotatably

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mounted upon said housing having a cam mounting portion located within said housing, a transparent panel mounted on said housing enclosing said cam mounting portion and permitting exterior viewing thereof, at least one cam mounted on said cam shaft mounting portion, tool operated rotatable adjustable mounting means adjustably mounting said cam upon said cam shaft, control means mounted on said housing engaging said cam and controlled thereby, and tool receiving means for receiving a tool for operating said adjustable mounting means mounted on said transparent panel for radial movement with respect to said cam shaft whereby said adjustable mounting means may be adjusted exteriorly of said housing by a tool received within said tool receiving means.

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