Aug. 1, 1950 E. H. BIRDSALL 2,517,079

CONTROL MECHANISM

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FIG. 1

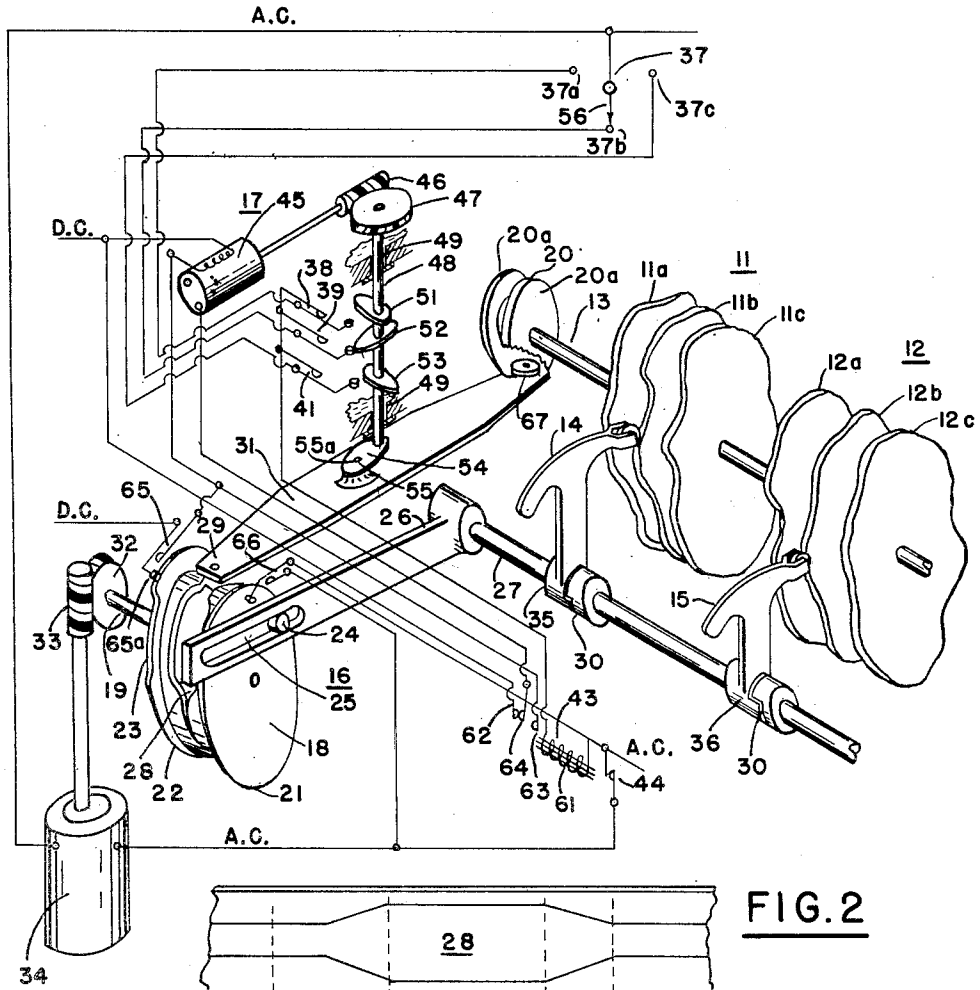


FIG. 2

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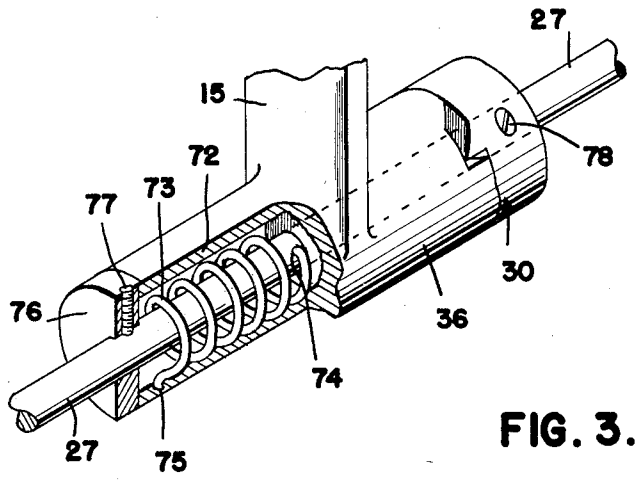


FIG. 3.

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CONTROL MECHANISM

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6 Claims. (Cl. 74—568)

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This invention relates, in general, to a control mechanism and, in particular, to a cam shaft shifting control device contained within a student training apparatus or the like requiring that any one of a plurality of different control motions be imposed thereon in order to present a variety of problems such as may be encountered in combat.

It is common practice in the training of student operators, whether they are to be future radio or underwater sound operators or the like, for an instructor through the manipulation of master controls to set up a variety of simulated signals which as nearly as possible reproduce the signals to be received under actual operating conditions. In sonar training devices, for example, these simulated signals are fed to any desired number of sonar receivers operated by the students who in time learn to distinguish between the various received echoes, reverberation noises and the like. Quite frequently the simulated signals are generated through cam action operating associated equipment, and in the course of the instruction it is often necessary to quickly change from one set of signals to another by the interchange of cams. It is further desirable that any of the cams be selected at will, without the necessity of following a fixed sequence once the equipment is set into operation. The present invention relates to a device for rapidly changing the above-described control cams.

It is one object of this invention to provide a motion initiating and control device which is adapted to be rapidly and easily adjusted to provide the desired movement of the apparatus with which it may be associated.

Another object of this invention is to provide a train of cams so associated with one another and with the followers with which they engage as to eliminate the necessity of disassembling, interchanging, and reassembling the cams, as is the usual procedure in most cam control apparatus presently employed.

Still another object of this invention is to provide a compact, simple, rugged and relatively inexpensive electrically operated control apparatus.

These, and other objects, as well as the various other novel features and advantages of this invention will become apparent from a reading of the specification and accompanying drawings of which:

Figure 1 is an isometric view of the control device, showing the electrical elements associated therewith, and

Figure 2 is an enlarged view of a portion of the cylindrical cam.

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Figure 3 is an enlarged sectional view of the clutch arrangement for operating the cam followers.

With reference to the drawings, this invention comprises a series of cams, groups 11 and 12, consisting of cams 11*a*, 11*b*, and 11*c* and 12*a*, 12*b*, and 12*c* respectively, positioned on shaft 13, adapted to engage followers 14 and 15 respectively, cam shifting unit 16 and cam shifting unit electrical control system 17. Shaft 13 and cam groups 11 and 12 rotate by means not shown and not a part of this invention for the purpose of operating switches or other signalling apparatus, likewise not illustrated, by the action of the cam followers 14 and 15.

The cam shifting unit 16 embodies a rotatable drum 18 secured to shaft 19, having circular flanges 21 and 22, the flange 22 being undercut at 23 for a portion of its circumference. Secured to flange 21 is a pin 24 adapted to be received within a recess 25 of a cam follower rocker arm 26 attached to shaft 27 upon which the followers 14 and 15 are positioned. The hub or central portion of drum 18 is undercut to define a path 28 within which a pin 29 of cam shifting lever 31 is received. The path 28 is adapted to provide operating zones for four cam motions, namely, zones within which the followers are raised, the cam shifting lever set, the cams shifted and the followers lowered respectively. A gear 32 secured to the shaft 19 engages with worm gear 33 rotated by electrical motor 34 for driving the drum 18. Cam followers 14 and 15 are rotatably mounted upon shaft 27 so that when the rocker arm 26 is actuated, the followers are pulled away from the cams by virtue of the clutch arrangement 30. As soon as the shaft is returned to its operable position, followers 14 and 15 also are returned through the action of suitable springs mounted in the base or hub portions 35 and 36 thereof. A typical construction for one of the clutch arrangements is clearly shown in Fig. 3 wherein the base 36 has a hollow sleeve-like portion 72 through which the shaft 27 extends. Within the sleeve portion 72 is a spring 73 coiled concentrically about shaft 27 and having one end 74 inserted through a hole in shaft 27 and the other end 75 inserted in a slot in sleeve portion 72, whereby, due to the action of the spring, the cam follower 15 is urged against one of the cams 12*a*, 12*b*, or 12*c*. The spring 73 urges follower 15 in a counterclockwise direction as viewed from Fig. 3. Closing the end of sleeve portion 72, but in freely sliding contact therewith is a collar 76 which may be attached to shaft 27 by means of set screw 77

whereby the cam follower 15 is prevented from moving axially along shaft 27. The member 30, forming the other portion of the clutch arrangement is rigidly attached to shaft 27 by means of a set screw 78, or the like.

The electrical control system 17 is made up of a selector switch 37, having a suitable electrical connection to a source of power, to stationary contacts 37a, 37b, 37c, and to three pairs of switching contacts 38, 39 and 41, which contacting elements are so associated with a relay 43 and additional switching contacts 44 as to insure proper electrical connection between the power source and the direct current motor 45 and alternating current motor 34. A worm gear 46 keyed to the shaft of direct current motor 45 engages with a gear 47 positioned on shaft 48. The shaft 48 is mounted in suitable bearings 49 and provided with a plurality of cams 51, 52 and 53 for opening the particularly desired electrical contacting elements of the group 38, 39 and 41. The lower end of shaft 48 is firmly secured to an adjustable fulcrum 54. The fulcrum 54 is provided with an opening 55 within which is rotatably received a pin 55a secured to cam shifting lever 31. Thus, the lever 31 is not only supported at the end of shaft 48 but is permitted to pivot about the pin 55a for effecting the cam shifting action.

Selector switch 37 comprises a movable contacting arm 56 which may be moved into any one of three positions (as shown) for closing an electrical circuit between one of the power lines and one of the contacting elements 38, 39 or 41 for purposes to be hereinafter disclosed.

The relay 43 is provided with an electromagnet 61, and two stationary contact elements 62 and 63 with a movable contact 64 mounted therebetween which is adapted to be drawn from its initial position of contact with element 62 into contact with element 63 when the electromagnet is energized. The support for element 64 is sufficiently resilient as to cause the element to return to its initial position upon de-energization of the electromagnet. In addition, two switches 65 and 66 are provided for closing or opening electrical circuit between D. C. motor 45 and A. C. motor 34 respectively.

The operation of this control device is carried out essentially in the following manner:

From the control position as illustrated in the drawing, let it be supposed that the operator desires to impose a new problem on the apparatus associated with and controlled by the followers 14 and 15 and that the motion desired will be that incident to engagement of followers 14 and 15 with cams 11a and 12a respectively.

The movable arm 56 of selector switch 37 is rotated so that it makes contact with element 37a thus energizing electromagnet 61. The magnet draws element 64 into contact with element 63 and, since switch 65 is closed by virtue of element 65a having dropped down into undercut portion 23 of flange 22 when the drum 18 is in the position in which the cam followers 14 and 15 are to be raised, the armature of motor 45 is excited and current furnished to the field winding thereof so that the motor begins to rotate driving the shaft 48, thus moving the cam 51 into engagement with the movable contact of switching elements 38. At the same time electromagnet 61 closes contact 44 to energize motor 34. It will be apparent that as soon as the cam 51 has travelled sufficiently far, the circuit will be broken at the switch 38, which in turn will de-energize the electromagnet 61 to cause switch element 64 to return to position of contact with element 62. The motor 45 is immediately brought to a stop and as the armature thereof is short circuited by reason of switch 65 being closed, coasting of the motor is prevented.

However, even though motor 45 is brought to a stop, upon completing the function of moving fulcrum 54 to the desired number one position, during the time pin 29 of cam shifting arm 31 is within the wide or fulcrum shifting position of cam path 28, the motor 34 continues to rotate inasmuch as the switch 66 is still closed. As the drum 18 rotates further, the pin 29 will strike the side portions of the circular cam path 28 and cause the arm 31 to pivot about pin 55a thus shifting the cams to their new positions by virtue of the axial movement imparted thereto by the knob 67 secured to the end of arm 31 and positioned between flanges 20a of drum 20.

Pin 24, of drum 18, rises to carry the rocker arm 26 to its high position so that the followers 14 and 15 are lowered and brought into engagement with the cams 11a and 12a and finally the rocker arm will be engaged with the movable contact of switch 66, opening the switch 66 and causing motor 34 to be brought to a stop.

As the cams have now been shifted to their newly selected positions, it is merely necessary to rotate the shaft 13 in order to impart the desired motions defined by the cams to the cam followers 14 and 15 for imposing a new problem on the apparatus associated with the followers.

It will be understood that the above description and accompanying drawings comprehend only the general and preferred embodiment of the invention and that various changes in construction and proportion as well as arrangement of the parts thereof may be made within the scope of the appended claims without sacrificing any of the advantages of the invention.

I claim:

1. In a control apparatus, the combination comprising a plurality of cams, a plurality of followers associated with said cams, means for moving said followers into and out of engagement with said cams, means for shifting said cams axially with respect to their axes of rotation, and cam shifting preselection means for determining in advance the position into which said cams are to be shifted comprising a selector switch, a motor, a plurality of switches interposed between said selector switch and said motor and means operable by said motor for interrupting the circuit between the one switch of said plurality closed by the operation of said selector switch and said motor.

2. In a control apparatus, the combination comprising a plurality of cams, a plurality of followers associated with said cams, a shaft supporting said followers, a rocker arm secured to said shaft, means for rocking said arm in a clockwise or counterclockwise direction, clutching means adapted to engage with said followers to cause rotation thereof together with said shaft when said shaft is rotated in one direction, means for shifting said cams axially with respect to their axes of rotation, and cam shifting preselection means for determining in advance the position into which said cams are to be shifted comprising a selector switch, a motor, a plurality of switches interposed between said selector switch and said motor and means operable by said motor for interrupting the circuit between said selector switch and said motor by operating one of said plurality of switches.

3. In a control apparatus the combination comprising a plurality of cams rotatable about a common axis, a plurality of followers associated therewith adapted to be moved into and out of engagement with said cams, driving means associated with and adapted to provide inward and outward movement of said followers, control means associated with said driving means, means adapted to shift said cams axially with respect to said followers to cause a selected group of cams to come into registration with said followers, and control means associated with said last-mentioned means for insuring movement of said cams to their selected positions.

4. Control apparatus for shifting a plurality of cams axially with respect to their axes of rotation and into and out of engagement with a plurality of cam followers comprising a selector switch for determining in advance the position into which said cams are to be shifted, a first motor, a plurality of limit switches, means driven by said first motor for operating said limit switches, a second motor, drum means driven by said second motor, said drum means acting to move the cam followers out of engagement with said cams and to shift said cams and to move said cam followers into re-engagement with said cams.

5. Control apparatus for shifting a plurality of cams axially with respect to their axes of rotation and into and out of engagement with a plurality of cam followers comprising a selector switch for predetermining the position into which said cams are to be shifted, a first motor, a plurality of limit switches in the circuit between said motor and said selector switch, means driven by said first motor for operating said limit switches, a cam shifting lever, said first motor driven means acting to alter the fulcrum of said cam shifting lever, a second motor, drum means driven by said second motor, said drum means having a recess in the face thereof for receiving one end of the above-mentioned cam shifting lever, said recess acting to apply force to said cam shifting lever to thereby shift said cams when the drum means revolves.

6. The apparatus of claim 5 in which said drum means has a pin in one face thereof, and a cam follower lever adapted to be moved by said pin, said pin acting to move the aforementioned plurality of cam followers out of engagement with said cams while said cams are being shifted and to re-engage said cam followers and cams after the shift.

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