

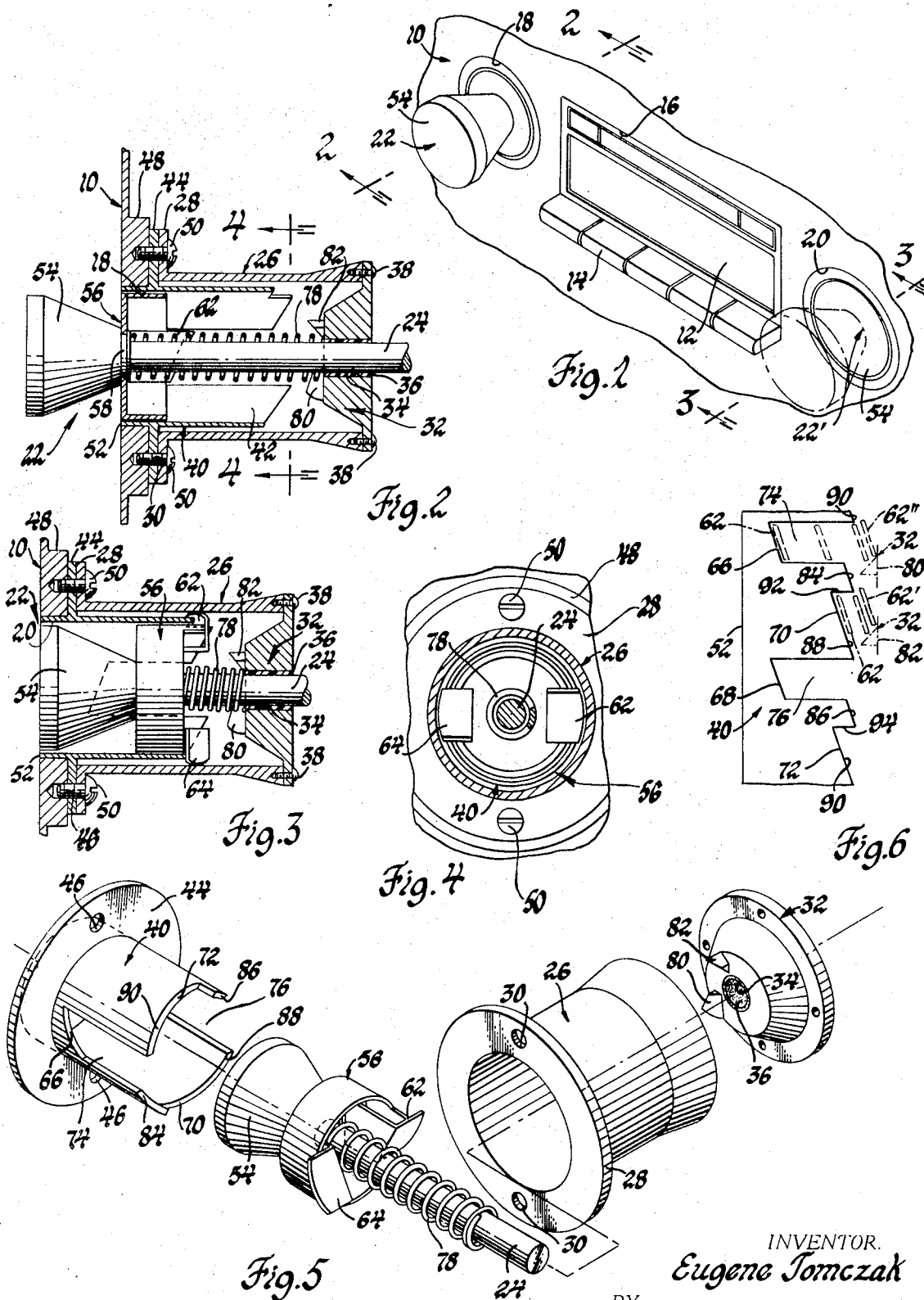
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CONTROL KNOB

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CONTROL KNOB

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ABSTRACT OF THE DISCLOSURE

A control knob assembly for a mechanism to be operated includes a control shaft rotatable and shiftable between a pair of longitudinally spaced positions defined by a plurality of stops on a cam cylinder surrounding the shaft which stops are engaged by a retaining member rotatably mounted on the shaft and shiftable as a unit therewith to locate the shaft in either of the spaced longitudinal positions without altering the angular position of the shaft.

The primary feature of this invention is that it provides a new and improved control knob assembly wherein a control shaft is bifunctionally mounted to control a mechanism in a first mode by shaft rotation and to control the mechanism in a second mode independently of the first mode by shiftable movement of the shaft between a pair of spaced longitudinal positions. Another feature of this invention is that it provides a control knob assembly wherein a control shaft is mounted to be shiftable longitudinally of its axis and is retained at selective longitudinal positions by a retaining member mounted on the shaft for rotation relative thereto and shiftable movement as a unit therewith. Still another feature of this invention resides in the provision of a cam cylinder or like means providing a plurality of stops remote from the shaft which stops define a pair of longitudinally spaced positions for such shaft and are engageable by the retaining member to locate the shaft at any one of these positions. Yet another feature of this invention is that it provides means in combination with the retaining member for rotatably indexing the latter sequentially and alternately from one stop to the next in the series so that the control shaft may be shifted sequentially through the longitudinal positions defined by the stops. These and other features of this invention will be readily apparent from the following specification and from the drawings wherein:

FIG. 1 is a partial perspective view of an automobile instrument panel having mounted thereon an automotive type radio receiver and a pair of control knob assemblies according to this invention;

FIG. 2 is an enlarged sectional view taken generally along the plane indicated by lines 2—2 in FIG. 1;

FIG. 3 is an enlarged sectional view taken generally along the plane indicated by lines 3—3 in FIG. 1;

FIG. 4 is a sectional view taken generally along the plane indicated by lines 4—4 in FIG. 2;

FIG. 5 is an exploded perspective view; and

FIG. 6 is a developed view of the cam cylinder.

Referring now to FIG. 1 of the drawings, an instrument panel 10 is mounted in an automotive vehicle in a conventional manner and includes a radio receiver unit, not shown, mounted behind the instrument panel in a conventional manner such that its dial face 12 and push button station selector 14 protrude through a rectangular aperture 16 in the instrument panel. Flanking aperture 16 in the instrument panel are a pair of circular apertures 18 and 20 for receiving control knob assemblies 22 and 22' to be fully described hereinafter.

The control knob assemblies 22 and 22' are structurally

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identical and include control shafts 24 capable of both rotational and longitudinal movement. The control shaft 24 in control knob assembly 22 is attached at its inner end within the receiver unit to suitable switch apparatus, not shown, operative to translate shaft rotation into receiver volume control and to activate and deactivate the receiver unit in response to longitudinal movement of the shaft. Such switches are well known and per se form no part of the invention. The control shaft 24 in the control knob assembly 22' is attached at an end thereof, not shown, to the receiver unit by conventional apparatus, not shown, which translates shaft rotation into receiver frequency selection and which will further permit longitudinal movement of the control shaft without rotation thereof. In both control knob assemblies the control shafts 24 may occupy extended positions indicated in FIG. 1 wherein each is manually rotatable to adjust the receiver unit and from which position each may be longitudinally depressed into and maintained in a retracted position wherein the free end of the control knob is generally flush with the surface of the instrument panel, such as indicated in full lines in FIG. 1 for knob assembly 22'. In control knob assembly 22, longitudinal movement of the control shaft between extended and retracted positions functions to activate and deactivate the receiver unit while in knob assembly 22' longitudinal movement of the control shaft between extended and retracted positions serves only to bring the control shaft flush with the instrument panel for aesthetic purposes.

Referring now to FIGS. 2, 3 and 5, control knob assemblies 22 and 22' are identical in detailed construction and accordingly only the knob assembly 22 will be described. It includes cylindrical housing member 26 with integral flange 28 thereof having therein a pair of mounting holes 30. Housing 26 is closed at its inner end, FIGS. 2 and 3, by a bearing plate 32 having a central bore 34 coaxial with the housing and with a sleeve bearing 36 therein, the bearing plate 32 being attached to the housing 26 by conventional means such as screws 38. Mounted coaxially within the housing 26 is a thin-walled cam cylinder 40 provided with an integral flange 44 having therein a pair of mounting holes 46 registerable with holes 30 in the housing flange 28. Housing 26 and cam cylinder 40 are mounted on an annular boss 48 on the inner surface of the instrument panel 10 by conventional means such as screws 50 through registered holes 46 and 30. When mounted on the boss, a forward portion of the cam cylinder 40 lies within the aperture 18 and cylinder edge 52 lies generally flush with the exterior surface of the instrument panel.

In the control knob assembly 22, the control shaft 24 is journaled in sleeve bearing 36 for rotational and longitudinal movement and has secured thereto a control knob 54. On the control shaft in close proximity to the inner face of knob 54 is a generally cup-like centrally bored retainer sleeve 56 journaled in a groove 58 on the shaft so that the retainer 56 is rotatable relative thereto and shiftable longitudinally as a unit therewith. The outer diameter of retainer 56 is only slightly less than the inner diameter of cam cylinder 40 so that shaft 24 is properly laterally supported as a unit with retainer 56 at the outer end of the knob assembly.

Referring now to FIGS. 4 and 5, retainer 56 has thereon a diametrically opposed pair of follower wings 62, 64 each of which follower wings comprises a surface extending laterally and having equal but opposite obliquity to a plane normal to the axis of the control shaft. Cam cylinder 40 has thereon a first pair of diametrically opposed stops 66, 68 situated at equal longitudinal distances from the cylinder edge 52 and a second pair of stops 70, 72 situated at equal longitudinal distances from the cylinder edge 52 which distance is greater than the distance be-

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tween cylinder edge 52 and stops 66, 68. The stops 66, 68. The stops 66, 68 and 70, 72 are angularly spaced or centered about the circumference of the cam cylinder generally at 90° intervals. The pair of slots 74, 76 in the cam cylinders forming the stops 66, 68 are of sufficient width to permit longitudinal movement of follower wings 62, 64 therein. For reasons appearing hereinafter, follower wings 62 and 64 will always abut either the first pair of stops 66, 68 or the second pair of stops 70, 72. With the follower wings abutting stops 66, 68 the control shaft 24 is in extended position, FIG. 2, wherein the knob 54 protrudes past the instrument panel exterior surface for convenient manipulation, and with the follower wings abutting stops 70, 72 the control shaft 24 is in retracted position, FIG. 3, wherein the knob 54 is generally flush with the exterior surface of the instrument panel.

The sequencing arrangement in the control knob assembly 22 for placement of the follower wings successively and alternately on the two sets of stops includes a compression spring 78 coiled around the control shaft 24 between the retainer 56 and bearing plate 32, and a pair of indexing cam projections 80, 82 on the bearing plate 32. As seen best in FIG. 6, the inner end portion of the cam cylinder 40 includes two pairs of diametrically opposed inclined cam edges 84, 86 and 88, 90 the latter being terminated by abutments 92, 94. The spring 78 biases the retainer 56 leftwardly, FIGS. 2 and 3, and the angle of cam edges 84, 86, and 88, 90 is generally complementary to the obliquity of the surfaces of the follower wings so that, if the angular position of the retainer 56 places the follower wings anywhere but in direct alignment with one of the two pairs of stops, the follower wings, under the urging of the spring 78, contact one pair of cam edges and slide therealong relative to the cam cylinder, rotating the retainer 56 clockwise, FIG. 4, until the follower wings contact either abutments 92, 94 whereupon the wings will be abutting stops 70, 72, or until the wings enter slots 74, 76 and are urged therealong into abutting rotation with stops 66, 68.

Once the follower wings 62, 64 in the control knob assembly abut directly on a pair of stops 66, 68 or 70, 72, it is the function of the indexing cam projections 80, 82 to engage the follower wings and rotate the retainer 56 relative to the cam cylinder under inward longitudinal movement of control shaft 24, thus to move the follower wings into position for contacting cam edge 84, 86 or 88, 90 so that the wings may be rotated by spring bias into engagement with the alternate pair of stops as described. The cam projections 80, 82 are of generally pyramid shape and are mounted on the bearing plate 32 such that an oblique face of one cam 80 generally opposes an edge of stop 66 and an oblique face of the other pyramid 82 generally opposes an edge of stop 70, FIG. 6. From the extended control shaft position, FIG. 2, or the retracted control shaft position, FIG. 3, rightward movement of the control shaft and retainer unit, against the action of spring 78, disengages the wings from the stops. The sides of slots 74, 76 or the abutments 92, 94 maintain alignment between the follower wings and stops until one edge of one of the follower wings contacts the oblique face of cam 80, 82, whereupon continued rightward longitudinal movement of the shaft initiates sliding movement of the follower wing edge over the oblique cam surface causing rotation of the retainer 56 relative to the shaft 24 and cam cylinder 40. The rightward longitudinal movement continues until the follower wing edge reaches the base of the cam projection 80 or 82 and abuts the bearing plate 32. The rotation of the retainer 56 moves the follower wings out of alignment with the previously engaged stops so that when the shaft is released the spring 78 urges the shaft and retainer unit leftward, FIGS. 2, 3 and 6, bringing portions of the follower wings into contact with an opposed pair of

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the cam edges of the cam cylinder 40. The follower wings follow the cam edges and rotate the retainer clockwise, FIG. 4, until abutting relation between the wings and the alternate pair of stops is attained.

In description now of a typical operational sequence and starting with the condition wherein the receiver unit is inoperative and both control shafts 24 are in retracted position, FIG. 3, the follower wing 62, 64 are maintained in abutting relation against stops 70, 72 by compression spring 78. To activate the receiver unit, knob 54 in control knob assembly 22 is depressed rightwardly, FIG. 3, causing disengagement of the follower wings from the stops 70, 72 and longitudinal movement of one of the follower wings 62 into engagement with indexing cam projection 82 whereupon the follower wings are rotated into position 62', FIG. 6, overlying cam edge portion 84. Release of the depressed knob 54 permits spring 78 to shift the control shaft and retainer unit leftwardly, FIG. 6, bringing follower wings 62, 64 into contact with the cam portions 84, 86 and initiating clockwise rotation of the retainer 56 until the wings 62, 64 are so aligned to fall into slots 74, 76 whereupon leftward movement continues until wings 62, 64 abut stops 66 and 68, respectively, FIG. 2. The leftward movement of the control shaft activates the receiver unit and exposes knob 54 for volume control purposes. The knob 54 in control knob assembly 22' is depressed and brought to extended position, broken lines FIG. 1, in a similar manner. With the receiver unit activated, knob 54 in control knob assembly 22 may be grasped and rotated to adjust the volume of the unit and control knob 54 in control knob assembly 22' may be grasped and rotated to tune the receiver unit to the desired frequency.

As long as activation of the receiver unit is desired, both control knob assemblies may be left in the extended position. The receiver unit may be deactivated without disturbing the volume adjustment, and/or the control knob assembly 22' may be depressed to flush condition without disturbing the selected station. In both cases, such depression shifts the follower wings 62, 64 rightwardly, FIG. 6, bringing follower wing 62 into engagement with indexing cam projection 80 whereupon the retainer 56 is rotated clockwise independently of control shaft 24 until the wing 62 reaches the position 62', FIG. 6. Release of the depressed knob 54 permits spring 78 to shift the control shaft and retainer unit leftwardly, FIG. 3, to bring the follower wings 62, 64 into engagement with cam edge portions 90, 88 respectively whereupon the wings 62, 64 slide along such edges until abutments 94, 92 are reached and the wings 62, 64 abut stops 72 and 70 respectively, to maintain the control shaft in flush retracted position, FIG. 3. In this retracted position of both control knob assemblies, the follower wing 64 now abuts stop 70 opposite the oblique surface of indexing cam projection 82 so that another depression of the knob 54 in either control knob assembly initiates another sequence of movement as described.

Having thus described the invention, what is claimed is:

1. A control knob assembly for a mechanism to be operated comprising a control shaft adapted for connection to said mechanism; means mounting said control shaft for rotation about an axis thereof to control said mechanism in a first mode thereof and for shiftable movement along said axis between a closed series of axially spaced positions to control said mechanism in another mode thereof; and means for axially locating said shaft at any one of said axially spaced positions and sequentially shifting said shaft from one of said positions to the next in said series of said positions without affecting the angular position of said control shaft, said locating and sequencing means including a plurality of axially spaced stop means remote from said control shaft, each of said stop means corresponding to one of said axially spaced positions, a retaining member mounted on said

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control shaft for rotation relative thereto and shiftable movement as a unit therewith, means on said retaining member engageable with said stop means under rotary indexing of said retaining member with respect thereto to locate said control shaft in the corresponding one of said axially spaced positions, and means engageable under selected axial movement of said control shaft and retaining member unit from any of said axially spaced positions thereof to rotatably index said retaining member relative to said control shaft for engagement with the stop means corresponding to the next in said series of axially spaced positions.

2. A control knob assembly for a mechanism to be operated comprising a control shaft adapted for connection to said mechanism; means mounting said control shaft for rotation about an axis thereof to control said mechanism in a first mode thereof and for shiftable movement along said axis between a closed series of axially spaced positions to control said mechanism in another mode thereof; and means for locating said shaft at any one of said axially spaced positions and sequentially shifting said shaft from said one position to the next in said series of positions without affecting the angular position of said control shaft, said locating and sequencing means including a cylinder disposed coaxially about said control shaft and having thereon a plurality of angularly spaced stop formations each corresponding to one of said axially spaced positions, a shaft retaining member mounted on said control shaft for rotation relative thereto and shiftable movement as a unit therewith within said cylinder, means on said retaining member engageable with said stops and under rotary indexing of said retaining member with respect thereto to locate said control shaft in corresponding ones of said axially spaced positions, means biasing said control shaft and retaining member unit axially in one direction, and indexing means engageable with said retaining member in response to selected axial movement of said control shaft against the action of said biasing means to rotate said retaining member from the stop corresponding to one axially spaced position to the stop corresponding to the next in said closed series of axially spaced positions.

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3. A dual mode control knob assembly for a mechanism to be controlled comprising, a control shaft adapted for connection to said mechanism; means mounting said control shaft for rotation about an axis thereof to control said mechanism and for shiftable movement along said axis between a plurality of axially spaced positions; a cylinder coaxially disposed around said shaft and having thereon a plurality of angularly spaced axially extending guide slots of varying depth opening to one end of said sleeve, the closed terminus of each of said guide slots defining one of said axially spaced positions of said control shaft; an annular retainer sleeve mounted on said control shaft for rotation relative thereto and shiftable movement as a unit therewith within said cylinder and having thereon at least one projection extending radially therefrom and registerable with any one of said axially extending slots for guidance into engagement with said terminus thereof to locate said control shaft at said corresponding axial position; spring means biasing said radial projection into engagement with said guide slots and termini thereof; and indexing means engageable with said radial projection in response to selected axial movement of said control shaft and retainer sleeve unit against the action of said spring means for indexing said radial projection from the axial slot corresponding to one of said shaft positions to the axial slot corresponding to another of said shaft positions, said indexing means including at least one cam surface stationary relative to said retainer sleeve and engageable with said radial projection under axial movement of said control shaft against the action of said spring means.

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