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CONTROL KNOB, FREE-WHEELING

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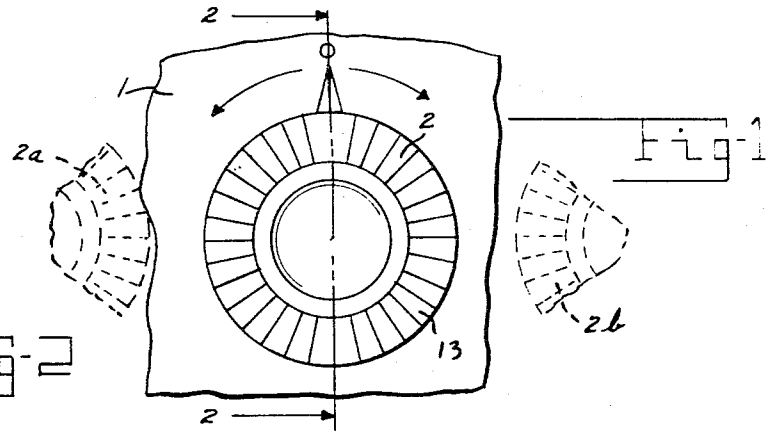


Fig-1

Fig-2

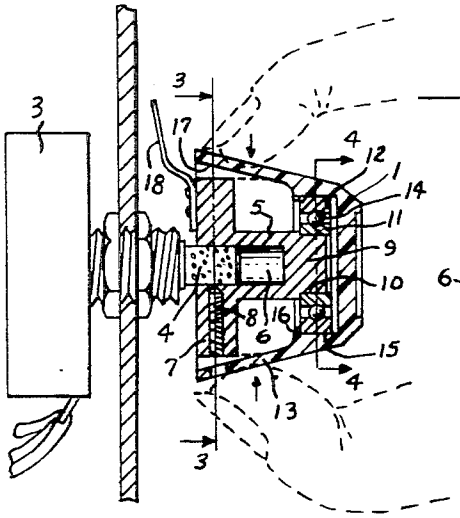


Fig-3

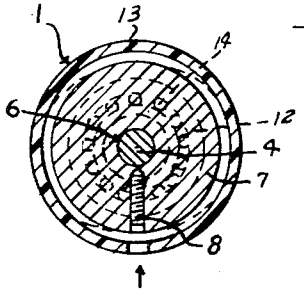


Fig-4

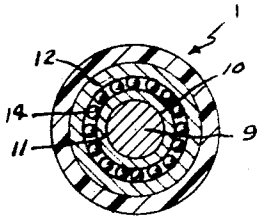


Fig-5

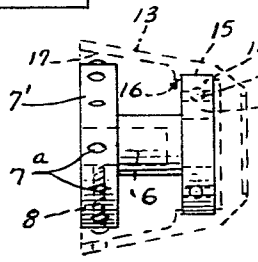


Fig-6

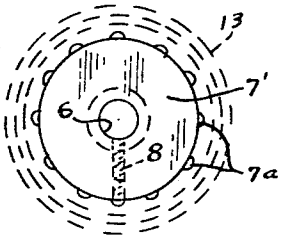
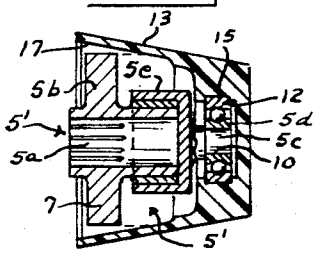


Fig-7



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CONTROL KNOB, FREE-WHEELING

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ABSTRACT OF THE DISCLOSURE

A control knob has an annular support adapted to be concentrically fixed on an adjustment control shaft and includes a flexible manual adjustment knob mounted for free concentric rotation on the support in closely spaced surrounding relation to said annular support to prevent accidental rotation of the support and shaft. The knob has an annular flexible resilient skirt area surrounding the annular support and depressible into contact with the periphery of the annular support by manual depression of the opposite sides thereof toward the annular support to frictionally engage the support for selective rotative adjustment of the support and the shaft.

BACKGROUND OF THE INVENTION

Standard manual adjustment instrument or device control knobs for various purposes have not been found completely satisfactory, especially where the manipulating knobs, for instance on a control panel, are small and closely spaced adjacent each other. When turning or adjusting a selected control knob, an adjacent control knob may, and is most likely to be accidently struck or brushed against and rotated.

The accidental hitting or striking of an adjacent control knob while adjusting a selected control knob often results in the inadvertent and unintentional turning, or partial turning, of the adjacent knob and may seriously change the setting, and effect the performance of the apparatus, or device, or instrument controlled by the initial setting of the adjacent knob or knobs.

This may cause a change of preset required values, and sometimes become very serious. In test work, computers, test bench equipment, and aircraft control panels where the control knobs, for compactness and convenience, may be relatively small and placed in close adjacent relation to each other the inadvertent striking and accidental adjustment of an associated control knob or knobs can be dangerous and have catastrophic results, causing lost effort, time and money.

In flying, especially under instrument control, the same rational exists. A change in latitude-longitude setting, during a night bombing problem because the glove of the navigator or pilot accidentally brushed or struck an adjacent control knob while grasping and adjusting a selected control knob could and probably would end up by missing the target, or even missing the desired drop location. In "war time" this would be a serious error.

Attempts have been made to lock control knobs by using positive locking means. These must first be "manipulated" to unlock or release the knobs so that they can be subsequently adjusted and then relocked. This required time and two, if not three, coordinated operations. Push-pull knob arrangements have been proposed, so that the knob will be locked against rotative adjustment and unlocked to permit the rotative adjustment thereof, respectively, when the knob is in one or the other of its "push-pull" positions. This also requires two coordinated separate operations. Push button locks for control knobs also require two separate coordinated operations for the manipulation thereof. The subject invention provides a novel adjustment knob control device and improvements over

the above previously known, or referred to, devices where the grasping only couples the knob to its adjustment control shaft.

Summary of the invention

The invention comprises a control knob adapted to be mounted on an adjustment control shaft for a device, instrument or apparatus that is to be selectively controlled by the rotative adjustments of the shaft, but the knob is normally "free wheeling" on the shaft so that the knob can be only connected to the control shaft by a single coordinated and purposeful natural grasping and squeezing of the opposite sides of the knob toward each other while turning the knob. When released the knob becomes "free wheeling" again on its supporting instrument or device adjustment control shaft and the shaft becomes impervious to accidental or unintentional rotative adjustment for any reason, such as by hitting, brushing or touching of its control knobs by an operator's hand or his glove, for instance, while selectively actuating or adjusting a selected adjacent control knob device. Accidental hitting or striking of the adjacent knobs will only result in a "free wheeling" spin of these knobs on their shafts, without disturbing the previously angular adjusted positions of the shaft—or shafts—on which the knobs are mounted and, of course, without disturbing the selected adjustments of the instruments, devices or apparatus controlled by the shaft or shafts.

Another object of the invention is the provision of a control knob for operating an adjustment control shaft which includes a central support or stem which is adapted to be fixed on the control shaft of an instrument or device and has a concentric circular disc fixed thereon, and an annular manual manipulating shell which is concentrically journalled for free rotation on the stem, in which said shell has an annular resilient concentric skirt portion disposed in radially spaced relation to and over the periphery of the disc, and is adapted to be grasped and squeezed between the thumb and forefinger of an operator to frictionally engage the periphery of the disc to rotate the central support or stem and the control shaft when the operator's hand is turned while still grasping the sides of the knob between his fingers.

Other objects and advantages will become apparent from the following description and accompanying drawing in which like reference characters refer to like parts in the several figures.

Brief description of the drawing

FIGURE 1 is a plan or elevational view of an instrument or other device adjustment control knob incorporating the invention with a portion of the mounting panel therefore broken away and portions of adjacent similar control knobs shown in dotted lines.

FIGURE 2 is a vertical sectional view taken approximately on the plane indicated by line 2—2 in FIGURE 1, the dotted lines showing an operator's forefinger and thumb grasping the knob and pressing or flexing the opposite sides of the peripheral portion of the knob into functional operating engagement with a friction disc on the supporting stem.

FIGURE 3 is a transverse sectional view taken about on line 3—3 in FIGURE 2, looking in the direction of the arrows.

FIGURE 4 is a transverse sectional view taken about on line 4—4 of FIGURE 2, looking in the direction of the arrows.

FIGURES 5 and 6 are detail side and end views of a slightly modified form of central support or stem with the "free wheeling" manipulating resilient knob or shell shown in dotted lines.

FIGURE 7 is a longitudinal sectional view through a

further modified form of control knob showing the adjustment control shaft receiving stem portion and the annular friction disc removable as a unit so that different size shaft receiving sockets may be substituted to accommodate and fit shafts of smaller or larger diameters.

Description of the preferred embodiment

Referring to the drawing, and more particularly FIGURE 1, the reference numeral **1** denotes a portion of a supporting or instrument control panel having a plurality of adjustment control knobs **2** incorporating the invention mounted thereon, each for selectively adjusting a device, instrument or part of an apparatus such as indicated at **3** in FIGURE 2, for instance as shown in this figure the control element or device **3** may be a potentiometer, rheostat, or other control device mounted or fixed in back of the panel **1** and having a control or adjustment shaft **4** projecting through the panel on which one of the adjustment knobs **2**, **2*a***, **2*b***, incorporating the invention, is mounted.

The control knobs **2** each include a central stem or supporting shaft **5** formed with a concentric recess or bore **6** in one end to snugly receive the end portion of an instrument adjustment shaft **4** therein.

The central stem **5** has a circular friction disc **7** concentrically fixed thereon adjacent the outer or recessed end thereof.

Means may be provided for fixedly securing the outer end of the instrument adjusting control shaft **4** in the recess bore **6** or socket of the stem **5** to prevent relative rotary or axial movement between the stem **5** and shaft **4**, such as set screw means **8** passing radially through the friction disc **7** and stem **5** into the side of the control shaft **4**.

While the recessed stem or shaft **5** and the concentric friction disc **7** are shown integral the stem may be made tubular from end to end, and the friction disc **7** made separate, and then "press-fitted" onto the instrument control shaft receiving end portion thereof, with the set screw **8** passing through the disc **7** and stem **5** to secure the elements **5** and **7** in fixed relation on the control shaft **4**, against both relative axial and rotative displacement.

The other or opposite end **9** of the stem **5** (or tubular member) carries a ball or anti-friction bearing mounting means or surface, preferably turned down to a reduced concentric diameter to receive the inner ball race **11** of a ball or anti-friction bearing **14** thereon by "press-fit" as shown in FIGURE 2.

The outer ball race **12** of the bearing **14** is freely rotatable on the stem **5** in a plane perpendicular to the axis of the stem, and carries thereon the outer or manipulating shell **13** of the manipulating knob **2**. The shell **13** is therefore freely rotatable on the control shaft **4**, when the same is inserted and secured in the socketed recess or bore **6** in the stem member **5**.

The manipulating knob **2** therefore comprises a hollow resilient shell or cup **13**, preferably made of suitable resilient plastic material, for instance, "nylon" and is formed with a ball bearing receiving recess **15** in its bottom, concentric to its central axis, to snugly receive and secure the outer ball race **12** of the ball or anti-friction bearing **14** therein.

It is contemplated that a cylindrical metal insert or bearing receiving cup (not shown) may be inserted, or even molded, in the center of the bottom or closed end of the manipulating shell or cup **13**, in which the insert has a central recess or socket to snugly receive and secure the outer ball race **12** of the bearing **14** therein by "press-fit," or other means such as cement.

As shown in the drawing, however, the bottom of the inside of the manipulating knob or shell **13** is formed with the circular concentric recess **15** to snugly receive the outer ball race **12** of the bearing **14**, and the shell **13** is preferably provided with an inwardly extending lip annular or detent means **16** for firmly retaining the outer ball race **12** of the bearing **14** in place in the recess **15** in the shell **13**.

The resilient flexible annular gripping portion of the manipulating cup or shell **13** extends away from the ball bearing receiving portion **15** with the outer end of the inner periphery of its skirt portion **17** disposed in concentric closely spaced surrounding relation to the periphery of the friction disc **7**, substantially as shown. As previously mentioned, the shell is resilient and flexible and may be thin with the outer end portion **17** of the skirt overlying the friction disc **7** in predetermined closely spaced concentric relation, normally preventing frictional contact of the inner annular surface of the shell **13** with the friction disc **7**.

The manipulating shell **13** of the adjustment control knob **2** is therefore normally free to turn and completely "free wheeling" around the axis of the friction disc member **7**, and of course, around the axis of the instrument adjustment control shaft **4**, when the shaft is inserted and secured in the receiving recess or bore **6** in the stem portion **5**.

If desired the friction disc **7** may be provided with a pointer **18**, substantially as shown, to indicate when the instrument control shaft **4** is actually turned or adjusted by the manipulating or adjustment control knob **2**, and to what extent.

As shown in FIGURE 1, the dotted lines illustrate two closely spaced adjacent adjustment knobs **2*a*** and **2*b***.

Since all of the knobs **2** (**2*a***, **2*b***, etc.) are normally free to turn, or "free-wheel," the striking or inadvertent hitting or brushing against any of the adjacent knobs (**2*a***, **2*b***, etc.), for instance, in manually adjusting a selected intermediate or adjacent knob controlled device or apparatus **3** will not and cannot effect the previous adjustments or setting of the adjacent shaft or shafts and the device or instrument controlled or adjustable by the adjacent knob or knobs. The adjacent knob or knobs would only "free wheel" or spin on their respective supporting adjustment control shaft or shafts **4**.

It might be mentioned that the manually adjustable control knobs **2**, **2*a*** and **2*b***, as shown, are probably much larger than those usually employed in actual practice, although they may be made any size as desired. On certain instrument control panels the diameters at the periphery of the manipulating shells **13** may be as small as one half inch, or even smaller, with the spacing between the adjacent adjustment control knobs very close, not much more than sufficient for an operator to grasp the opposite sides of the skirt portion **17** of the shell, for instance as seen in dotted lines in FIGURE 2. By grasping or squeezing the opposite sides of the annular skirt **17** of the knob **2**, both sides are pressed or flexed toward each other into frictional engagement with the periphery of the friction disc **7**. Turning adjustment of the operator's hand while grasping the selected knob, therefore, adjusts the control shaft **4** on which the selected knob is mounted.

Even with thick gloves on the operator's hand, a brushing contact or striking of an adjacent control knob or knobs can only cause the knobs contacted to spin on their supporting ball bearings **14** and the setting, or desired adjustments of the instruments, apparatus, or devices controlled thereby will not be disturbed.

The knobs **2** incorporating the invention, like any other conventional knobs, must be grasped between the thumb and forefinger and turned to make an adjustment.

In the subject invention the grasping, however, also couples the selected "free-wheeling" knob **2** to the selected control shaft **4** in a single natural operation, followed by the turning to make the desired adjustment.

Release and withdrawal of the fingers permit the resilient skirt portion **17** to flex or spring back outwardly away from the periphery of the friction disc and release the control shaft. The actuation becomes natural in that all of the control knobs **2** are normally "free wheeling," except the ones that are grasped and turned. One natural

manual actuation only is necessary, that of grasping and turning, otherwise the knob 2 is free to spin on its control shaft 4.

Referring to FIGURES 5 and 6, the periphery of the friction disc 7' is provided with a plurality of equally spaced low projections or "bumps," indicated at 7*a*. The squeezing of the opposite sides of the periphery of the resilient flexible skirt portion 13 of the shell or knob 7' toward each other brings the opposite sides of the inner surface of the shell 13 into frictional operating contact with the low projection 7*a*. The spaces between the projections 7*a* allow any dust, dirt, grease, etc., that might accumulate within the shell 13, to escape between the projections 7*a*.

In the modification shown in FIGURE 7 the knob mounting stem 5' may be made in two (or more) pieces so that the central adjustment shaft engaging socket portion 5*a*, together with the friction disc portion 5*b*, may be changed to accommodate instruments or apparatus having control shafts, such as 4, of different diameters.

In this form of the invention, the portion of the stem 5*c*, that is fixed or otherwise concentrically secured in the inner ball race 5*d*, carries an enlarged socket or cup 5*e* in which the control shaft receiving socket portion 5*a* is secured, for instance by a "shim" sleeve and "press fitted" or pinned together.

It may be desirable to make the friction disc 7 of softer or increased friction material. In this event, the friction disc would be made separate, with a central hole, and tightly fitted in place on the instrument adjustment control shaft receiving socket portion of the stem 5.

For the purposes of exemplification, a particular embodiment of the invention has been shown and described to the best understanding thereof. However, it will be apparent that changes and modifications in the arrangement and construction of the parts thereof may be resorted to without departing from the true spirit and scope of the invention as defined in the accompanying claims.

I claim:

1. An adjustment control knob for instruments, devices, and apparatus having adjustment control shafts comprising, a central stem, means for connecting said central stem to an instrument adjustment control shaft, an annular friction disc concentrically fixed on said stem, a manual manipulating control knob mounted for free concentric rotation on said stem, said manipulating control knob having a circular resilient skirt portion surrounding said annular friction disc in closely spaced concentric relation to normally permit free rotation of said manipulating knob on said stem, said resilient flexible circular skirt portion flexible inwardly toward said stem into frictional driving engagement with the periphery of said annular friction disc when said manipulating knob is grasped, to frictionally connect said manipulating knob to said stem for rotative adjustment control shaft when fixedly connected to said stem.

2. Manipulating control knob for adjusting instruments devices, and apparatus, each having an adjustable control shaft substantially as claimed in claim 1, in which the central stem is concentrically recessed at one end to provide a bore to tightly receive the end portion of the adjustment control shaft concentrically therein in axial alignment with the axis of said stem.

3. Apparatus as set forth in claim 2, including annular ball bearing means having an inner ball race concentrically fixed on the other end of said stem perpendicular to the axis of said stem, said ball bearing means having an outer ball race concentrically fixed in said manipulating control knob in axially spaced relation from said resilient flexible circular skirt portion and from said annular friction disc.

4. Apparatus as set forth in claim 3 in which said manipulating control knob comprises a substantially circular cup shaped body adapted to surround said stem in concentric spaced relation having an annular concentric outer ball race receiving recess formed therein, receiving and securing said outer ball race of said ball bearing therein, in a plane perpendicular to the axis of said cup shaped body, said body including a circular flexible resilient annular wall portion having an inner peripheral end portion disposed in concentric closely spaced surrounding relation around the periphery of said friction disc, and adapted to be flexed radially inward by opposing pressure on the opposite sides thereof into frictional contacting engagement with the periphery of said friction disc when said skirt portion of said manipulating knob is grasped between the thumb and forefinger of an operator while turning his hand about the axis of said control shaft, to adjust said central control stem and an instrument adjustment control shaft when concentrically secured in said recess in said stem.

5. A control knob comprising, a concentric supporting stem, a hollow cup shape manipulating shell portion journalled for free rotation on said stem concentric to the axis of said stem, said shell portion having an annular thin flexible resilient skirt portion surrounding said stem in radially spaced concentric relation thereto, a circular friction disc fixed on said stem perpendicular to the axis thereof in a transverse plane through the outer end portion of said skirt portion, said circular friction disc having its periphery within the skirt portion of said cup shaped manipulating shell portion in closely spaced concentric relation to the inner surface of said annular thin flexible resilient skirt portion.

6. Apparatus as set forth in claim 5 including a supporting instrument control panel, a plurality of instrument adjustment control shafts extending through said panel in predetermined closely spaced relation to each other, a manual manipulating instrument adjustment control knob journalled on each of said control shafts for free rotational spin when brushed, struck, and hit by an operator when grasping and turning any other selected adjustment manipulating instrument adjustment control knob, said manual manipulating adjustment control knobs each comprising a central stem member having a central bore in one end thereof snugly receiving the outer end portion of one of the aforesaid instrument adjustment control shafts, a circular friction disc fixed on each stem perpendicular to the axis of said stem, located adjacent the control shaft receiving end portion of said bore, means extending through the side of the stem into said bore to contact with the inserted end portion of said adjustment control shaft when disposed in said bore to fixedly secure said stem on said adjustment control shaft against relative movement therebetween, an annular ball bearing having inner ball race, said inner ball race concentrically fixed on the other end portion of said stem, said ball bearing including an outer concentric ball race, said manipulating instrument adjustment control knob comprising a shell having an outer ball bearing race receiving recess formed in the central portion thereof, snugly receiving said outer ball race of said ball bearing thereon, said instrument adjustment manipulating control knob having a circular flexible thin resilient concentric skirt like wall portion extending away from said inner ball race receiving recess in concentric surrounding spaced relation to said stem and over the periphery of the friction disc, said circular skirt like wall portion having a circular inner surface normally disposed in closely spaced concentric non-touching relation around the periphery of said friction disc and flexible inwardly when grasped between the thumb and forefiinger of an operator into frictional actuating engagement with the periphery of said friction disc to rotate said friction disc, stem, and the instrument adjustment control shaft inserted in and secured to the stem when the operator's hand is turned, whereby striking, hitting, and brushing an adjacent similar manipulating instrument adjustment control knob or knobs causes the same to rotate and spin without disturbing the adjusted positions and adjustments of the control

shafts on which the said adjacent control knob or knobs are mounted.

7. Apparatus as set forth in claim 6 in which said central stem member is formed in at least two axially aligned sections, one section having the inner ball race fixed on one end thereof, the other section of the stem having one end recessed to receive and secure the end of an instrument adjustment control shaft concentrically therein, and having said circular friction disc concentrically secured thereon in a transverse plane through its recessed end, and means securing the respective other ends of the two sections together with their axes in axial alignment.

8. Apparatus as set forth in claim 6 in which the periphery of said friction disc is formed with annularly spaced low projections, disposed in closely spaced concentric relation to the inner surface of the shell, for frictional contacting engagement with the inner surface of the shell when the opposite sides of the shell in a plane

substantially through the friction disc perpendicular to the axis thereof are flexed toward each other by an operator in grasping the knob for the purpose of turning the same to adjust the instrument control shaft on which the instrument adjustment manipulating control knob is mounted.

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