

[54] **KNOB ASSEMBLY FOR VERNIER CONTROL DEVICE**

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[58] Field of Search 74/502, 487, 489, 554, 504, 74/503

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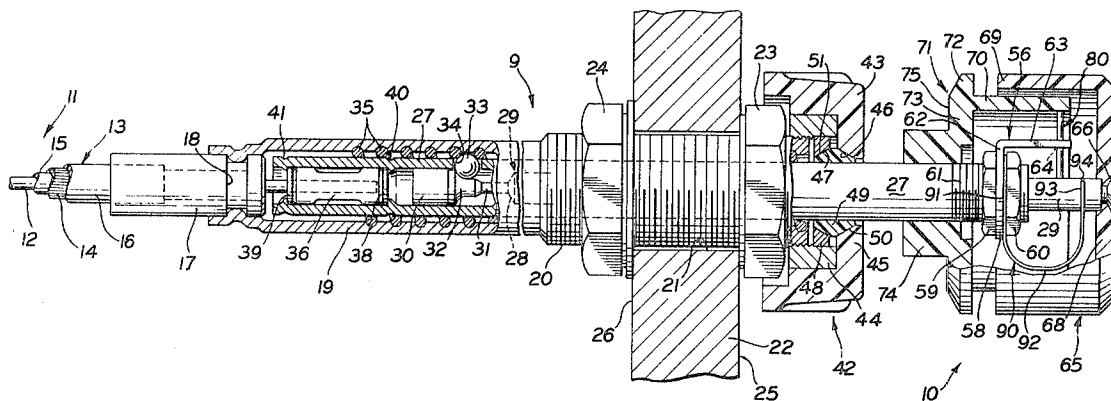
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[57] **ABSTRACT**

A knob assembly particularly adaptable to a control device for moving the core of a push-pull cable with respect to the casing thereof in gross amounts, and, selectively, in accurately fine, or vernier, increments. The control device employs concentric inner and outer members that are rotatable in unison to provide vernier control, but the inner member must first be moved in one direction independently of the outer member and sequentially thereafter the inner and outer members must be moved axially in unison to effect gross control. The knob assembly has a fixed knob means secured to the inner member, and a floating knob means slidably mounted about the outer member. A lever arm is swingingly mounted on a fulcrum carried by the outer member and operatively joins the floating knob means to the inner member in order to effect the required coordination of movement between the inner and outer members in response to the natural application of forces to the knob assembly by an operator.

5 Claims, 5 Drawing Figures



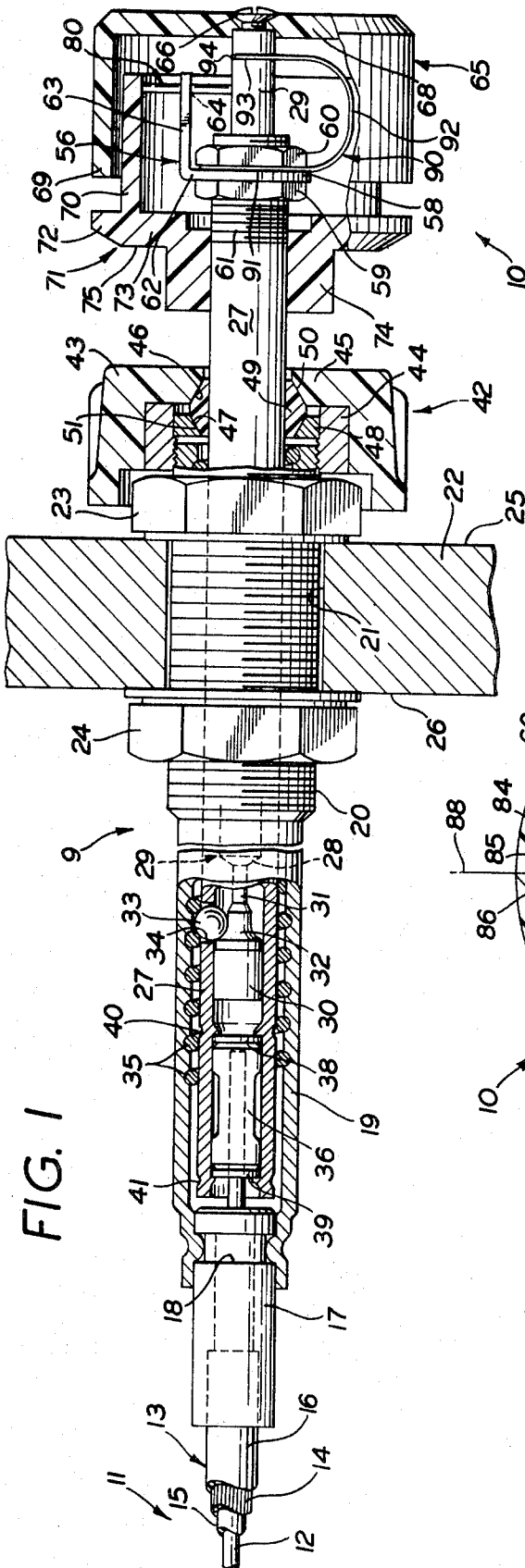


FIG. 1

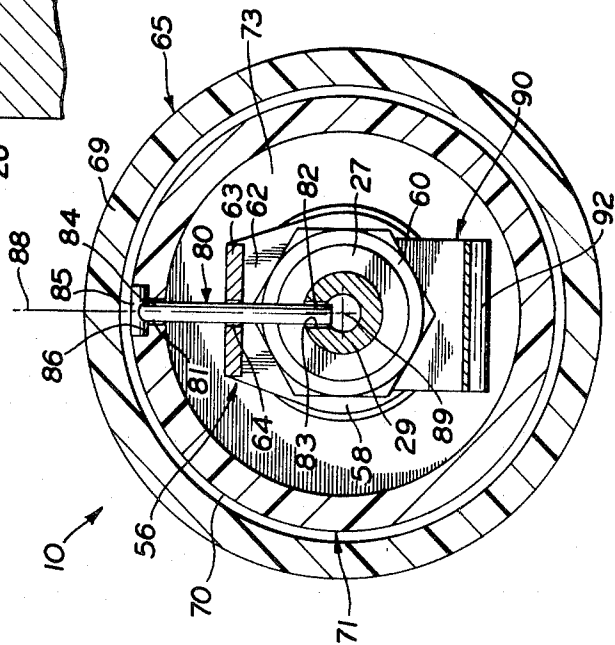


FIG. 5

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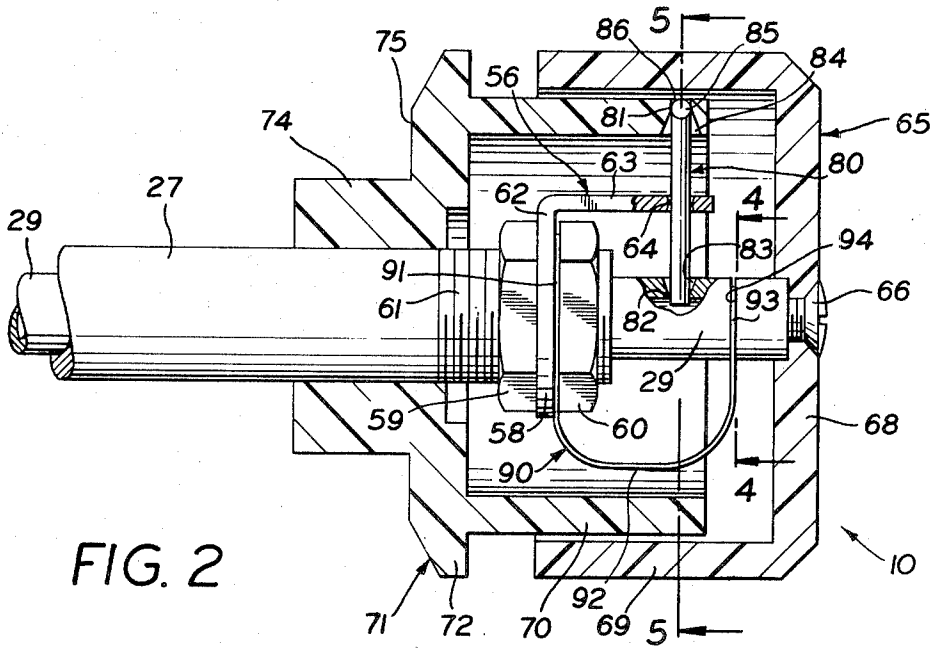


FIG. 2

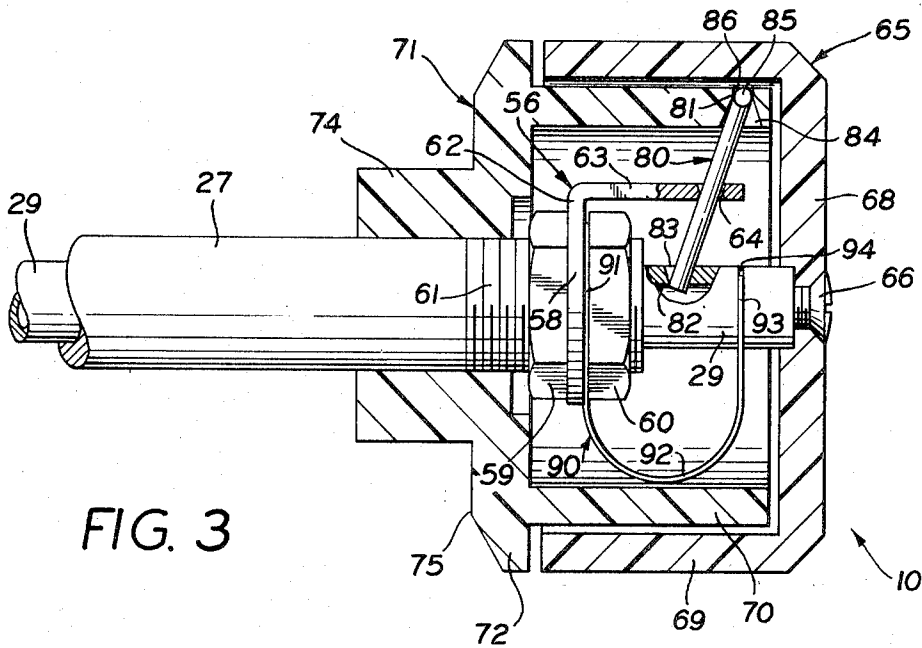


FIG. 3

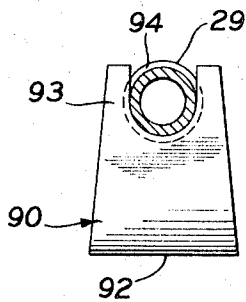


FIG. 4

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KNOB ASSEMBLY FOR VERNIER CONTROL DEVICE

BACKGROUND OF THE INVENTION

Push-pull control cables comprise a core that is slidably received within a casing and they are generally well known to the art as devices capable of transmitting mechanical motion in either direction by axial translation of the core when at least the ends of the casing are satisfactorily clamped in position. Push-pull cables, being flexible, are particularly suitable for installations where motion transmitting devices are required to extend through a number of bends between a control station and a remote controlled station. The use of a push-pull cable in conjunction with a throttle control typifies an installation of this nature and also exemplifies the situation wherein it is imperative that the control be capable of providing not only quick, major adjustments in gross but also fine, accurate, vernier adjustments.

Heretofore, several known control devices have been employed to provide such a result. One, popular, prior known construction utilizes a tubular housing attached to the cable casing. A tubular adjusting member, or sleeve, is slidably received within the housing and is connected to the cable core. The sleeve, in turn, has a selector rod slidably received therein for positioning a ball-like engaging member into and out of mating engagement with the threaded interior of the tubular housing member.

Many permutations on this basic construction have been devised in order to provide facile change from vernier to gross operation, and vice versa. Some prior art approaches have been completely unsatisfactory, and others have been rather successful, but for many installations the heretofore satisfactory approaches have been mechanically quite complex and therefore more expensive to manufacture and maintain than is desirable.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide a knob assembly particularly suited for a control adapted to adjust the core of a push-pull cable in gross, or, selectively, with accurately fine, or vernier, increments—the facile operation of which is totally independent of the personal stress to which the operator may be subjected.

It is another object of the present invention to provide a knob assembly, as above, that cooperatively interacts with the control not only to provide vernier adjustment merely upon rotation of the knob assembly but also instantaneously converts to provide adjustment in gross upon the natural application of axial force to the knob assembly.

It is a further object of the present invention to provide a knob assembly, as above, that is not only relatively uncomplex for economical manufacture and maintenance but which is also readily adaptable to prior known vernier control devices.

These and other objects, together with the advantages thereof over existing and prior art forms which will become apparent from the following specification, are accomplished by means hereinafter described and claimed.

In general, a control knob assembly embodying the concept of the present invention is adapted to rotate first and second members in unison and, selectively, to move the first member axially with respect to the second member and sequentially thereafter move the two members axially in unison. A fixed knob means is secured to the first member, and a fulcrum means is secured to the second member. Swingingly mounted on the fulcrum is a lever arm that has a force receiving portion and a force imparting portion spaced from the fulcrum. The force receiving portion interacts with a floating knob means slidable axially with respect to the two members, and the force imparting portion interacts with the first member so that rotation of the knob assembly rotates the two members in unison and the application of axial force to the knob assembly is adapted to move the first member axially with respect to the second member and thereafter the two members axially in unison.

One preferred embodiment of the present invention is shown by way of example in the accompanying drawings and described in detail without attempting to show all of the various forms and modifications in which the invention might be embodied; the invention being measured by the appended claims and not by the details of the specification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal section, partly broken away, through a vernier control device secured to a push-pull cable, said control device being provided with a knob assembly embodying the concept of the present invention;

FIG. 2 is an enlarged longitudinal section through the knob assembly depicting the components thereof oriented to provide vernier adjustment;

FIG. 3 is a view similar to FIG. 2 depicting the components of the knob assembly as they orient in response to the application of axial force to provide adjustment in gross;

FIG. 4 is a cross section taken substantially on line 4—4 of FIG. 2 depicting, in end elevation, a preferred form of spring means incorporated within the knob assembly to apply a biasing action between two members of the vernier control device; and,

FIG. 5 is a transverse section taken substantially on line 5—5 of FIG. 2 and appearing on the same sheet of drawings as FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, a control device 9 embodying the subject control knob assembly, indicated generally by the numeral 10, is depicted as being operatively attached to a push-pull control cable assembly 11. The push-pull control cable assembly 11 includes a core 12 and a casing 13 in which the core 12 reciprocatingly slides. The prior art knows many casing constructions, one of which is depicted environmentally herein and comprises a plurality of wires 14 contiguously laid in the form of a helical coil about the radially outer surface of an inner, flexible tube 15 that extends the full length of the casing 13. An outer, flexible cover 16 encases the coil of wires 14 and extends along the entire casing to within a short distance from the end of the wires 14.

An end fitting 17 having an annular mounting groove 18 is received over the end of the wires 14 and is securely attached thereto, as by swaging. The tubular housing 19 of the control device 9 may be connected to the fitting 18—and, as hereinafter further described, the cable casing 13—by crimping the tubular housing 19 into the mounting groove 18. To mount the control device 9 the threaded shank portion 20 of the housing 19 may extend through a suitable opening 21 in a control panel 22 and be secured in position by a pair of mounting nuts 23 and 24, the mounting nut 23 engaging the front face 25 of panel 22 and the mounting nut 24 being tightened against the rear face 26 of the panel 22.

Slidably received within the tubular housing 19 is a control sleeve 27, which, in turn, receives the shaft portion 28 of a release, or selector, rod 29. The shaft portion 28 of the selector rod 29 is slidable within the control sleeve 27 between an axially inner and an axially outer position with respect to the control sleeve 27. A head portion 30 is attached to, and spaced axially from, the shaft portion 28 by a neck 31 of reduced diameter. The head portion 30 presents a conically convex work face 32 adjacent the neck 31, and the work face 32 engages a thrust ball 33 when the selector rod 29 is in the axially outer position, but the work face 32 withdraws from the thrust ball 33 when the selector rod 29 is in its axially inner position.

The thrust ball 33 is movable inwardly and outwardly through a radial aperture 34 in the control sleeve 27. In its radially outermost position the thrust ball 33 meshingly engages the threads 35 on the interior of the tubular housing 19 to provide vernier control, as is more fully hereinafter described.

In providing such a vernier control device it is necessary that the control sleeve 27 and the selector rod 29 rotate relative to the housing 19, and, because the cable core 12 is often attached at its remote end in such a way that rotation thereof would be undesirable, it is preferable that the control sleeve 27 and the selector rod 29 contained therein be rotatably attached to the core 12. An exemplary construction is depicted in FIG. 1. The end of the control cable core 12 is swaged, or otherwise, affixed, to a cylindrical plug 36 that is rotatably received within the control sleeve 27. Two positioning members, in the form of washers 38 and 39, engage the opposed ends of the plug 36 and retain it against axial displacement with respect to the control sleeve 27. The washer 38 is maintained in its position against the plug 36 by a dimple crimp 40, and the washer 39 is similarly maintained against plug 36 by an end crimp 41.

The opposite end of the control sleeve 27 extends axially outwardly of the housing 19, through and beyond a frictional holding means 42. The holding means 42 employs an adjusting knob 43 having a nutlike base 44 that meshingly engages the threaded shank portion 20 of the housing 19 outwardly of the mounting nut 23. The adjusting knob 43 has a radially inwardly directed neck portion 45 that lies concentrically of the control sleeve 27. That side of the neck portion 45 facing the housing 19 flares conically outwardly to present a throat 46. A similar throat 47 on a compression disc 48 that bottoms against the end of housing 19 oppositely faces throat 46.

An annular friction collar 49 slidably engages the control sleeve 27 between the throats 46 and 47 and is preferably provided with conically tapered edges 50 and 51 matingly to be engaged by the corresponding throats 46 and 47 so that by turning the adjusting knob 43 to vary the axial separation of throats 46 and 47 a corresponding variation in the frictional resistance offered against movement of the control sleeve 27 can be obtained.

The structure heretofore described is generally well known to the art; however, the control knob assembly 10 mounted on the sleeve 27 and selector rod 29, as well as the interaction between the sleeve and selector rod afforded thereby, are wholly unique.

Outwardly of the housing 19, the control sleeve 27 carries an outrigger 56. As depicted, the base portion 58 of the outrigger 56 may be secured between two lock nuts 59 and 60 carried on a threaded portion 61 of control sleeve 27. A spacer arm 62 extends laterally of the base portion 58 and terminates in a support arm 63 that is oriented in generally parallel relation with the control sleeve 27 to present a fulcrum 64 axially beyond the sleeve 27. The selector rod 29 extends not only axially beyond the control sleeve 27 but also preferably beyond the support arm 63 to mount the fixed knob means 65 of the control assembly 10 immovable with respect to the rod 29, as by screw 66 that pierces the face 68 of the fixed knob means 65.

An annular skirt means 69 extends from the face 68 toward the housing 19. A barrel portion 70 on a floating knob means 71 of the control knob assembly 10 extends concentrically within the skirt means 69. An extension flange 72 extends radially of the floating knob means 71 in proximity to the juncture between the barrel portion 70 and a hub portion 73 that carries a collar 74 which slidably circumscribes the control sleeve 27 over a sufficient axial span that motion of the floating knob means 71 with respect to the control sleeve 27 is generally restricted to axial translation. The floating knob means 71 thus presents a radially oriented grasping surface 75 to facilitate engagement by the fingers of an operator, as will be more fully hereinafter described with respect to the operation of the subject control knob assembly 10.

A lever arm 80 is supported on the fulcrum 64 for swinging movement that is preferably limited to a plane radially of the axis of the control sleeve 27. The lever arm 80 has a force receiving portion 81 and a force imparting portion 82 spaced from the fulcrum 64. The force imparting portion 82 engages a pivot bearing in the form of a flared, radial bore 83 (FIGS. 2

& 3) extending at least partially through the selector rod 29 (one wall, as shown), and the force receiving portion 81 of the lever arm 80 engages a pivot bearing in the form of a flared bore 84 radially through the barrel portion 70 of the floating knob means 71. One arrangement by which the force receiving and imparting portions of the lever arm 80 can be maintained in their respective pivot bearings is to provide a head 85 on the force receiving portion 81 and have the head 85 rotatably captured within a recess 86 in the radially outer side of the barrel portion 70. Engagement of the head 85 with the recess 86 prevents the lever arm 80 from being displaced radially inwardly, and the proximity of the skirt means 69 on the fixed knob means 65 to the barrel portion 70 of the floating knob means 71 prevents the lever arm 80 from being displaced radially outwardly.

It should also be appreciated that by making the head 85 in the form of a transverse bar and employing a mating recess 86, as shown, the swing of the lever arm 80 can be restricted to a single plane; in the situation depicted, a plane 88 (FIG. 5) extending radially of the axis 89 of the control sleeve 27.

The control device 9 is normally disposed to afford vernier control upon the mere rotation of the control knob assembly 10. This result obtains by the employment of a spring means 90 disposed to bias the selector rod 29 axially outwardly with respect to the control sleeve 27. As shown, the spring means 90 has an anchor tab 91 that is secured to the control sleeve between the base 58 of outrigger 56 and the mounting nut 60. A bowed arm 92 curves in a generally U-shaped configuration from the anchor tab 91 to a forked end 93 that interlock with an annular notch 94 in the outer surface of the selector rod 29.

Because the biasing action of the spring means 90 urges the selector rod 29 axially outwardly with respect to the control sleeve 27, the work face 32 on head 30 is normally biased against the thrust ball 33 to urge it outwardly through aperture 34 and in engagement with the threads 35 on the interior of housing 19.

In most situations an operator will grasp the skirt 69 on the fixed knob portion 65 to rotate the control knob assembly 10, although an operator might occasionally grasp the edge of the flange 72, but in either event the control sleeve 27 and the selector rod 29 will rotate in unison because the lever arm 80 is restricted to swinging movement only in a plane transverse the direction of rotation. During this rotation of the control sleeve 27 and the selector rod 29 in unison the ball 33 follows the helical course of the threads 35 to effect vernier, or fine, axial displacement of the core 12 within the casing 13.

Should it be desired to effect control in gross, the operator need only grasp the control knob assembly 10 in the most natural manner and apply pressure in the direction in which gross control is desired.

For example, should it be desired to apply gross control by a withdrawal motion of the control knob assembly 10, the operator would merely place his fingers behind the lips 72, engage them with the grasping surface 75 and apply pressure axially outwardly thereagainst. Because the thrust ball 33 normally engages both the control sleeve 27 and the thread means 35, the control sleeve 27 will tend to resist axial translation. Accordingly, the application of the withdrawal pressure on grasping surface 75 will translate the floating knob means 71 axially outwardly with respect to the control sleeve 27, thereby swinging the lever arm 80 about fulcrum 64 to displace the selector rod 29 axially inwardly with respect to the control sleeve 27 (i.e., from the position depicted in FIG. 2 to the position depicted in FIG. 3). This relative movement between the selector rod 29 and the control sleeve 27 translates the work face 32 on head 30 axially away from the thrust ball 33 permitting the latter to withdraw within the aperture 34 so that the control sleeve 27—and thus cable core 12—can be displaced in gross.

Once the withdrawal pressure on the grasping surface 75 is released, the spring means 90 immediately responds to extend the thrust ball 33 radially outwardly into engagement with the threads 35 for an instantaneous, automatic return to readiness for vernier operation.

Should gross control be desired in the opposite direction, the operator need only apply axially inwardly directed pressure against the fixed knob means 65. Here, too, the thrust ball 33 tends to maintain the control sleeve 27 axially fixed with respect to the housing 19 until the axially inward force applied to the knob means 65 displaces the selector rod 29 axially inwardly with respect to the control sleeve 27 an amount sufficient to release the radially outward directed force component (by work face 32) against the thrust ball 33. Thereafter, the continued application of axially inwardly directed force against the knob means 65 displaces the control sleeve 27 and selector rod 29—and thus cable core 12—in gross.

It should now be apparent that a knob assembly embodying the concept of the present invention is particularly adaptable to a control device for a push-pull cable and not only permits facile and instantaneous conversion from vernier to gross adjustment, and vice versa, but also otherwise accomplished the objects of the invention.

What is claimed is:

1. A control knob assembly for rotating concentric inner and outer members in unison, and selectively, for moving the concentric inner member axially in one direction and sequentially thereafter axially in either direction in unison with the outer member comprising, a fixed knob with a skirt portion secured to the inner member, a floating knob with a barrel portion movably axially within said skirt portion, said floating knob being slidably mounted on the outer member, a lever arm swingingly mounted on said outer member and operatively engaging said floating knob and said inner member.

2. A control knob assembly, as set forth in claim 1 in which a generally radial grasping surface is provided on said floating knob means and is presented axially of said fixed knob means.

3. A knob assembly for a vernier control device to actuate a push-pull cable having a core and a casing, the vernier control device having a housing secured to the cable casing, a control sleeve slidably received in said housing, one end of the control sleeve operatively secured to the cable core, a selector rod

received in said control sleeve and movable between an axially inner and an axially outer position, a spring means for cooperating with said selector rod to bias it toward the axially outer position whereby the thread engaging means normally mesh with the thread means in said housing, thread means on the interior of said housing and thread engaging means movable generally radially of said control sleeve in response to axial movement of said selector rod, said control knob assembly comprising, a fixed knob means secured to the selector rod, a fulcrum carried on said control sleeve, a floating knob means slidably mounted on said control sleeve, and a lever arm movably mounted on said fulcrum and operatively connecting said floating knob means to said selector rod, said fixed knob means has a skirt portion and said floating knob means has a generally radial grasping surface located axially of said skirt portion, said floating knob means has a barrel portion movable within said skirt portion and in which said fulcrum is spaced axially beyond said control sleeve and medially of said barrel portion and the selector rod, said lever arm having opposed ends, one end cooperatively engaging said barrel portion and the opposite end cooperatively engaging said selector rod.

4. A knob assembly, as set forth in claim 3, in which said lever arm has a head portion engaging said barrel portion, the interaction of said head portion and said barrel portion maintaining said lever arm against displacement radially inwardly of said barrel portion, and the proximity of said head portion with said skirt portion on said fixed knob means maintaining said lever arm against displacement radially outwardly of said barrel portion.

5. A knob assembly, as set forth in claim 3, in which said lever arm has a head member, said barrel portion of the floating knob means having a recess, said head member being received within said recess, the cooperative interaction of said head member and said recess restricting movement of said lever arm to swinging motion in one plane.

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