July 16, 1946. C. S. WOLOWICZ ET AL 2,404,116

ADJUSTING MECHANISM

Filed April 15, 1944

Fig. 1.

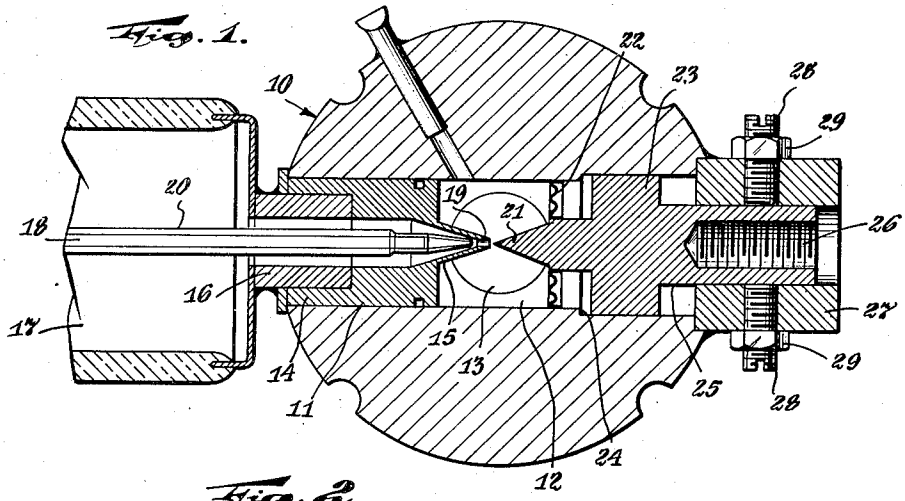


Fig. 2.

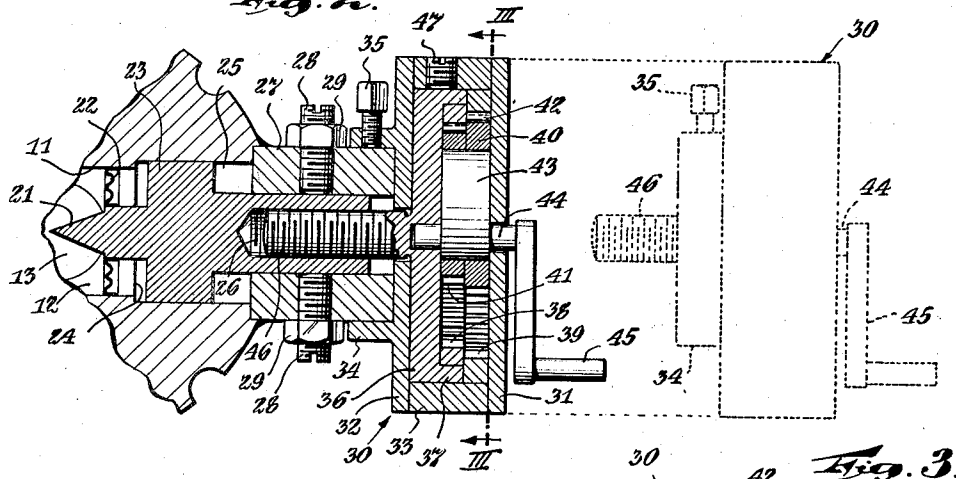


Fig. 3.

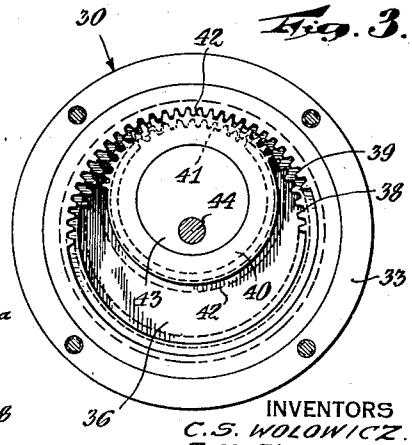
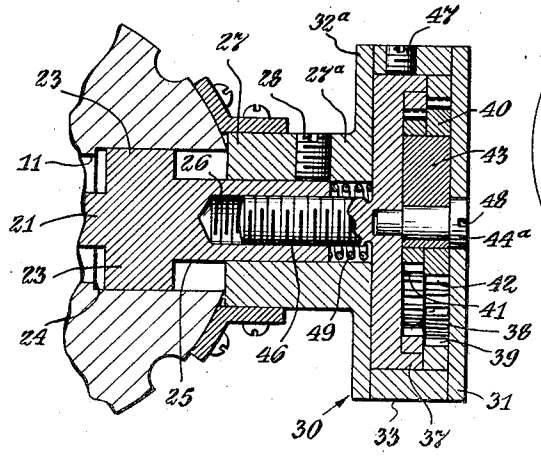


Fig. 4.



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ADJUSTING MECHANISM

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5 Claims. (Cl. 74—401)

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This invention relates to adjusting mechanism and more particularly to adjusting mechanism for use with TR boxes forming part of radar systems.

The use of TR boxes is now well established in the art, although specific construction of the same may differ considerably. Essentially a TR box is a cavity enclosure within which are situated two electrodes across which a high voltage short circuit may be effected usually with the aid of an ionizable medium. In order that the cavity may transmit weak signals therethrough intervening between the blocked high voltage pulses, said cavity must be delicately turned to be in resonance with such signals. The tuning is ordinarily performed at the place of manufacture of the TR box, but has proved to be unsatisfactory in many instances for various reasons.

An object of the present invention is to provide a more positive and more satisfactory tuning or adjusting mechanism.

Another object of the invention is to avoid appreciable back-lash in the tuning operation.

Another object of the invention is to provide a structure capable of being locked in adjusted position.

A further object of the invention is to provide a removable adjustment control.

Yet another object is to maintain axial alinement of the electrodes irrespective of adjustment thereof.

Still other objects will appear to those skilled in the art to which the invention appertains as the description proceeds, both by specific recitation thereof and by inference from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is a cross sectional view of a TR box with that part of the tuning mechanism thereon which remains part thereof;

Figure 2 is a similar cross sectional view of a TR box to which the removable portion of the tuning mechanism, namely the tuning control, is applied, removability of the tuning control being indicated by dotted line representation thereof withdrawn from the TR box;

Figure 3 is a sectional view on line III—III of Fig. 2; and

Figure 4 is a cross sectional view of a portion of a TR box to which a modified form of tuning mechanism is applied as a permanent part thereof in its entirety.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 indicates the body of a TR box here constructed as a thick disc having a large diametric passage 11 intersected by an axial passage, the intersecting portions of said passages constituting the resonant cavity 12 of the device. The ends of the axial passage at the flat faces of the body portion are sealed vacuumtight with windows 13 transparent to a micro wave energy. The said disc body portion is, in use, interposed between the ends of waveguide sections (not shown) with the windows facing into said sections. The impulses come into the cavity 12 from one said section, and those which are permitted to pass the cavity leave through the opposite window to continue to the receiver.

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One end of the diametric passage 11 of the body portion has a fixed hollow plug 14 therein terminating within the cavity 12 in the form of a conical hollow electrode 15 axially coincident with the axis of the cavity, and said hollow electrode having its virtual apex toward the middle of the cavity. The other end of said plug 14 at the outside of said body portion 10 has a socket wherein is received and secured vacuumtight a neck portion 16 of a reservoir 17. This reservoir assures presence of an ionizable gas available to the cavity 12. Said reservoir is of course vacuumtight and has a cylindrical glass wall for insulating purposes in order that a pilot electrode 18 may be supported out of electrical connection with the said body 10. This pilot electrode 18 extends through plug 14 coaxially therewith and terminates within the hollow conical electrode 15 close to the inner wall thereof toward the apex. Said apex has a coaxial hole 19 therein as a continuation of the hollow interior of the plug, and the end of the said pilot electrode is positioned close to that hole. Preferably said pilot electrode is provided with a glass or other insulating sheath 20, which covers the same except at the tip where discharge and ionization between said pilot electrode and hollow conical electrode is desired. A direct current voltage difference is maintained between these two electrodes, and thus an ionized medium is maintained in the cavity 12.

Cooperating with said hollow conical electrode 15, opposed thereto and on a common axis therewith and with diametric passage 11, is a solid electrode 21 having a conical end portion, the apex of which is likewise toward the middle of the cavity 12 and consequently in proximity to the virtual apex of the hollow conical electrode 15. Next the base of the conical portion of solid

electrode 21 is secured, vacuum tight, a flexible diaphragm 22, the periphery whereof is sealed vacuum tight to the cavity wall therearound, said solid electrode projecting into said cavity through the middle of said diaphragm. At the outer side of said diaphragm, the said solid electrode is enlarged to form a piston 23, the periphery whereof has sliding fit with the wall of diametric passage 11. Said passage, in the region containing piston 23, is preferably of somewhat greater diameter than the region containing the diaphragm, thereby providing a shoulder 24 facing outwardly toward the piston and constituting a stop by which inward movement of the piston is limited for preventing the solid electrode from ever engaging the hollow electrode.

At the opposite face of the piston 23 from the conical portion or tip of the electrode 21 is a stem 25 of less diameter than and projecting coaxially from the piston. This stem is drilled longitudinally inward from its outer end and the drilled hole is tapped with screw threads 26 of small pitch. Said stem 25 is slidable within a bearing collar 27 (Figs. 1 and 2) or 27*a* (Fig. 4), which is made a fixed part of the body portion of the TR box at the end of diametric passage 11 thereof.

In Figures 1 and 2, the said collar 27 is indicated as soldered in permanent position. Set screws 28 extending radially of the collar wall are adapted to engage stem 25 of the solid electrode for securing said electrode in position to which adjusted. For added security, these set screws 28 may in turn be rendered immovable by lock nuts 29 thereon. The structure according to showing of Fig. 1 is adjusted, and the set screws and lock nuts securely tightened at the place of manufacture or elsewhere, and the device used in the field without adjustment by inexperienced or unauthorized persons.

In conjunction with the part of the adjusting means which is a permanent part of the TR box, a removable portion of the tuning mechanism is provided and shown in detail in Figures 2 and 3. Said removable portion will be herein designated in its entirety as the adjusting key 30. Viewed generally, said key provides a cylindrical housing made up of front and back disc plates 31, 32 and a cylindrical wall 33 interposed between the peripheral margins of said plates. At the outside of the back plate 32 is an annular flange 34 of appropriate diameter to make fitting engagement upon the peripheral end margin of the aforementioned collar 27, thereby enabling the housing to be coaxially assembled upon the projecting end of said collar. A set screw 35 in said flange 34 provides for the temporary retention of the housing in its assembled position on the collar.

Within said housing of the tuning key and against the inner face of back wall 32 thereof is a drum 36 flanged as at 37 at its periphery with said flange projecting toward the front wall of the housing. Fixed within this flange is a toothed ring 38, the teeth of which are at the radially inner periphery thereof. Between said ring and the front plate 31 and overlapping the front edge of flange 37 is another toothed ring 39, the teeth whereof are likewise at the radial inner periphery of the ring. Said rings are of different diameters affording different pitch diameters for the teeth so that said rings constitute a differential. The forward and larger of these differential rings is fixed with respect to the housing. Within the two said rings is provided an eccentric band or gear 40 having a peripheral series of teeth 42 in mesh with the teeth of the larger ring 39. Assembly of differential toothed rings and double eccentric gear is designated an epicyclic differential.

The eccentric band or gear 40 is rotatably mounted on an eccentric 43 in turn fixed on a stub shaft 44 having means for rotating the same, illustrated in Figure 2 as a crank 45 fixed on the outer end of said stub shaft. Coaxial with said stub shaft and projecting from and fixed with respect to drum 36 and likewise coaxial with respect thereto, is a screw 46 threaded to mesh with the small pitch screw threads 26 of the piston stem 25. Since the outer larger ring 39 is fixed to the housing and the inner smaller ring 38 is fixed to the drum and said drum and screw 46 are integral, rotation of said eccentric 43 revolves the eccentric gear band 40 with respect to fixed ring 39 and differentially drives the smaller ring 38, drum and screw a part of a revolution with each revolution of the crank. A very minute movement of the piston accordingly results from each revolution of the crank.

Application of the key 30 to operative position is readily accomplished by applying the screw 46 to the threaded hole 26 of the stem and spinning the housing until flange 34 thereof assumes its fully overlapping position on the end of collar 27. Set screw 35 is then manipulated to lock the housing against movement with respect to the collar, thus making the TR box and key a unit, after which operation of crank 45 will be effective to rotate screw 46 and adjust piston 23, solid electrode 21 and flexible diaphragm 22 by which resonant frequency of cavity 12 is varied and tuning accomplished. By preference, an auxiliary set screw 47 may be provided in housing wall 33 to hold drum 36 stationary while applying and removing the key and while tightening set screws 28. Loosening set screw 47 enables drum 36 to rotate independently of the housing. After said cavity is properly tuned, the key 30 is removed in reverse order and returning of the cavity is prevented except by an authorized person having the key.

It is deemed, however, within the scope of the invention, to retain the key as a permanent part of the TR box is so desired. If such be the desideratum, collar 27 of the TR box may be made integral with the back plate 32 of the housing. Fig. 4 is exemplary of such construction. Collar 27*a* therein is shown integral with plate 32*a* of the key housing. This view likewise shows actuating means for the epicyclic gearing to be accomplished by providing a kerf 48 in the outer end of a stub shaft 44*a*, the outer end of said shaft having an enlarged head instead of a crank thereon. Furthermore, a spring 49 may be placed between the piston stem and the drum 36 if so desired to keep the threads and other parts in tight engagement.

We claim:

1. An adjusting mechanism comprising a fixed member and a part slidable therein for adjustment, a housing on said fixed member, an adjusting screw projecting from said housing into said slidable part and adapted to adjust the same by rotation of said adjusting screw, gearing in said housing connected operatively to said adjusting screw, means for operating said gearing and thereby operating said adjusting screw and adjusting said slidable part, and means for locking said slidable part in adjusted position independent of holding of said part by said screw.

2. An adjusting mechanism comprising a fixed

member and a part slidable therein for adjustment, a housing on said fixed member, an adjusting screw projecting from said housing into said slidable part and adapted to adjust the same by rotation of said adjusting screw, gearing in said housing connected operatively to said adjusting screw, means for operating said gearing and thereby operating said adjusting screw and adjusting said slidable part, and means for locking said gearing and screw against rotation in said housing.

3. An adjusting mechanism comprising a fixed member and a part slidable therein for adjustment, a separate housing having overlapping engagement with said fixed member and removable from said fixed member, means for retaining said housing on said fixed member, gearing in said housing, means operatively connecting said gearing with said slidable part when said housing is applied to said fixed member, and means for locking said slidable part with respect to said fixed part, thereby permitting removal of said housing, gearing and operatively connecting means to said slidable part after adjustment of said slidable part.

4. An adjusting mechanism comprising a fixed member and a part slidable therein for adjustment, a separate housing having overlapping engagement with said fixed member and removable from said fixed member, means for retaining said housing on said fixed member, gearing in said housing, means operatively connecting said gearing with said slidable part when said housing is applied to said fixed member, means for locking said slidable part with respect to said fixed part, thereby permitting removal of said housing, gearing and operatively connecting means to said slidable part after adjustment of said slidable part, and means for locking said gearing in said housing while applying and removing said operatively connecting means to and from said slidable part.

5. An adjusting mechanism comprising a fixed member and a part slidable therein, a housing at one end part of said fixed member, said fixed member having one wall of said housing an integral part thereof, a drum rotatable in said housing, said drum having a screw projecting through said wall and in threaded engagement with said slidable part, gearing in said housing having driving connection to said drum and screw for adjusting said slidable part, and a spring interposed between said slidable part and drum.

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