March 10, 1953 K. W. LINDSAY ET AL 2,631,212

POTENTIOMETER TANDEM ASSEMBLY

Filed July 24, 1952 2 SHEETS—SHEET 1

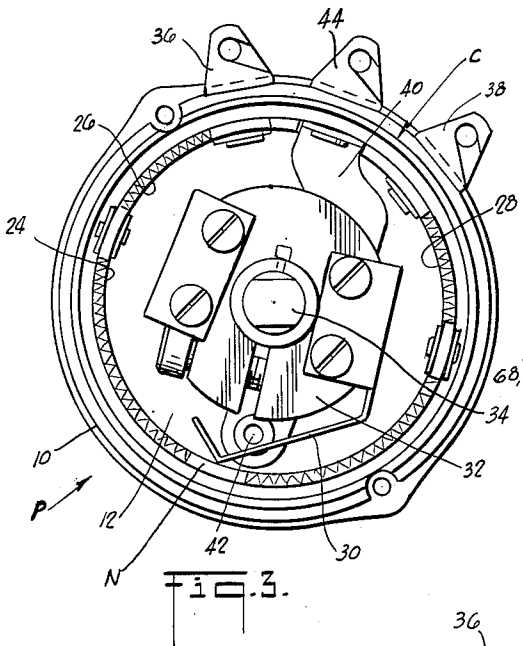


Fig. 3.

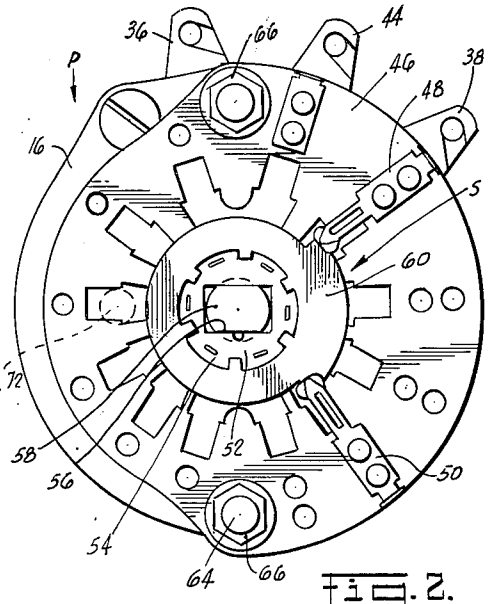


Fig. 2.

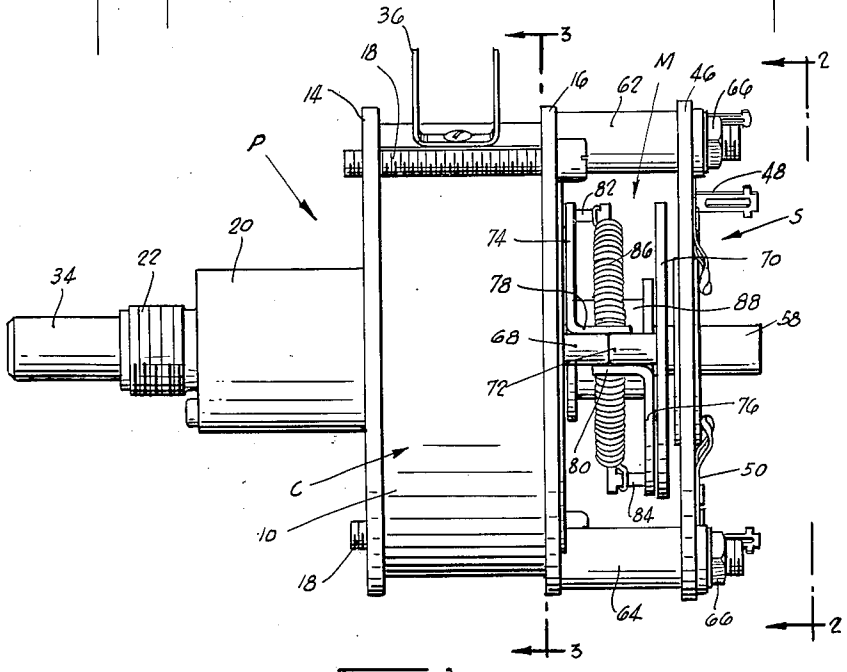


Fig. 1.

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Fig. 4.

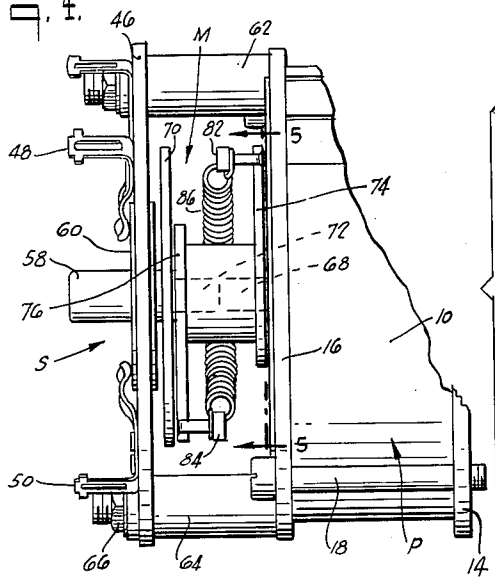
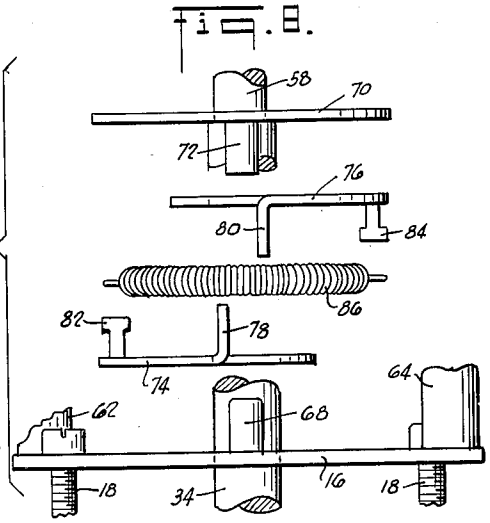


Fig. 8.



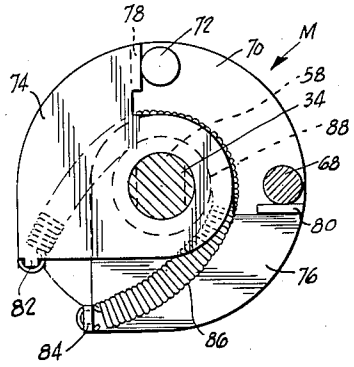


Fig. 6.

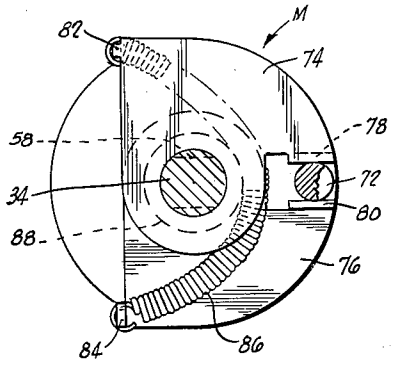


Fig. 5.

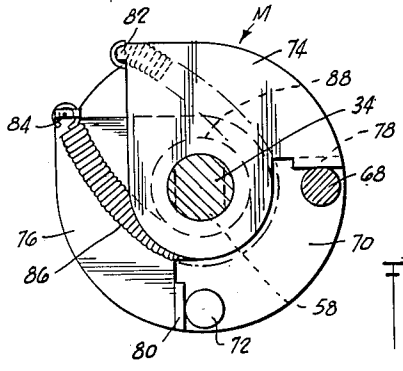


Fig. 7.

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POTENTIOMETER TANDEM ASSEMBLY

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2 Claims. (Cl. 201—48)

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This invention relates to a potentiometer tandem assembly and more particularly to the combination of a potentiometer and a second electrical instrument such, for example, as a switch, assembled in tandem relation with mechanical and cooperative electrical precision.

The potentiometer tandem assembly of the present invention pertains in its particular embodiment to a tandem assembled potentiometer and switch in which the movable element of the potentiometer and the movable element of the switch associated instrument are manually rotatable unitarily in either direction from a neutral potentiometer position, and which upon manual release are automatically returned to such neutral potentiometer position.

Such potentiometer and switch assemblies are employed in radio and radar circuits which require initial precision operation and repeated unerring reproduceable performance. To accomplish this, the following are two desiderata, both of which are prime objects of the present invention, one being concerned with the manufacture of the assembly and the other with its use:

1. The potentiometer instrument and the associated electrical instrument such as the switch should be so assemblable in tandem, that mechanically (apart from any of the usual electrical tests made subsequently on the assembly), they become coupled in the act of mechanical assembly, even though produced on a mass production basis, with an exact mutual relationship with a high degree of precision, and

2. The potentiometer instrument and the associated electrical instrument in use should maintain with exactitude the desired precision relationship therebetween and should be capable after each of the repeated operations, of automatically returning the operated parts with continued reliability to their mutual relationship within the closest tolerances.

To the accomplishment of these objects the present invention relates to the potentiometer tandem assembly as particularly defined in the appended claims taken together with the following specifications and the accompanying drawings in which:

Fig. 1 is a side view of the potentiometer tandem assembly in its completed form, the parts being shown in the potentiometer neutral position.

Fig. 2 is a rear elevational view thereof.

Fig. 3 is a view thereof taken in cross-section in the plane of line 3—3 of Fig. 1.

Fig. 4 is a side elevational view taken on the

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side opposite to that of Fig. 1, with parts of the potentiometer broken away.

Fig. 5 is a partial view thereof showing the essential parts of the mechanism for coupling the potentiometer and the switch instrument, the same being a view taken in cross-section in the plane of the line 5—5 of Fig. 4 and showing the parts in the same relative relation as they are shown in Fig. 4.

Fig. 6 is a view similar to Fig. 5 showing the position that the parts assume when the potentiometer shaft is rotated in the direction shown by the arrows in this figure.

Fig. 7 is a view similar to Fig. 6 and showing the position that the parts assume when the potentiometer shaft is rotated in the opposite direction, and

Fig. 8 is an exploded view of the parts employed for coupling the potentiometer and the second electrical instrument, namely, the switch.

Having reference first to Fig. 1 of the drawings the tandem potentiometer assembly of the present invention comprises a potentiometer, generally designated as P, of known construction and a second electrical instrument coupled in tandem thereto such, for example, as a switch mechanism S, which also may be of known construction, and mechanism generally designated as M mechanically coupling the potentiometer and the switch mechanism to enable precise assembly and electrical cooperation therebetween.

The potentiometer P comprises a casing *c* containing the potentiometer elements, the casing comprising, for example, a cylindrical housing 10 provided with an integral front 12 made in the form of an insulating plastic unit, the said housing being provided at its outer end with a metal cover plate 14 and at its inner end with a metal closure plate 16, the said plates being secured together and to the casing by means of the diametrically positioned bolts 18, 18. The front plate 14 has riveted thereto a spacer post 20 provided at its front end with a threaded portion 22 for instrument mounting purposes. The casing *c* houses the potentiometer elements which consist of a fixed loop potentiometer coil 24 having a pair of sections 26 and 28 (see Fig. 2) and a rotatable contact unit comprising the contact element 30 movable over the range of the resistance element of the potentiometer, said contact element being attached to a rotatable hub 32 clamped to, but insulated from, an operating shaft 34. The potentiometer coil is united mechanically to the casing *c* by means of two riveted terminals 36 and 38 which at the same time are

connected conductively to the terminal leads of the potentiometer sections. The hub 32 rides over and makes electrical contact with a metal arm 40 riveted at 42 to the front or base of the housing 10 and riveted at its front end to the potentiometer common terminal 44 and mechanically to the housing 10. Potentiometers of this construction are of standard or known make. The potentiometer sections 26 and 28 are separated by a neutral area *n* and it will be noted in Fig. 3 of the drawings that the engaging region of the contact element 30 is located precisely at the mid-line of this neutral area.

The second electrical instrument which is united in tandem to the potentiometer and which is here illustrated as a switch mechanism S comprises a support or holder in the form of a plate 46 made of insulating material and designed to carry or have attached thereto two or more fixed switch elements, two of which, 48 and 50, are shown in the drawings (see particularly Fig. 2), these elements being riveted to the holder plate 46. Mounted centrally on the plate 46 is the rotatable switch member which comprises a metal annulus 52 secured to a wafer 54 made of an insulating material having a squared central opening 56 to fit over and to be anchored to a squared section 58 formed at the inner end of the shaft 34. The metal annulus 52 is formed with a contact blade section 60 which in Fig. 2 is shown to bridge and to make contact with the fixed switch contacts 48 and 50. This type of switch mechanism is also of a standard or known construction. It will be apparent that upon rotation of the shaft 34, the switch blade 60 may be moved into and out of mating or bridging relation with the fixed contacts 48 and 50 and may be made to make or break contact with any of the fixed elements which are mounted on the switch support or holder 46.

As a factor in producing a tandem assembly which is capable of the precision assembling steps and precision maintenance in use, the switch instrument S is directly united to a part of the potentiometer unit. The switch holder or plate 46 is therefore directly assembled to two spacer posts 62 and 64 which are riveted at their inner sides to the potentiometer cover plate 16, the switch holder or plate being attached to the spacer posts at their other ends by any suitable securing means such as by the nuts 66.

As aforesaid, tandem potentiometer and switch assemblies of the type thus far described are employed in radio and radar circuits which require initial precision operation and repeated unerring reproduceable performance, these requirements being satisfied by two desiderata which essentially are that (1) the tandem instruments should be so assembled, that mechanically they become coupled in the act of mechanical assembly with an exact mutual relationship with a high degree of precision and (2), the tandem connected instruments should maintain, with exactitude, the desired precision relationship therebetween and should be capable, where designed for automatic return of the parts, of automatically returning the operated parts with continued reliability as to their mutual relationship within the closest tolerances.

These ends are accomplished by the invented construction of the coupling mechanism M. The cover plate 16 is provided integrally (the same being riveted to the cover plate) with a pin 68 projecting outwardly from said closure element and defining a precise reference point in relation to the neutral area *n* of the potentiometer. Received by the squared portion 58 of the operating shaft 34 is a member in the form of a drive plate 70 rotated by the shaft 34 which drive plate is provided with a fixed pin 72 projecting inwardly thereof and movable (when the shaft is moved) over and into and out of registry with said fixed reference pin 68, the same being shown in registry position in Figs. 1, 4 and 5 of the drawings. Mounted on the round portion of the shaft 34 and loosely rotatable thereon at its tandem portion are two members 74 and 76, the member 74 being provided with a finger 78 and the member 76 with a finger 80, the finger 78 being arranged to engage one side and the finger 80 being arranged to engage the opposite side of the movable pin 72, and each finger being adapted to be brought into corresponding engagement with the reference pin 68. The members 74 and 76 comprise, specifically, arm plates having the fingers upturned therefrom, the arm plates being also formed with upturned anchoring fingers 82, 84. These members or arm plates 74 and 76 are connected by means of a coil spring 86 the ends of which are anchored to the anchoring fingers 82 and 84, the said coil spring being extended about a shaft spacer hub 88, the said spring connecting said members 74 and 76 in a direction to urge engagement of the fingers 78 and 80 thereof with the pins 68 and 72 to bring the latter into registry.

The construction of this coupling mechanism M, its functioning in the assembly and the operation of the parts resulting therefrom, are best depicted in Figs. 5 to 8 of the drawings. In Fig. 8 these parts are shown in exploded condition, the parts in superposed relation indicating the manner in which these parts are assembled. Fig. 5 shows the parts of this mechanism in the normal or manual released condition. The spring 86 is normally (Fig. 5) under initial tension, of approximately one pound, the coils of the spring being wound tight. In this normal position, the fingers of the plate arms 74 and 76, under the influence of the tension of the spring 86 are active on the pin 72 of the drive plate 70 and have moved the same in exact registry over the fixed reference pin 68. It will now be seen, first, how this construction ensures the assembling of the parts of the instrument with exactitude. The potentiometer elements are in a closed casing all forming a unit, the potentiometer elements of which are not visible to the assembler when the tandem instrument is to be united thereto. The reference pin 68 is, of course, in fixed relation to the inclosed potentiometer elements and has a determined relation with reference to, say, the midline of the neutral area *n* of the potentiometer coil. As a result the drive plate 70, keyed to the squared tandem portion 58 of the operating shaft 34 has its pin 72 so located thereon that when the two pins 68 and 72 are brought into exact registry in the manner shown in Fig. 5 of the drawings, the contact element of the potentiometer is at the exact midline of the neutral area *n* of the potentiometer coil and the switch blade 60 is in the exact bridging relation with reference to the contact elements of the switch. Therefore, by means of this construction, the mere bringing into assembly of the potentiometer unit and the switch unit, even though the parts of the former are concealed in the potentiometer casing, brings about

that exactitude of the relationship of the parts referred to.

Fig. 6 portrays the operation of the instrument when the shaft is rotated in the direction shown by the arrows in this figure. Fig. 7 illustrates the operation when the shaft is rotated in the reverse direction. In the former case, the pin 72 of the drive plate 70 moves the arm 76 to place the spring 86 under increased tension; and in the latter case, the drive pin 72 moves the arm 74 to similarly place the spring under increased tension. When, in either case, the shaft is manually released, the arm plate, resiliently active on the drive plate, will move the same and return back into pin registry position and will thus return the shaft, even after continuous and repeated operations in use, to the initial potentiometer and switch positions referred to and as are portrayed in Figs. 3 and 2 respectively.

The construction of the tandem instrument, the manner of assembling the same, the use of this instrument and the advantages thereof in manufacture and service are believed to be fully apparent from the above detailed description thereof. It will be further apparent that changes may be made therein, within the purview of the essence of the invention described without departing from the spirit of the invention defined in the claims which follow.

We claim:

1. In a tandem potentiometer assembly, consisting of a potentiometer comprising a closed casing having an inner end plate as its closure element, a fixed resistance element mounted in said casing having resistance sections separated by a neutral area, a contact element rotatably mounted in said casing movable over the range of said resistance elements, a shaft fixed to said contact element for rotating the same, said shaft having an operating portion extending from said casing at its outer end and a tandem portion extending from said casing at its inner closure plate end, and a second electrical device assembled in tandem to said potentiometer and comprising an electrical element fixedly mounted to said closure plate and a mating electrical element fixed to the tandem extending portion of said shaft to rotate therewith, the improvement comprising mechanism mechanically coupling the potentiometer and the electrical device for precise assembly and electrical cooperation therebetween comprising a fixed pin projecting outwardly from said closure element and defining a precise reference point in relation to the neutral area of said resistance element, a member fixed to the tandem portion of the shaft and rotatable therewith provided with a fixed pin projecting inwardly thereof and movable over and into and out of registry with said fixed reference pin, a pair of members loosely rotatable on the tandem portion of the shaft each provided with a finger, one finger being arranged to engage one side and the other finger being arranged to engage the opposite side of said rotatable pin, and each finger being adapted to be brought into corresponding engagement with said reference pin, and a spring connecting said members in a direction to urge engagement of the fingers thereof with said pins to bring the latter into registry, the said fixed reference pin acting as a stop for both members with the pins in registry and acting as a stop for either one of the members when the other one of the members is moved out of registry by the rotation of the shaft, the said spring acting to automatically return all the moving parts to the potentiometer neutral position.

2. In a tandem potentiometer assembly, consisting of a potentiometer comprising a closed casing having an inner end plate as its closure element, a fixed resistance element mounted in said casing having resistance sections separated by a neutral area, a contact element rotatably mounted in said casing movable over the range of said resistance elements, a shaft fixed to said contact element for rotating the same, said shaft having an operating portion extending from said casing at its outer end and a tandem portion extending from said casing at its inner closure plate end, and a switch device assembled in tandem to said potentiometer and comprising a contact element fixedly mounted directly to said closure plate and a mating contact element fixed to the tandem extending portion of said shaft to rotate therewith, the improvement comprising mechanism mechanically coupling the potentiometer and the switch device for precise assembly and electrical cooperation therebetween comprising a fixed pin projecting outwardly from said closure element and defining a precise reference point in relation to the neutral area of said resistance element, a member fixed to the tandem portion of the shaft and rotatable therewith provided with a fixed pin projecting inwardly thereof and movable over and into and out of registry with said fixed reference pin, a pair of members loosely rotatable on the tandem portion of the shaft each provided with a finger, one finger being arranged to engage one side and the other finger being arranged to engage the opposite side of said rotatable pin, and each finger being adapted to be brought into corresponding engagement with said reference pin, and a tension spring under initial tension connecting said members in a direction to urge engagement of the fingers thereof with said pins to bring the latter into registry, the said fixed reference pin acting as a stop for both members with the pins in registry and acting as a stop for either one of the members when the other one of the members is moved out of registry by the rotation of the shaft, the said spring acting to automatically return all the moving parts to the potentiometer neutral position.

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No references cited.