Feb. 6, 1940. E. W. GENT 2,189,548

REMOTE CONTROL

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FIG. 1

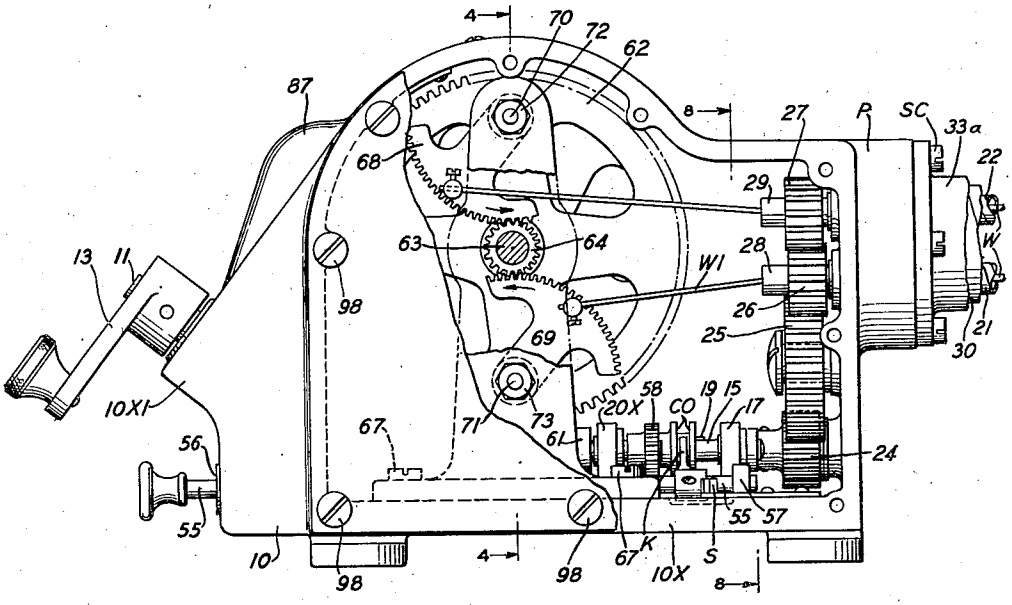

FIG. 2

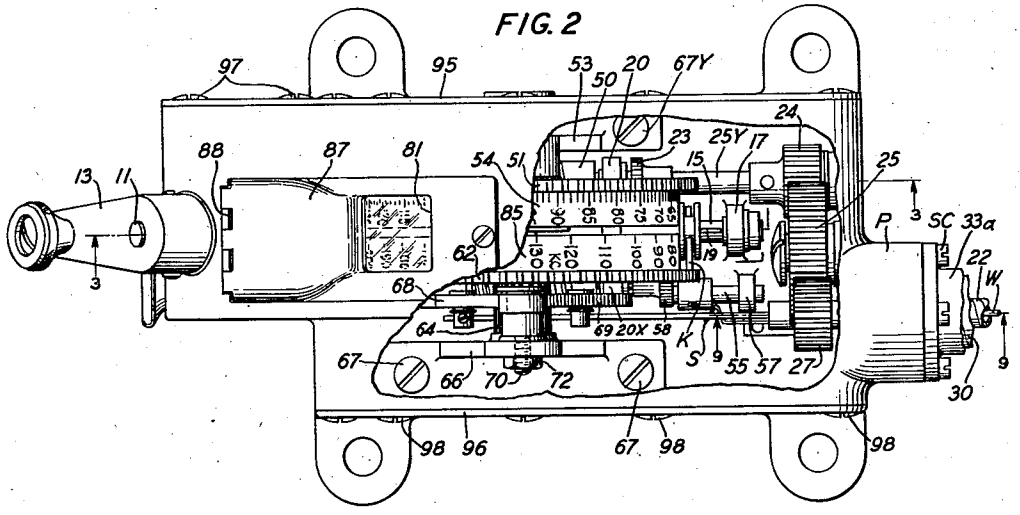

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FIG. 3

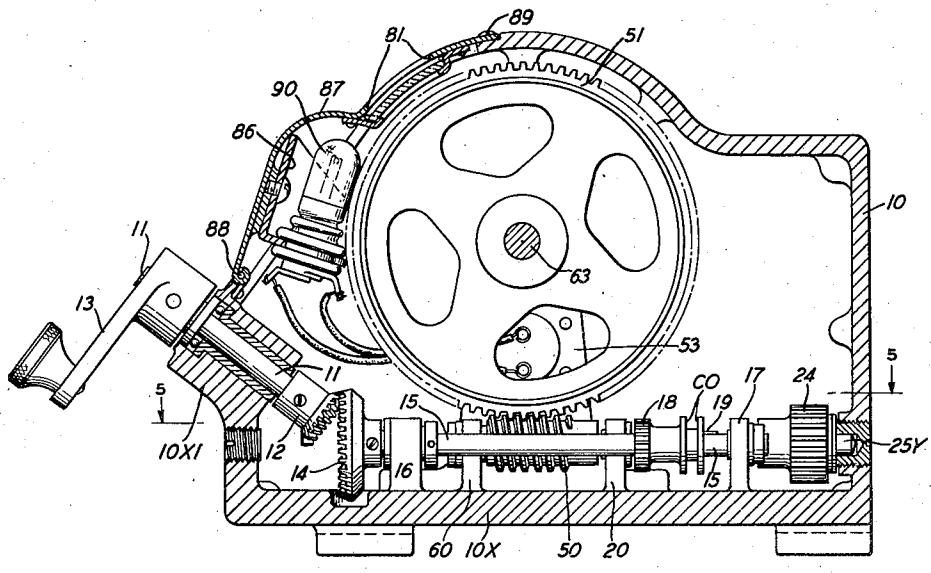


FIG. 4

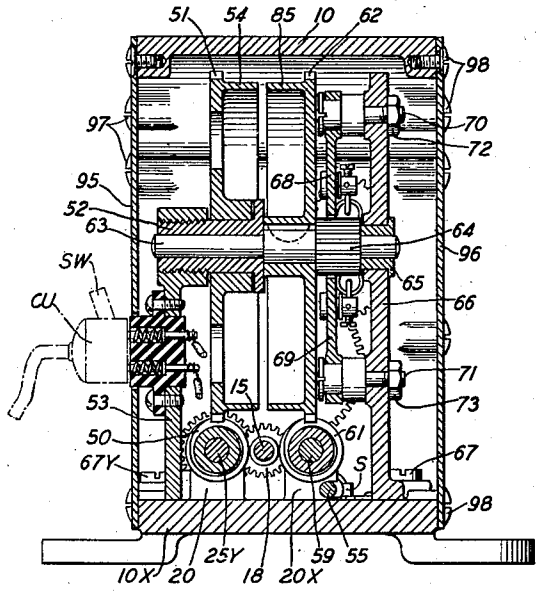
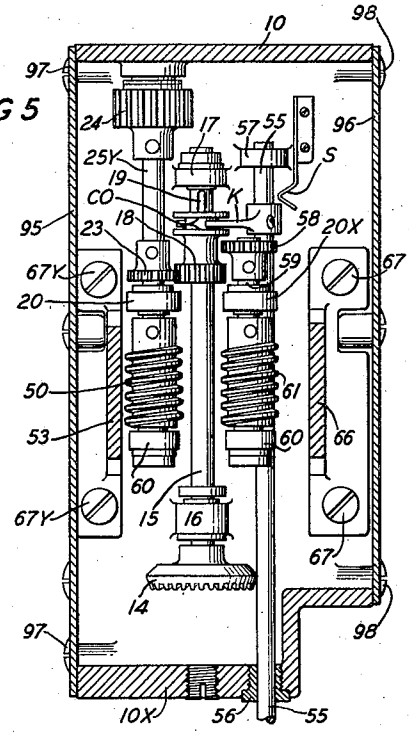


FIG 5



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REMOTE CONTROL

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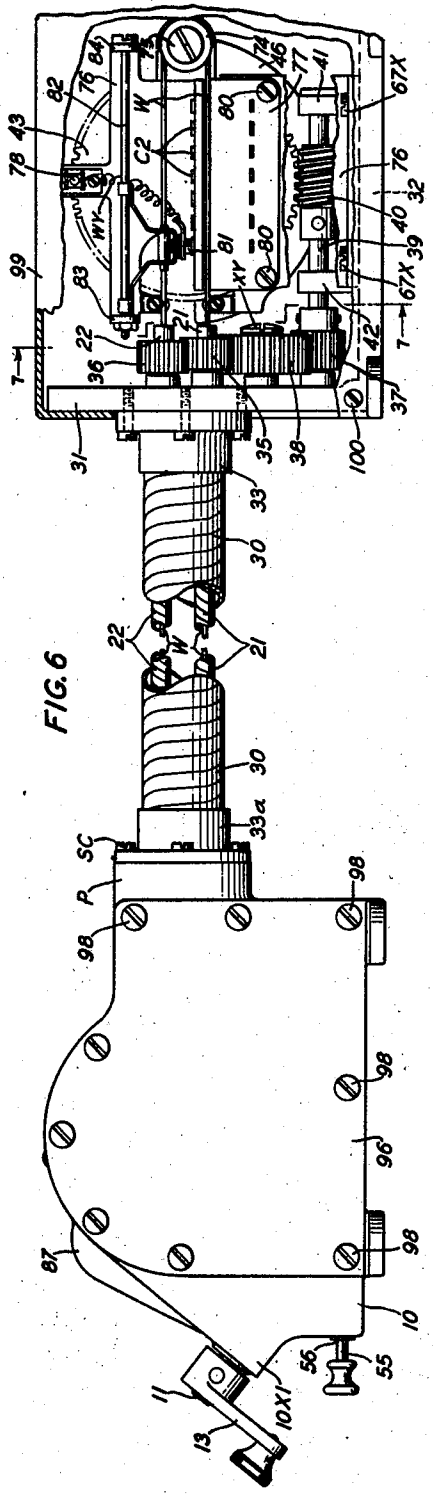

FIG. 6

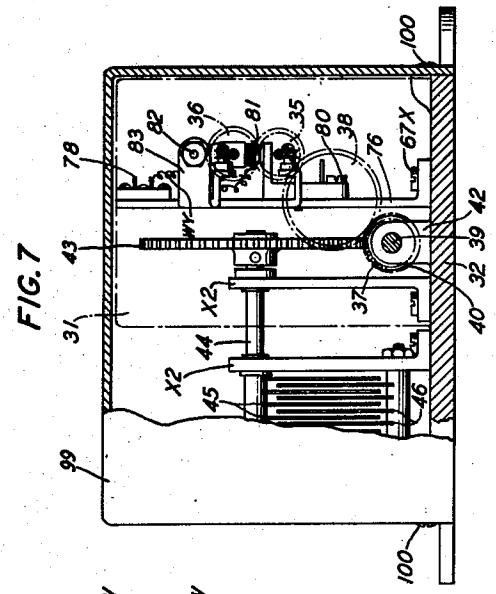

FIG. 7

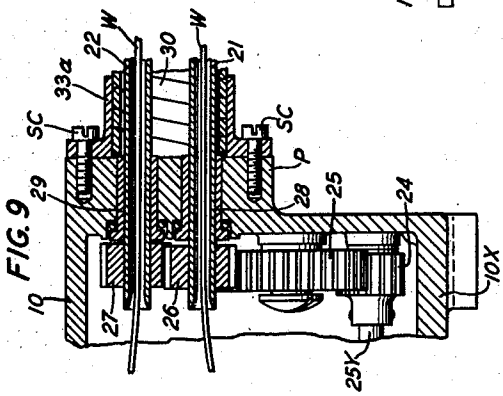

FIG. 9

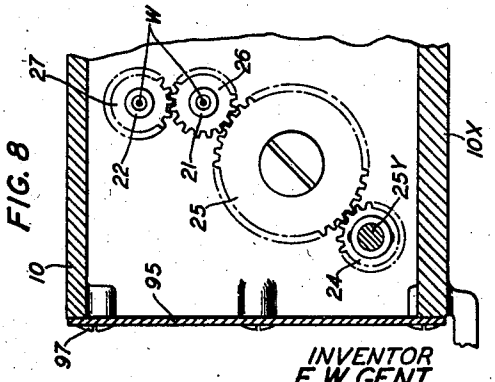

FIG. 8

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Patented Feb. 6, 1940

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UNITED STATES PATENT OFFICE

2,189,548

REMOTE CONTROL

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Application July 1, 1938, Serial No. 216,913

6 Claims. (Cl. 74—10)

This invention relates to remote controls of the type used in airplanes, for example, for tuning radio receiving and transmitting sets.

According to the invention, a remote control arrangement is provided in which flexible shafts are rotated by the operation of a handle lever for imparting rotary movements to the adjusting element of an electrical apparatus placed at a remote point from the operator for tuning it. Means at the driving end of the control is provided for translating and indicating such adjustment in wave-lengths or in any electrical value desired and lost motion between the adjusting element of the electrical apparatus and the indicating mechanism is eliminated by torsionally tensioning the flexible shafts against each other an amount greater than the torque required for the rotation of the adjusting element, and operatively connecting one of the flexible shafts to the indicating mechanism and to the electrical apparatus at the remote end of the control.

Manually operable means is provided whereby the operation of the handle lever is rendered ineffective relative to the flexible shafts and the indicating mechanism connected thereto, while being rendered effective relative to a wire placed for sliding movement in the flexible shafts for moving another adjusting element of the electrical apparatus in a back and forth linear motion, with means provided at the driving end of the control for translating and indicating the linear movement of such adjusting element in any predetermined electrical value desired and a lamp is provided for illuminating each of the translating means upon the operation of a switch mounted on the casing housing the driving mechanism.

Other novel features and advantages of the invention will appear from the following description and by the claims appended thereto, reference being had to the accompanying drawings in which:

Fig. 1 is a side elevation of the driving end of the control showing the casing with portions cut away and a number of operating parts in section;

Fig. 2 is a top view thereof;

Fig. 3 is a vertical longitudinal cross-section taken on line 3—3 of Fig. 2;

Fig. 4 is a cross-sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is a horizontal longitudinal sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is an assembly view showing the driving and the driven end of the remote control, the casing housing the driven mechanism being shown with portions cut away;

Fig. 7 is a cross-sectional view of the driven mechanism taken on line 7—7 of Fig. 6;

Fig. 8 is a vertical sectional view taken on line 8—8 of Fig. 1 showing the gearing mechanism connecting the driving shaft to the flexible shafts; and

Fig. 9 is a vertical sectional view taken on line 9—9 of Fig. 2.

The remote control of the invention consists at its driving end of a casing 10 formed with a base portion 10*x* shown in Figs. 1 and 3, having a bearing portion 10*x*1 provided for rotatably mounting a spindle 11 to one end of which is securely mounted a pinion 12 and at its opposite end a crank 13. Pinion 12 is disposed in engaged relation with a bevel gear 14 keyed on one end of a shaft 15 journaled on lug portions 16 and 17 formed with the base portion 10*x* of casing 10 and on the opposite end of this shaft is slidably mounted a gear 18 held against rotary movement thereon by a key 19 shown in Figs. 1, 3 and 5. The movement of crank 13 and thereby the movement of shaft 15 is imparted to a shaft 25*y* through gears 18 and 23 while the movement of shaft 25*y* is imparted to flexible shafts 21 and 22 through the gear 24 secured on shaft 25*y*, the intermediary gear 25 and the gears 26 and 27 shown in Figs. 1, 2, 8 and 9, the gears 26 and 27 being secured to bushings 28 and 29 in turn secured to the ends of the flexible shafts 21 and 22, respectively. The gear ratio from pinion 12 to gears 26 and 27 is, according to the invention, of the order of 2 to 1 but may be of any speed ratio desired consistent with the length of the flexible shafts and the force required for the operation of the electrical apparatus connected to these shafts at the remote end of the control.

The bushings 28 and 29 are each rotatably mounted in a projection P in casing 10, each of these bushings having a rim which in cooperation with shoulder portions formed in the projection P form end thrust bearings with balls placed between the rims of bushings 28 and 29 and the shoulder portions for reducing the friction therebetween. The flexible shafts 21 and 22 are fitted or encased into a common flexible envelope 30 shown in Figs. 1, 2, 6 and 9. This envelope is securely attached to casing 10 by a flanged bushing 33*a*, as by screws *sc* and at its other end to a sleeve 33 shown in Fig. 6, which in turn is secured to one side of an upright flange 31 extending perpendicularly from a base 32

while the other ends of flexible shafts 21 and 22 are secured to similar gears 35 and 36 rotatably mounted in bushings not shown in upright flange 31.

The turning movement of interengaged gears 35—36 at the driven end of the control is imparted to a gear 37 shown in Figs. 6 and 7 through an intermediary gear 38 pivoted on a shoulder screw *xy* engaging the upright flange 31. The gear 37 is secured at one end of a shaft 39 and on this shaft is securely mounted a worm 40 engaged by a worm gear 43 securely mounted at one end of a shaft 44 best seen in Fig. 7, carrying the rotor plates or element 45 of an air condenser, the stator element 46 of such a condenser being mounted on a pair of upright supports *se*2 secured to the base 32.

On shaft 25*y*, at the driving end of the control, as shown in Figs. 2, 3, 4 and 5, there is securely mounted a worm 50 disposed in operative relation with a worm gear 51 loosely mounted on a bushing 52 laterally extending from an upright support 53 secured to the base portion 10*x* of casing 10. The worm gear 51 is formed with a rim 54 which may be printed at its periphery with marks for translating the adjusting angular movement of the condenser in any electrical value desired.

A rod 55 shown in Figs. 1, 2, 4, 5 and 6 is slidably mounted in bushing 56 and in a lug 57 formed with the base portion 10*x*. This rod carries a fork-shaped lever K engaging a collar formed in the hub of the gear 18 for moving this gear out of engagement from gear 23 and into engagement with gear 58 securely mounted on one end of a shaft 59, the rod 55 and the gear 18 actuated thereby being yieldably held in each position by a leaf spring S engaging the hub of fork K.

The shaft 59 is journaled in lugs 20*x* and 60 formed with the base portion 10*x* of the casing and on this shaft is securely mounted a worm 61 engaged by a worm gear 62 keyed on a shaft 63. This shaft is formed with a pinion 64 and is journaled in bearing 52 of upright support 53 and in bearing 65 in support 66 secured to the base portion 10*x* by screw 67.

The pinion 64 is engaged by gear sectors 68 and 69 best seen in Figs. 1, 2 and 4 pivoted on studs 70 and 71 laterally extending from upright support 66. These studs are held securely by nuts 72 and 73 and on gear sectors 68 and 69 are attached the ends of a wire W slidably mounted in the flexible shafts 21 and 22 and pass over a pulley 74 at the driven end of the control, as shown in Fig. 6. This pulley is loosely mounted on a stud 75 laterally extending from an upright support 76 secured to the base 32 as by screws 67*x*, the movement of gear sectors 68 and 69 as imparted by the clockwise and counter-clockwise rotation of pinion 64 carried by shaft 63 depending upon the direction of movement of crank 13 being effective to impart a back and forth movement to the wire W for moving a wiper member 81 on a row of associated contacts C2 shown in Figs. 6 and 7. Contacts C2 are molded in a bank 77 of insulating material, secured to the upright support 76 as by screws 80 and the terminal ends of these contacts protrude from one side of this bank for connecting the electrical apparatus to be controlled by the movement of the wiper 81, this wiper being in turn electrically connected to a terminal 78 secured to the upright support 76 by a conducting wire *wy* coiled to permit the movement of the wiper 81 in its linear movement guided by a rod 87 supported by lug portions 83 and 84 formed and laterally extending from the upright support 76.

The gear 62 at the driving end of the control is provided with a rim 85 which may be printed at its periphery with marks for indicating the position of wiper 81 on contacts C2. The marks on rims 85 and 54 of worm gears 62 and 51 are visible through a window 81 in an oblong-shaped cover 87, having one of its ends hinged as at 88 on casing 10 and its other end secured to the casing by a screw 89 while an electric bulb 90 mounted on bracket 86 carried by cover 87 is provided for lighting the marks on rims 54 and 85, the energization of electric bulb 90 being controlled by a switch SW in the connector CO diagrammatically shown in Fig. 4.

Side plates 95 and 96 which are secured to the casing 10 by a plurality of screws 97 and 98 cooperate with this casing and its base portion to form a housing enclosing the driving mechanism while a cover 99 at the driven end of the control is secured to the base 32 as by screws 100 to form therewith a casing for housing the electrical apparatus at this end of the control.

In a typical operation of the device supposing that it is desired to move the plates of the rotor element 45 of the air condenser shown in Fig. 7 relative to the plates of its stator element 46. With the rod 55 in the position shown in Figs. 1, 2, 5 and 6 the gear 18 engages the gear 23 where it is yieldably held by the leaf spring S engaging the hub of fork K. The manual rotation of crank 13 is effective to rotate pinion 12 and bevel gear 14 for rotating the shaft 15 and thereby gears 18 and 23. The operation of gear 23 is effective to actuate the shaft 25*y* and the flexible shafts 21 and 22 through gear 24, the intermediate gear 25 and the gears 26 and 27 connecting the driving ends of the flexible shafts. The movement of flexible shafts 21 and 22 in turn is effective to rotate at the driven end of the control the gears 35 and 36, the intermediary gear 38 and the gear 37 for rotating the shaft 39 and thereby the worm 40 engaged by the worm gear 43 keyed on shaft 44, thus actuating the rotor element 45 of the air condenser.

The operation of shaft 25*y* at the driving end of the control and consequently the rotation of the worm 50 carried thereby is effective to rotate the worm gear 51 and the dial 54 thus formed for indicating the adjustment of the rotor element 45, the flexible shafts 21 and 22 being torsionally tensioned against each other as to prevent any loose motion between the indicating dial 54 and the rotor element 45.

Supposing now that it is desired to effect the adjustment of the wiper 81 relative to its associated contacts C2 shown in Figs. 6 and 7. The rod 55 at the driving end of the control is moved longitudinally for disengaging the pinion 18 from gear 23 and engaging it with gear 58 where it is held by the resiliency of spring S engaging now the opposite side of the hub of the fork member K. The operation of crank 13 as above described is effective to rotate the shaft 59 and thereby the worm 61, the movement of which is imparted to worm gear 62, Figs. 1, 2 and 4, keyed on shaft 63. The movement of this shaft and the pinion 64 carried thereby is effective to actuate the gear sectors 68 and 69 in the direction indicated by the arrows for imparting a pulling action on the end W1 of wire W for successively positioning the wiper 81 in adjustment on any one of the contacts C2 while the movement of

worm gear 62 at the driving end of the control is effective to position the dial 65 carried thereby for indicating such adjustment.

It is understood that minor changes may be made to the invention without departing from the scope of the appended claims.

What is claimed is:

1. A remote control device for electrical apparatus having adjustable elements, said device comprising a plurality of independently operable gearing mechanisms, a pair of flexible shafts, a wire slidably mounted in said flexible shafts, manually operable means for actuating said gearing mechanisms, means operable in two positions for selectively operatively connecting said gearing mechanisms to said manually operable means for actuating said flexible shafts and said slidable wire independently, and means operatively connecting said flexible shafts and said wire to the adjustable elements of the electrical apparatus.

2. A remote control device for electrical apparatus having adjustable elements, said device comprising a plurality of independently operable gear mechanisms, a pair of flexible shafts operatively connected to one of said mechanisms, a wire mounted for sliding movement in said flexible shafts and operatively connected to the other of said mechanisms, a crank, means manually operable in two positions, in one of said positions, for actuating said shafts and in the other position for actuating said wire by the turning movement of said crank for changing the position of each of said elements, and means actuated by said gear mechanisms for indicating the adjusting movement of said elements.

3. A remote control for apparatus having adjustable elements, said control comprising a plurality of driving gear mechanisms and a driven gear mechanism, a pair of pretensioned flexible shafts operatively connecting one of said driving gear mechanisms to said gear driven mechanism, a wire mounted for longitudinal movement in said flexible shafts and operatively connected to the other of said gear driving mechanisms, means operatively connecting said flexible shafts to one of the adjustable elements of the apparatus, means operatively connecting the wire to the other of said elements, manually actuated means common to both of said mechanisms, and means movable in two positions to cause in one position the movement of one of said driving gear mechanisms and in the other position the movement of the other of said mechanisms by the operation of said actuating means.

4. A remote control for a plurality of electrical apparatus, one of the apparatus having a rotary adjustable element and the other a rectilinear adjustable element, said control comprising a plurality of driving gear mechanisms and a driven gear mechanism, a pair of pretensioned flexible shafts operatively connecting one of said gear driving mechanisms to said gear driven mechanism, a wire mounted for longitudinal movement in said flexible shafts and operatively connected to the other of said gear mechanisms, means operatively connecting said driven mechanism to one of the adjustable elements of said apparatus, means operatively connecting the wire to the other of said elements, a crank, and manually operable means for selectively connecting each of said gear driving mechanisms to said crank for actuating each of said driving gear mechanisms independently, one of said gear mechanisms rotating said flexible shafts and the other for longitudinally moving said wire in said flexible shafts adjustably positioning the elements of the rotary and the rectilinear movable electrical apparatus.

5. A remote control for a plurality of electrical apparatus, one of the apparatus having a rotary adjustable element and the other a rectilinear adjustable element, said control comprising a plurality of gear driving mechanism and a driven gear mechanism, a crank, a pair of flexible shafts torsionally tensioned against each other operatively connecting one of said driving gear mechanisms to said gear driven mechanism for actuating said rotary adjustable element upon the operation of said crank, manually operable means for rendering the operation of said crank ineffective relative to said driving mechanism and simultaneously rendering it effective relative to the other of said gear driving mechanisms, a wire connected to the last-mentioned driving mechanism and passing over a pulley at the remote end of the control and connected to the other adjustable element of the electrical apparatus, and a plurality of means at the driving end of the control for indicating the extent of movement of the adjustable elements.

6. A remote control for a plurality of electrical apparatus, one of the apparatus having a rotary adjustable element and the other a rectilinear adjustable element, said control comprising a driving shaft, a pinion secured at one end of said shaft, a crank secured at the opposite end of said shaft, a second shaft having a gear engaging said pinion, a gear slidably mounted on the other end of said second shaft, a pair of parallelly disposed shafts, each of said shafts having a gear secured at one of its ends, a manually operable member for moving said slidable gear in engaged relation with the last-mentioned gears selectively, a worm carried by one of said shafts, a worm gear rotated by said worm, a supporting shaft for said worm gear movable therewith, a pinion carried by said supporting shaft, a pair of upright supports for said supporting shaft, a pair of gear sectors pivoted on one of said upright supports and engaging said pinion, a pair of torsionally tensioned flexible shafts operatively connected to the other of said parallel shafts and connecting with a rotary adjustable element of the apparatus at the driven end of the control, a wire mounted in said flexible shafts and engaging a pulley at the driven end of the control, means carried by each of said gear sectors for securing the ends of said wire, means at the driven end of the control for securing the other adjustable element of the apparatus to said wire, and a plurality of means at the driving end of the control for indicating the operation of said adjustable elements.

EDGAR W. GENT.