June 20, 1961 J. YOUHOUSE ET AL 2,989,259

AUTOMATICALLY OPERATED RADIO ANTENNA

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Fig. 1

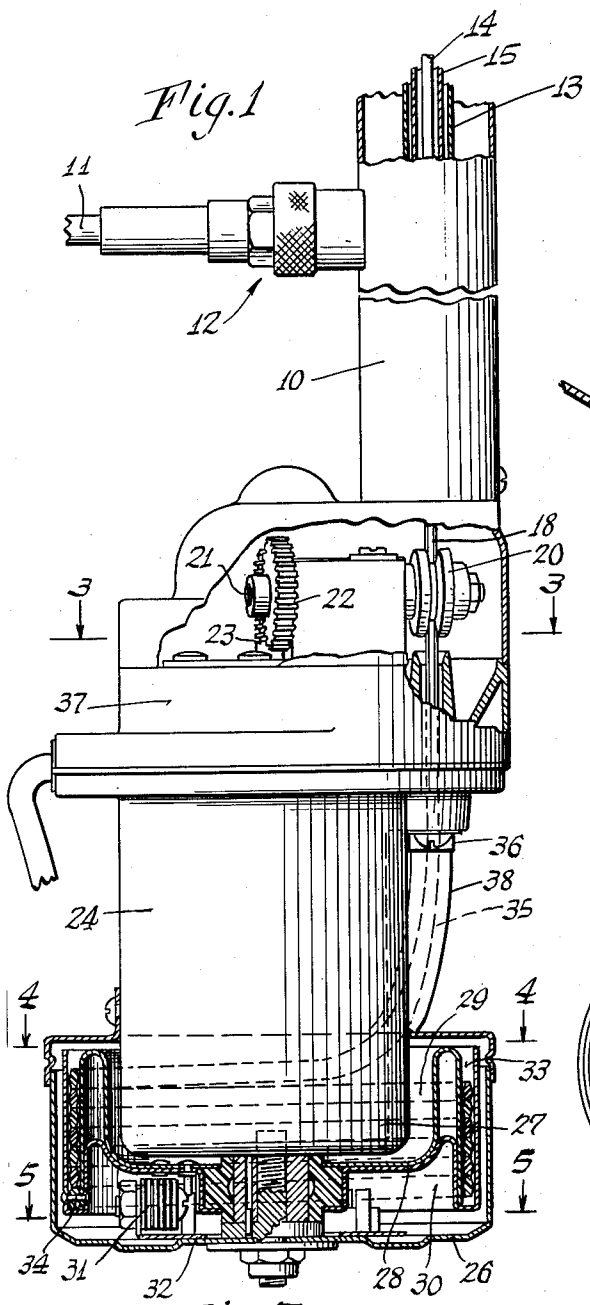


Fig. 2

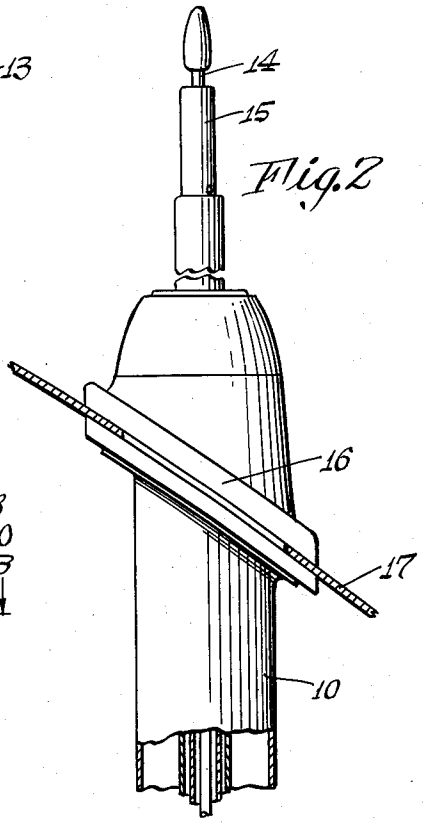


Fig. 3

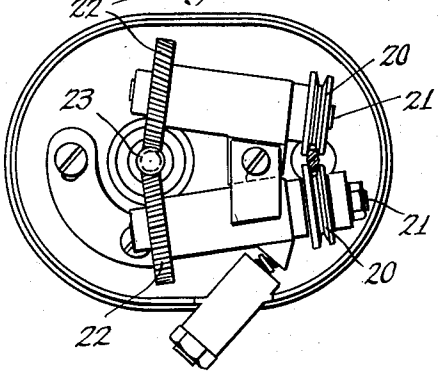
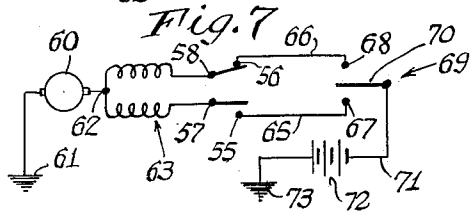


Fig. 7



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Fig. 4

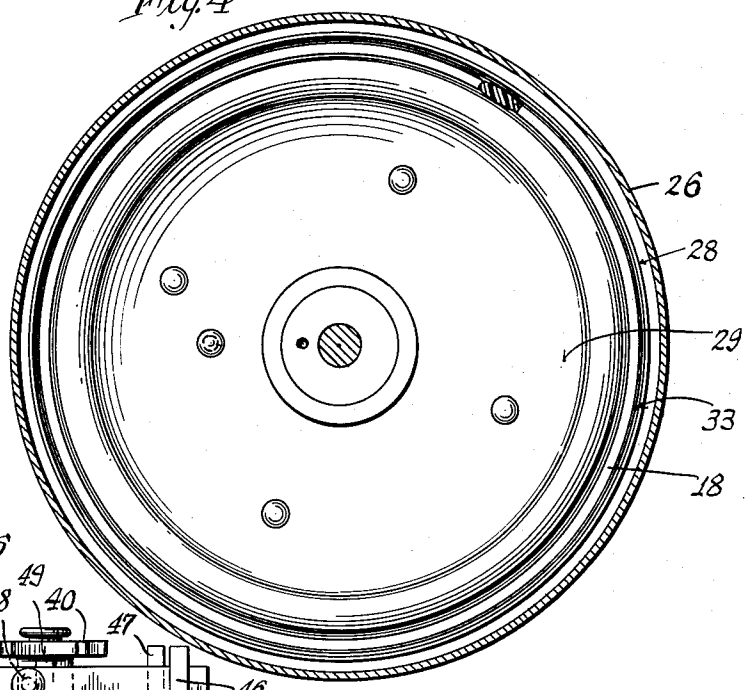


Fig. 6

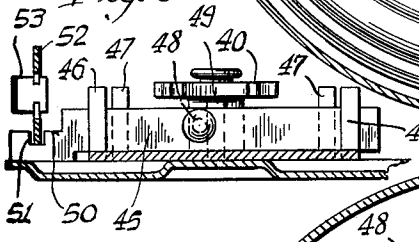
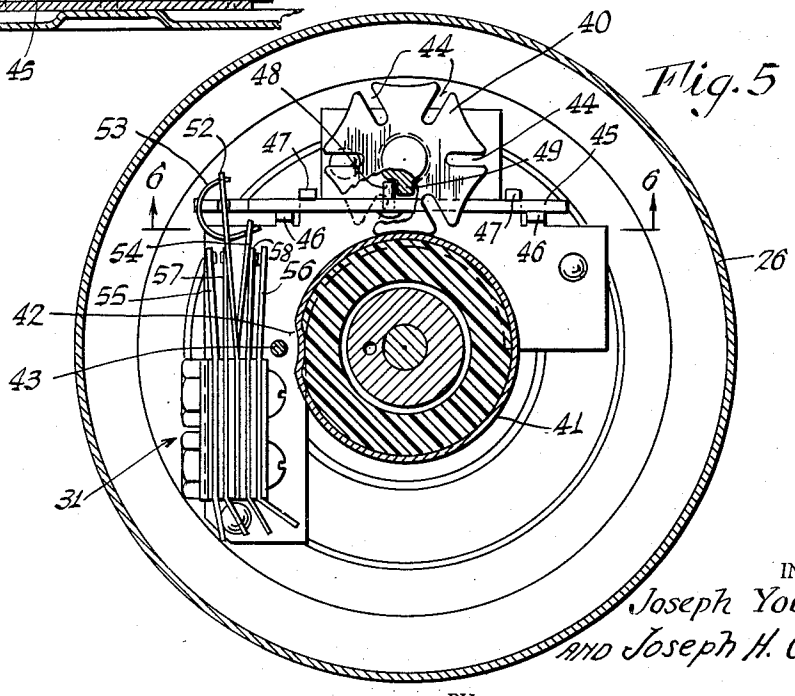


Fig. 5



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United States Patent Office 2,989,259 Patented June 20, 1961

2,989,259

AUTOMATICALLY OPERATED RADIO ANTENNA

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Filed Feb. 1, 1955, Ser. No. 485,400
11 Claims. (Cl. 242—54)

This invention relates to motivated extensible and retractible radio antennas, as, for example, used in automobiles, and more particularly to controls for antennas of the type having a flexible driving strip adapted to actuate a movable antenna section.

An object of the invention is to provide a novel and improved, motivated extensible and retractible antenna wherein the movements of the antenna section or sections are reliably, automatically controlled to enable fully extended and retracted positions of said section or sections to be readily and quickly obtained.

Another object of the invention is to provide a novel and improved automatic antenna as above characterized and having a flexible driving strip, which is compact and relatively small in size so that its space requirements are not critical or difficult to meet.

A further object of the invention is to provide a novel and improved, motivated antenna of the type wherein a driving strip is stored on a reel, which antenna has automatic means for controlling and limiting the extension and retraction of the antenna sections.

Still another object of the invention is to provide an improved antenna as characterized immediately above, wherein the movement of the reel is utilized to effect the control.

Yet another object of the invention is to provide an automatic antenna of the above type, wherein there is effected a reliable and effective control of the motive means without physically limiting the movement of the antenna sections or driving strip, or of the reel.

A feature of the invention resides in the provision of an improved, automatically operative antenna employing a motor and storage reel, wherein the reel is so constructed and arranged as to extend around one end of, and nest the motor, thereby to effect a substantial saving of space.

Other features and advantages will hereinafter appear.

In the accompanying drawings:

FIGURE 1 is a view partly in side elevation and partly in vertical section, showing the improved antenna control mechanism of the invention.

FIG. 2 is a side elevational view of upper portions of the antenna, including the means by which it is mounted on the automobile.

FIG. 3 is a horizontal sectional view taken on line 3—3 of FIG. 1 showing the motor drive mechanism.

FIG. 4 is a horizontal sectional view taken on line 4—4 of FIG. 1.

FIG. 5 is a horizontal sectional view taken on line 5—5 of FIG. 1.

FIG. 6 is a fragmentary vertical section taken on line 6—6 of FIG. 5.

FIG. 7 is a schematic diagram showing the circuit of the control device.

Referring to FIGS. 1–3, the automatic antenna shown therein comprises an elongate, tubular casing **10** to which the antenna lead wire **11** is attached by a suitable fitting **12**, the casing **10** enclosing a stationary, elongate tubular antenna section **13**. Movable in the stationary section **13** are telescoping inner and outer antenna sections **14** and **15**, which are extensible from the stationary section and also retractible therein, all in the well known manner. The casing **10** has mounting means **16** by which it may

be attached to a body panel **17** of an automobile, or any other similar supporting surface, as is well understood.

The innermost antenna section **14** is preferably in the form of a solid rod, and is actuated by an elongate, flexible driving element or strip **18** which is attached to its lowermost end. The strip **18** may be advantageously formed of a plastic material, such as fiber-forming polymeric amide.

The driving strip **18** passes between friction wheels **20** carried by divergent shafts **21** which mount worm gears **22** engaging a worm **23** carried by the shaft of an electric driving motor **24**. Operation of the motor **24** in either forward or reverse directions will result in the driving strip **18** being forced longitudinally either upward or downward, thereby extending or retracting the antenna sections, as will be understood.

In accordance with the present invention a novel and advantageous control means is provided, for controlling the operation of the motor **24** so as to obtain automatic extension and retraction of the movable antenna sections in response to actuation of a two-position electric switch. By coupling the two-position switch to the "on-off" switch of a radio set, automatic extension of the antenna may be effected when the set is turned on, and automatic retraction effected when the set is turned off.

Referring to FIG. 1 a cylindrical housing **26** is provided, extending around and enclosing the lower end portion **27** of the motor **24**. Within the housing **26** there is a reel **28** having a recess **29** at one side in which the lower end **27** of the motor **24** is accommodated. The reel **28** has a substantially cylindrical recess **30** in its other side, to provide clearance for a two-position electric switch **31** which is mounted on the lower end **32** of the housing **26**. The reel **28** also has an annular recess **33** arranged to receive in coil or helical form the flexible driving strip **18**. The lower end of the driving strip **18** is secured to the lower portion of the reel **28** by a pin **34**, FIG. 1, or any other suitable means. As shown in this figure, the flexible driving strip **18** is coiled in the annular recess **33** of the reel **28** and extends upwardly from the reel along a curved path indicated by the broken outline **35**, to pass through a guide bushing **36** into an upper housing **37** which encloses the driving mechanism shown in FIG. 3. A curved guide **38** extends between the upper housing **37** and the lower housing **26**, confining the curved portion of the driving strip **18** and providing for smooth and uninterrupted movement of the driving strip to and from the reel **28**.

By the above construction forward or reverse operation of the motor **24** will cause the driving strip **18** to move longitudinally upward or downward, either uncoiling the strip from the reel **28** or coiling the strip in the reel, in the recess **33** thereof. Thus movement of the driving strip **18** will be accompanied by a corresponding turning of the reel **28**, as the strip is either coiled on the reel or uncoiled from it.

We employ this concurrent movement of the reel **28** to effect a novel and advantageous control by which the motor **24** is automatically started and halted in accordance with actuation of the "on-off" switch of the radio set, the motor first performing its function of raising or lowering the antenna sections and then being automatically halted without further action on the part of the operator. This control does not require that either the driving strip **18** or the reel **28** be brought to a halt, but instead is responsive to the reel **28** attaining either of two different rotative positions, as by turning of the reel through more than one revolution.

In the embodiment of the invention illustrated herein the control employs a Geneva movement comprising a slotted star wheel **40** cooperable with a hub **41** on the reel **28**, said hub having a concave depression **42** to

provide clearance for the star wheel 40 when the reel 28 is at one given rotative position. Adjacent the depression 42 the reel 28 has a driving pin 43 receivable in slots 44 in the star wheel 40. It will be understood that the reel 28 may turn through almost a complete revolution without driving the star wheel 40, but upon the pin 43 being moved into engagement with the star wheel the latter may be actuated through a part of a revolution, in this case one-sixth revolution. Thus for six turns of the reel 28 the star wheel 40 will make a single complete turn.

Actuated by the star wheel 40 is a slide bar 45 movable between guides 46 and 47 carried by the bottom wall 32 of the housing 26. The slide bar 45 has a projecting pin 48 engageable with a projecting lug 49 on the star wheel 40 whereby the bar may be reversibly shifted longitudinally when the star wheel 40 is turned in either of opposite directions. One end of the slide bar 45 has a cutaway portion 50 provided with a notch 51 receiving an actuating member 52 of the switch 31, said switch being of the snap type and having a toggle leaf spring 53 engageable with a toggle member 54 by which a snap action is obtained. The switch 31 has a pair of stationary contacts 55 and 56 and a pair of movable contacts 57 and 58 respectively enageable with the contacts 55 and 56. The movable contacts 57 and 58 are alternately held in engagement with their cooperable contacts by the toggle member 54. The closed and opened circuit conditions of the switch 31 are thus responsive to positioning of the slide bar 45 as effected by the star wheel 40. When the bar 45 is shifted to the right as viewed in FIG. 5 it will cause engagement of the contacts 55 and 57 and separation of the contacts 56 and 58, and when the slide bar 45 is returned it will cause a reverse actuation and condition of said contacts.

The structure as above described is so constituted and arranged that when the motor 24 drives the antenna sections 14, 15 upward to extended position, uncoiling of the driving strip 18 from the reel 28 will cause clockwise turning of the reel as viewed from above and this will shift the star wheel 40 counterclockwise, and cause the slide bar 45 to be moved from left to right. In so doing the contacts 55 and 57 will be brought together and the contacts 56 and 58 will be separated. When the motor 24 is in reverse, causing the driving strip 18 to be coiled in the reel 28 the latter will be turned counterclockwise, causing the star wheel 40 to turn clockwise and return the slide bar 45 from right to left, thereby separating the contacts 55 and 57 and causing engagement of the contacts 56 and 58.

In FIG. 7 a schematic circuit diagram is shown, wherein the motor armature is indicated at 60, connected through one brush to a ground 61 and through another brush to a center tap 62 of a split field 63 the ends of which are connected to the contacts 57 and 58 of the switch 31. The switch contacts 55 and 56 are connected by wires 65 and 66 respectively to contacts 67 and 68 of a single pole double throw switch 69 having a movable blade 70. The switch blade 70 is connected by a wire 71 to a battery 72 which is connected to a ground 73.

The single pole double throw switch 69 maybe actuated simultaneously with the "on-off" switch of the radio set. When the blade 70 is caused to engage the contact 68 in the switch 69 it will connect the motor 24 through one part of the field winding 63, to cause forward turning of the motor by virtue of the contacts 56 and 58 being engaged. The antenna will then be extended, and as it nears the upper limit of its movement the star wheel 40 will shift the slide bar 45 to the right, to actuate the switch 31. This will separate the contacts 56 and 58, halting the motor. At the same time the contacts 55 and 57 will be engaged, setting the circuit for subsequent retraction to the antenna. When the radio set is turned off, the switch blade 70 will be disengaged from the contact 68 and engaged with the contact 67. This will energize the motor 24 for reverse turning, and will cause the antenna to be withdrawn into the casing 10. As the reel 28 is turning counterclockwise and the antenna approaches its lower limit of movement the star wheel 40 will be actuated clockwise to shift the slide bar 45 from right to left, separating the contacts 55 and 57 and thus deenergizing and halting the motor 24. The contacts 56 and 58 will again be engaged, placing the circuit in readiness for the extending movement of the antenna when the switch 69 is again actuated to engage the blade 70 with the contact 68.

With the above construction we have provided a compact and relatively small yet effective and reliable control mechanism, operated in response to turning of the reel 28 concurrently with raising and lowering of the antenna sections 14 and 15, to automatically halt said sections when they reach either the upper or lower limits of their movement. The control is relatively simple, has few parts which are not likely to get out of order easily, and may be economically manufactured.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

We claim:

1. In an antenna having an extensible and retractible section and an elongate, flexible, longitudinally-movable driving element connected to said section to actuate the same; drive means frictionally engaging the element to longitudinally move it; a rotatably-mounted member; means causing said member to turn concurrently with movement of the element; and control means including connections to said member to cause actuation of the control means in response to turning of said member to control the drive means.

2. In an antenna having an extensible and retractible section and an elongate, flexible driving element connected to said section to actuate the same; a rotary member on which the driving element may be coiled, said member being freely rotatably mounted but caused to turn concurrently with coiling of the element thereon or uncoiling of the element therefrom; and control means including connections to said member to cause actuation of the control means solely in response to turning of said member.

3. In an antenna having an extensible and retractible section and an elongate, flexible driving element connected to said section to actuate the same, a rotary member on which the driving element may be coiled, said member being freely rotatably mounted but caused to turn concurrently with coiling of the element thereon or uncoiling of the element therefrom; and control means including connections to said member to cause actuation of the control means solely in response to said member attaining either of two different rotative positions.

4. In an antenna having an extensible and retractible section and an elongate, flexible driving element connected to said section to actuate the same; drive means frictionally engaging the element to longitudinally move it; a reel having an annular groove in one side, in which the driving element may be coiled, said reel turning concurrently only with coiling of the element therein or uncoiling of the element therefrom; and control means including connections to said reel to cause actuation of the control means in response to said reel attaining either of two different rotative positions to control the drive means.

5. The invention as defined in claim 1 in which the rotatably-mounted member comprises a reel on which the driving element may be coiled and from which it may be uncoiled, said element at one end being attached to said reel.

6. In an antenna having an extensible and retractible section and an elongate, flexible driving element connected to said section to actuate the same, a rotary member on which the driving element may be coiled, said member being freely rotatably mounted but caused to

turn concurrently with coiling of the element thereon or uncoiling of the element therefrom, control means actuated solely in response to said member attaining either of two different rotative positions, and in which the control means includes a Geneva movement driven by the rotary member and a circuit control switch actuated by the Geneva movement.

7. The invention as defined in claim 6 in which the control means includes a slotted star wheel and a projection carried by the rotary member for intermittently turning said wheel, a slide bar actuated in reverse directions by reverse turning of the star wheel and a snap switch actuated by the slide bar.

8. The invention as defined in claim 7 in which the slide bar has a projection and the star wheel has a lug engageable with the projection and constituting a driving connection by which the bar is actuated.

9. In an antenna having a driving motor and a flexible, longitudinally movable driving element; means frictionally interconnecting the motor and the element; a reel freely rotatably mounted adjacent an end of the motor, said reel having outer and inner peripheral walls defining an annular recess for coiling and confining the driving element, said element when coiled on the reel extending around the said end of the motor; a curved guide means engaging the driving element adjacent the reel and guiding the same in a curved path between the reel and the said end of the motor; said reel being formed to have a substantially cylindrical recess on the side of the reel opposite from the side of the reel adjacent the motor; and control means disposed in said cylindrical recess and actuated solely in response to turning of the reel to control the driving motor.

10. An antenna comprising an extensible and retractable section; an elongate, flexible driving element connected to said section to actuate the same; drive means frictionally engaging the element to move same; a reel rotatably mounted and being rotated solely by the element being coiled thereon or uncoiled therefrom; a pin carried by the reel and cooperating with a star wheel to rotate the star wheel only a portion of a revolution for each revolution of the reel; control means including an electric switch actuated by the rotative movement of the star wheel; a manually operable switch for actuating the drive means; and a circuit including the control means, the driving means and the manually operable switch whereby the control means effectuates control of the drive means after a predetermined rotative movement of the star wheel irrespective of the manually operable switch.

11. An extensible and retractable antenna comprising an antenna section mounted for telescoping movement into and out of a stationary, tubular section; a flexible rod having one end connected to the movable section for actuating the latter upon longitudinal movement of the rod; a pulley mounted to have its periphery in engagement with the rod; motor means connected to the pulley to rotate same; pressure means for causing frictional engagement between the rod and pulley; a reel mounted for free rotational movement; means connecting the other end of the rod to the reel to cause rotation thereof as the rod is stored or removed from the reel; and control means including connections to said reel to cause actuation of the control means in response to turning of the reel to control the motor means.

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