March 4, 1958 D. E. GRAY 2,825,240

HYDRAULIC ANTENNA ROTATOR

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Fig. 1.

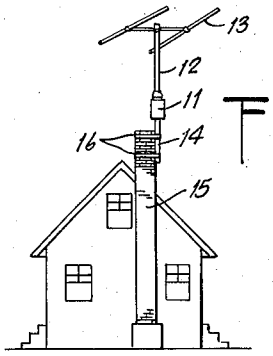


Fig. 2.

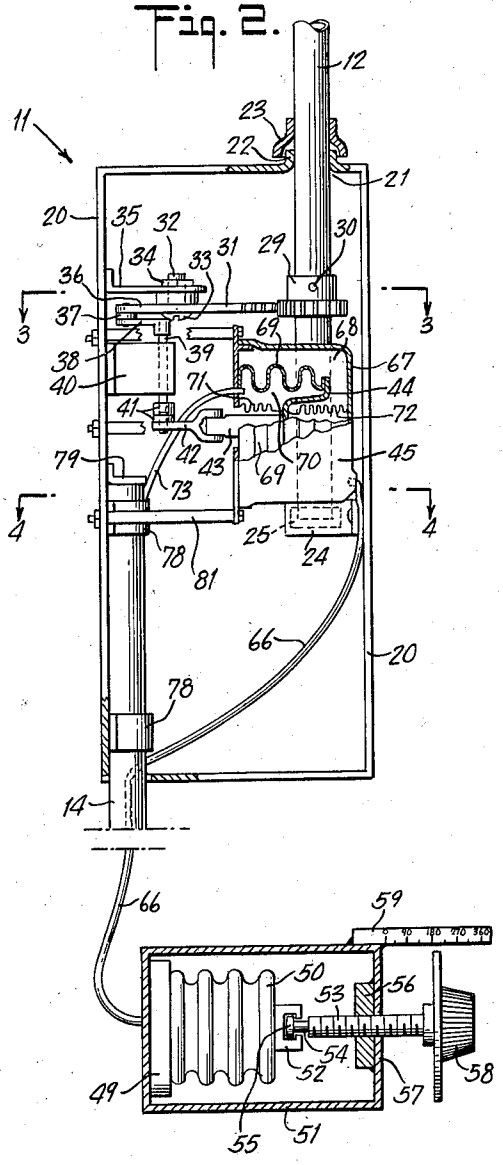


Fig. 3.

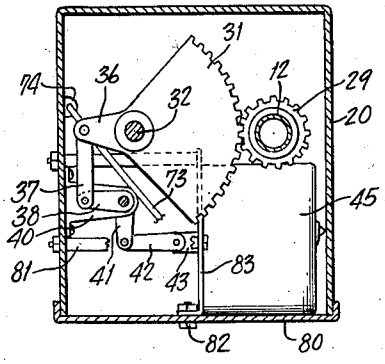
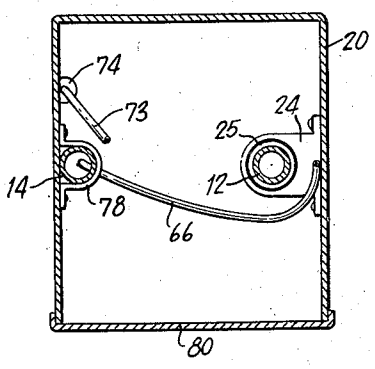


Fig. 4.



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HYDRAULIC ANTENNA ROTATOR

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10 Claims. (Cl. 74—507)

This invention is concerned with an antenna rotator, and more specifically a hydraulic bellows actuated rotator for use with directional antennas.

In many locations television antennas should be rotatable in order to obtain satisfactory results for all of the channels that may be received in that area. Heretofore, attempts to solve this problem and provide antenna rotators have not been generally acceptable because of the cost involved or other handicaps.

Consequently, it is an object of this invention to provide a remote control rotator that is at the same time simple, compact, rugged and inexpensive.

Another object of this invention is to provide a directional antenna rotator that employs merely a single small diameter, hydraulic pipe as the sole connection from the rotator located at the antenna to the remote control which may be conveniently located near the receiving set.

Another object of this invention is to provide a hydraulic bellows actuated rotator which may be turned throughout a full revolution by merely turning a knob on a remote bellows which may be conveniently located near the receiving set.

Still another object of this invention is to provide a hydraulic bellows rotator that includes temperature compensation for the variations in outdoor temperature which would normally render the positioning of the rotator variable throughout the seasons.

Briefly, this invention is concerned with an antenna rotator for a directional antenna having an upright supporting member therefor. The invention comprising bearing means for rotatably supporting the upright member, and means for rotating said member through substantially one revolution. The rotating means including fluid actuated bellows, means coupling said bellows to said rotatable means to position the member in rotation, second bellows remotely connected to said fluid actuated bellows, and means for varying the volume of said second bellows to actuate said fluid actuated bellows to position the support member in rotation.

One embodiment of the invention is described in detail below and illustrated in the drawings in which—

Fig. 1 is an elevation illustrating the mounting of the rotator in conjunction with the entire directional antenna;

Fig. 2 is a side elevation having some details in cross-section and being taken on the open side of the antenna rotator with the cover removed, and including a broken away view partly in cross-section of the remote control bellows;

Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 2; and

Fig. 4 is a cross-section view taken along the line 4—4 of Fig. 2.

Referring to Fig. 1, it will be observed that the unit for rotating a directional antenna may be mounted as an element of the shaft for the antenna so that the mounting of the complete antenna plus rotator may take the usual form, with brackets or straps for mounting on

a chimney. As illustrated in Fig. 1, the external elements of the rotator include a rotator 11 that supports a shaft 12 which carries the usual directional antenna 13 at the extremity thereof. This antenna 13 may be any style directional antenna, e. g. a simple dipole with reflectors as illustrated. Below the housing 11 there is another shaft 14. This lower or supporting shaft 14 may be a piece cut off of the same shaft 12 at the time of mounting the rotator 11 if the rotator is added to an existing stationary unit. In any case, shaft 14 is mounted for adequate support on an elevated portion of a suitable location such as near the top of a chimney 15 as illustrated in Fig. 1. In this type of mounting there is a pair of straps 16 which clamp on to shaft 14 and encircle the chimney 15 for support.

Referring to Figs. 2, 3 and 4, the details of the remotely controlled rotator 11 are clearly illustrated. There is a rectangular housing 20 which may be constructed of any suitable material, e. g. aluminum or other weatherproof material having sufficient structural strength. The shape of this housing 20 might be other than rectangular, depending upon the particular design of the rotator. There is a hole or opening 21 in the top of the housing 20 that is formed with an upstanding lip 22 to aid in excluding moisture from running down the shaft 12 into the interior of housing 20. Located on the shaft 12 in cooperation with the lip 22 of opening 21, there is a resilient material collar 23 on the shaft 12 which overlaps the lip 22 to give a weatherproof joint between the shaft 12 and the housing 20. The lip 22 and opening 21 together act as an upper bearing for supporting the shaft 12, while allowing free rotation thereof. Other types of bearing might be employed, e. g. a ball-bearing or some special bearing material surface may be used if desired.

Inside the housing 20, securely attached thereto by rivets or in some other feasible manner, there is a support 24 that holds a thrust bearing 25 which receives the extremity of the shaft 12 and lends vertical support to the shaft, as well as lateral bearing support thereto. Securely attached to the shaft 12 at a convenient location for rotation with the shaft there is a pinion 29 that may have a pin 30 transversely through the collar thereof to insure the rotation of pinion 29 and shaft 12 together. Meshing with the pinion 29 there is a gear sector 31 that is pivotally mounted on a short shaft 32 having a screw head 33 and being threaded to receive a nut 34 for attaching the gear sector 31 in a pivotal manner to a bracket 35 which is welded or otherwise securely fastened to the inside of housing 20. On the other side of the pivot shaft 32 from gear sector 31 there is a crank arm extension 36 to which is pivoted a connecting link 37. Pivoted in turn to the other extremity of the link 37 there is another crank arm 38 that is securely attached to a shaft 39 for rotation therewith. Shaft 39 is rotatably supported in a bracket 40 which is secured by riveting or welding or otherwise to the interior of the housing 20. At the other end of shaft 39 (bottom as viewed in Fig. 2) there is another crank arm 41, which is secured to the shaft 39 for positive rotation therewith and which is situated at approximately 90° to the position of crank arm 38, relative to shaft 39. Pivoted to the extremity of crank arm 41 there is a connecting link 42 which has a forked or bifurcated portion at its other end for pivotally attaching the link 42 to an actuating shaft 43 which is securely attached to and integral with a movable central yoke 44 of a differential bellows member 45.

The differential bellows 45 is remotely actuated by means of a simple bellows 50 (Fig. 2) which is housed in any convenient manner as by means of a rectangular housing 51, which has attached to one end thereof a base 49 of the bellows 50. Squeezing and extending of

bellows 50 is directly regulated by means of an extending lug 52 which has a shape such that a coupling may be had with the flanged end of a threaded shaft 53, that has a reduced diameter smooth extension 54 with a relatively enlarged flange or head portion 55 at the extremity thereof. The threaded shaft 53 is carried by an internally threaded supporting block 56 which is welded or otherwise securely fastened to the inside of end plate 57 of housing 51. End plate 57 has a hole therethrough which leaves ample clearance for the threaded shaft 53. For turning the shaft 53 and regulating its longitudinal position, there is knob 58 at the outer extremity thereof. In addition, there is an indicating bar 59, which may be calibrated as illustrated in order to indicate (in cooperation with the flange of knob 58) a rotational position of the antenna shaft 12 that is being remotely rotated.

Connecting bellows 50 with differential bellows 45, there is a small size hydraulic pipe 66. It is contemplated that the inside diameter of pipe 66 may be sufficiently small to maintain a capillary action with the hydraulic fluid that is being employed, such that the pipe 66 may be cut or broken without having hydraulic fluid flow out of the pipe so long as the system is not under pressure at the time. The pipe 66 leads out from the base of bellows 50 and may conveniently be taken into the interior of housing 20 of the rotator 11, e. g. by being led up inside of shaft 14 since the supporting shafts 12 and 14 are ordinarily of a tubular construction. The pipe 66 will then lead into the top of a cup-shaped outer structure 67 of the differential bellows 45. In this manner hydraulic fluid that is filling a space 68 within the bellows 45 is connected for fluid transferral to the inside of bellows 50. The inner construction of differential belows 45 involves a main bellows 69 that separates space 68 within the cup-shaped outer structure 67, from a space 70 that is formed around an inner supporting bellows 71 which surounds the actuating shaft 43 of the differential bellows 45. The space 68 is similarly situated with respect to another supporting bellows 72, that is centrally located within the structure 67 on the other side of the yoke 44 from supporting bellows 71. Connected to the space 70 for fluid coupling therewith there is a fluid pipe 73 that leads to a temperature-sensitive element or enclosed chamber 74 (see Figs. 3 and 4).

It will be observed that the structure of differential bellows 45 is such that there are two tightly sealed chambers 68 and 70 located adjacent but in a fluid separating manner, each of which has a pipe 66 and 73 respectively for transferring fluid into or out of the respective chambers. The yoke 44 is an impervious solid cup-shaped dividing partition between chambers 68 and 70 and is movable longitudinally within the outer structure 67 as it is acted upon by the difference in pressure in chambers 68 and 70 so as to vary the volume relationship between these two chambers as the main bellows 69 is squeezed or extended while the supporting bellows 71 and 72 are alternatively compressed and extended with the movement of yoke 44.

The housing 20 is supported on lower extending shaft 14 by means of two brackets or loops 78 and an end thrust angled bracket 79. The housing 20 includes an end cover 80 (see Figs. 3 and 4) that fits over the open side of the housing 20. Differential bellows 45 is supported securely in place within the housing 20 by means of three legs or posts 81 and a short bolt 82 which passes through a bent down portion of a flange 83. This flange 83 extends around the base, or left end of differential bellows outer structure 67 as viewed in Figs. 2 and 3.

Operation

The operation of the antenna rotator will first be explained without reference to temperature compensation and it is as follows:

The space 68 within differential bellows 45 and the interior of bellows 50, as well as the entire hydraulic pipe 66, are completely filled with the hydraulic fluid. Consequently when the knob 58 is rotated, threaded shaft 53 will be displaced longitudinally which will compress or extend the bellows 50. Such action will cause hydraulic fluid to flow one way or the other from the bellows 50 to the space 68 within differential bellows 45, and this fluid flow will cause displacement of the yoke 44 which in turn will carry the output shaft 43 therewith in a longitudinal movement (horizontally left and right as viewed in Figs. 2 and 3). This longitudinal motion of output shaft 43 is transmitted via the link 42 and crank arms 41 and 38, in conjunction with their supporting shaft 39, to the link 37 and thence to the crank arm 36 of the gear sector 31. Consequently, sector 31 is pivoted about its shaft 32 and causes a rotation of the pinion 29, which carries with it in rotation the antenna shaft 12 for variably rotating the directional antenna 13. As indicated above, the indicator bar 59 at the remote control bellows 50 may be calibrated with markings to show the geographical position of the directional antenna 13 in connection with its supporting shaft 12.

In order to avoid errors in the positioning of shaft 12 and antenna 13, the use of differential bellows 45 comes into play. Within the space or chamber 70 of the differential bellows 45 there is located a compressible fluid which is in communication with the temperature sensitive element 74. Therefore the changes in temperature that take place at the rotator 11 will be felt as an expansion or contraction effect on the temperature sensitive element 74, so as to vary the fluid pressure in chamber 70 of the differential bellows 45. In this manner the position of output shaft 43, as determined by yoke 44 of the differential bellows, will be the combined effect of the position of bellows 50 and the pressure on the fluid in the chamber 70 as determined by the temperature, within or at the housing 20 of the rotator.

While there has been described a specific embodiment of a rotator in accordance with the applicable statutes, this is not to be taken in any way as limiting the scope of this invention but merely as being descriptive thereof.

It is claimed:

1. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including first fluid actuated bellows, means for coupling said bellows to said upright member to position the member in rotation, second bellows remotely located and connected to said fluid actuated bellows, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, and temperature sensitive means for compensating for changes in temperature at said first named bellows.

2. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including first differential pressure fluid actuated bellows, means for coupling said bellows to said upright member to position the member in rotation, second bellows remotely located and connected to said fluid actuated bellows, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, and temperature sensitive means for compensating for changes in temperature at said first named bellows.

3. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including first differential pressure fluid actuated bellows, means for coupling said bellows to said upright member to position the member in rotation, second bellows remotely located and connected to said fluid actuated bellows, means for varying the volume of said second bellows to actuate said first fluid actuated bellows

to position the supporting member in rotation, temperature sensitive means for compensating for changes in temperature at said first named bellows, and indicator means located at said second bellows and acting in conjunction with said volume varying means to indicate the rotational position of said upright member.

4. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including a pinion on said upright member, a gear sector meshing with said pinion, first fluid actuated bellows, means for coupling said first bellows with said gear sector for pivotally rotating the sector to cause rotation of said pinion, second bellows remotely located and connected to said fluid actuated bellows, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, and temperature sensitive means for compensating for changes in temperature at said first named bellows.

5. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including a pinion on said upright member, a gear sector meshing with said pinion, first differential pressure fluid actuated bellows, means for coupling said first bellows with said gear sector for pivotally rotating the sector to cause rotation of said pinion, second bellows remotely located and connected to said fluid actuated bellows, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, and temperature sensitive means for compensating for changes in temperature at said first named bellows.

6. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including a pinion on said upright member, a gear sector meshing with said pinion, first differential pressure fluid actuated bellows, said bellows having two fluid tight chambers, means for coupling said first bellows with said gear sector for pivotally rotating the sector to cause rotation of said pinion, second bellows remotely located and connected to one of said chambers, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, a temperature sensitive element containing a compressible fluid therein, and means for connecting said element to the other of said chambers for providing temperature compensation in the rotator.

7. An antenna rotator for a directional antenna having an upright supporting member therefor comprising bearing means for rotatably supporting said upright member, means for rotating said member through substantially one revolution including a pinion on said upright member, a gear sector meshing with said pinion, first differential pressure fluid actuated bellows having two fluid tight chambers, means for coupling said first bellows with said gear sector for pivotally rotating the sector to cause rotation of said pinion, second bellows remotely located and connected to one of said chambers, means for varying the volume of said second bellows to actuate said first fluid actuated bellows to position the supporting member in rotation, a temperature sensitive element containing a compressible fluid therein, means for connecting said element to the other of said chambers for providing temperature compensation in the rotator, and indicator means located at said second bellows and acting in conjunction with said volume varying means to indicate the rotational position of said upright member.

8. An antenna rotator for a directional antenna having an upright supporting member therefor comprising a housing, means for supporting said housing from a shaft, a thrust bearing within said housing for supporting said upright member, a lateral support bearing for said upright member associated with said housing and spaced vertically from said thrust bearing, a pinion attached to said upright member for rotating it, a gear meshing with said pinion, first fluid actuated bellows, coupling means for causing rotation of said gear by said bellows, second bellows remotely located and connected to said fluid actuated bellows, a threaded shaft having a knob thereon, and means coupling said threaded shaft to said second bellows for variably compressing and expanding the same.

9. An antenna rotator for a directional antenna having an upright supporting member therefor comprising a housing, means for supporting said housing from a shaft, a thrust bearing within said housing for supporting said upright member, a lateral support bearing for said upright member associated with said housing and spaced vertically from said thrust bearing, a pinion attached to said upright member for rotating it, a gear meshing with said pinion, first differential pressure fluid actuated bellows, said bellows having two fluid tight chambers, coupling means for causing rotation of said gear by said bellows, second bellows remotely located and connected to one of said chambers, a threaded shaft having a knob thereon, means coupling said threaded shaft to said second bellows for variably compressing and expanding the same, a temperature sensitive element containing a compressible fluid therein, and means for connecting said element to the other of said chambers for providing temperature compensation in the rotator.

10. An antenna rotator for a directional antenna having an upright supporting member therefor comprising a housing, means for supporting said housing from a shaft, a thrust bearing within said housing for supporting said upright member, a lateral support bearing located in the top of said housing, weather proofing means surrounding said upright member adjacent to the top of said housing, a pinion attached to said upright member for rotating it, a gear meshing with said pinion, first differential pressure fluid actuated bellows, said bellows having two fluid tight chambers, coupling means for causing rotation of said gear by said bellows, second bellows remotely located and connected to one of said chambers, a threaded shaft having a knob thereon, means coupling said threaded shaft to said second bellows for variably compressing and expanding the same, a temperature sensitive element containing a compressible fluid therein, means for connecting said element to the other of said chambers for providing temperature compensation in the rotator, and an indicator cooperating with said knob for indicating the rotational position of said antenna.

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