Feb. 6, 1951 W. J. SMITH, JR 2,540,696

DRIVE MECHANISM FOR ADJUSTABLE ANTENNAS

Filed July 16, 1949 3 Sheets-Sheet 1

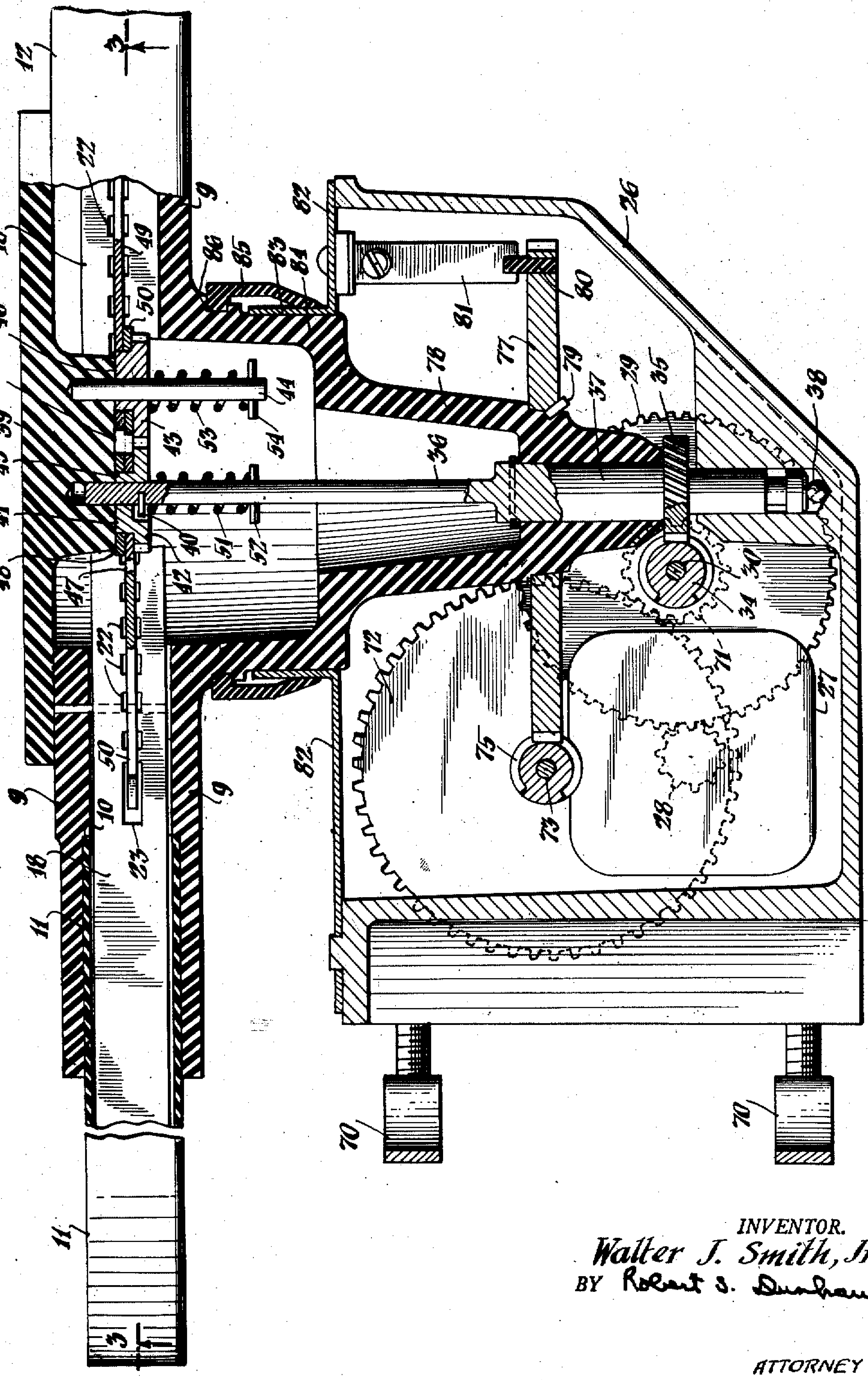

Fig. 1

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DRIVE MECHANISM FOR ADJUSTABLE ANTENNAS

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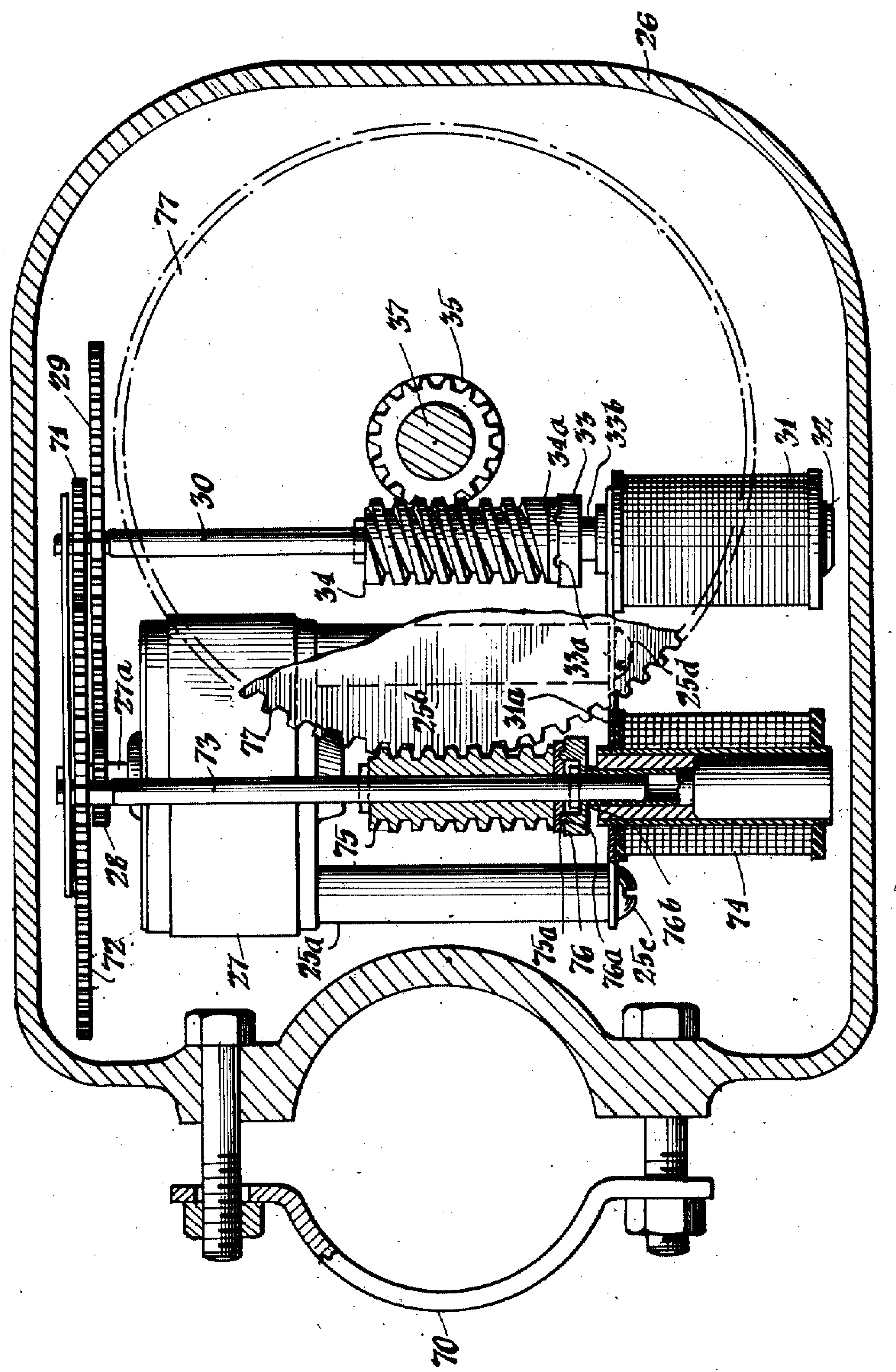

Fig. 2

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DRIVE MECHANISM FOR ADJUSTABLE ANTENNAS

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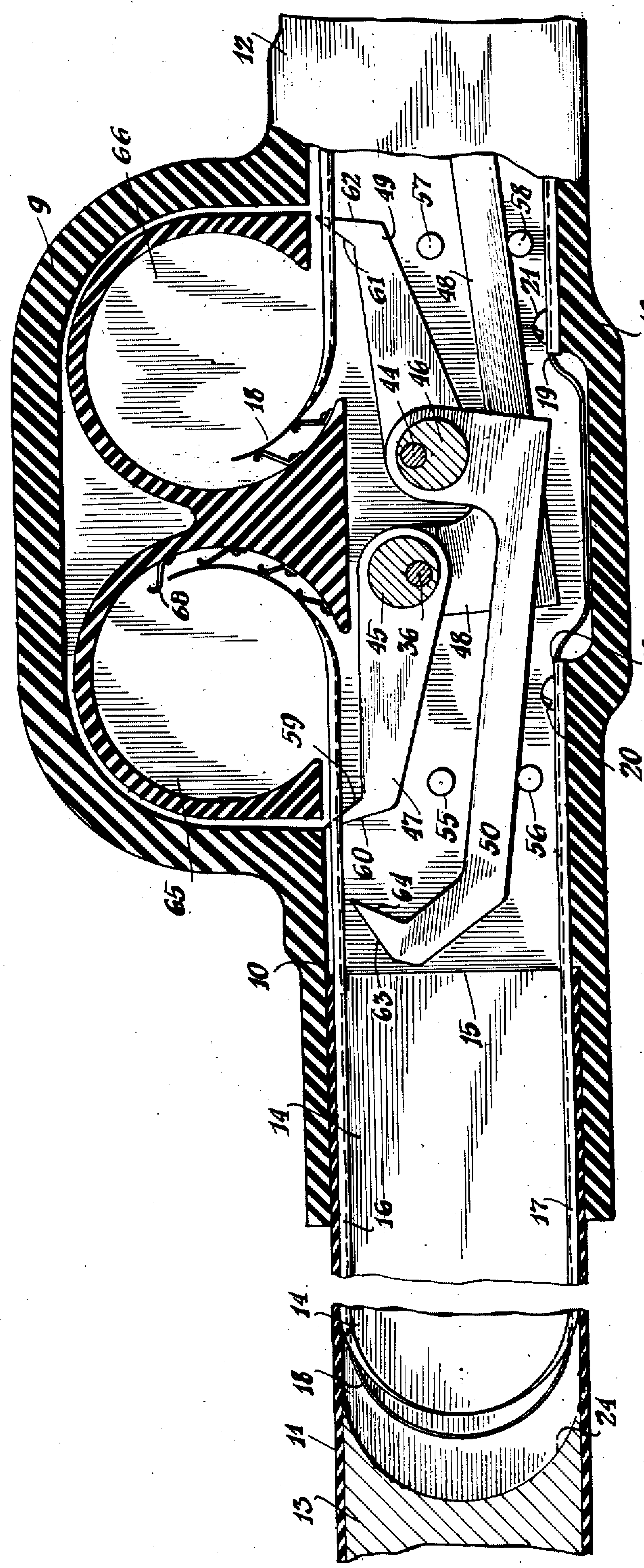

Fig. 3

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2,540,696

DRIVE MECHANISM FOR ADJUSTABLE ANTENNAS

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12 Claims. (Cl. 250—33)

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This invention relates to a directional high-frequency antenna and particularly to an adjustable antenna for use in the television and other high-frequency radio fields.

In high and ultra-high frequency radio and television receivers, it is desirable that the signal strength of the received signal be as strong as possible. The utilization of a tuned, receiving antenna, capable of being rotated to any desired direction, greatly improves the performance of the receiver because the signal strength of the received signal is greater in proportion to the stray noises and interference effects than in the case of an untuned non-rotatable antenna. In order to provide for a maximum of received signal strength over a band or range of frequencies, it is desirable to utilize an antenna that may be selectively tuned to any frequency within the operating band and that may be directionally located for optimum performance at any particular frequency. It is also desirable to utilize tuned transmitting antennas to provide for a maximum of radiated power at any given frequency.

The elements of a conventional directional high-frequency radio or television antenna are normally dimensionally preset or tuned to provide a maximum received signal strength at a predetermined frequency within the operating band. These normally preset elements are not tuned for other frequencies within the operating band and, as a result, the signal strength decreases as the operating frequencies move away from the predetermined frequency at which the antenna is tuned.

Many conventional antenna systems utilize a stacked array to minimize the loss in signal strength at frequencies other than the resonant frequency of the particular antenna elements. However, the stacked array only provides an antenna that is turned at several predetermined frequencies within the operating band and a loss in signal strength occurs at frequencies apart from the resonant frequencies as determined by the preset dimensions of the antenna elements.

Conventional television antennas are normally mounted in a fixed position, usually being oriented to provide a maximum of a signal strength in a given direction. A fixed mounting is not unduly objectionable when the television transmitters are all located in a same general area. However, when several transmitters are located in different areas, with respect to azimuth from the receiving antenna, an antenna with a fixed mounting will only provide a maximum signal strength in a single direction.

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This invention may be briefly described as an improved light-weight, high-frequency, directional antenna including means peculiarly adapted to dimensionally vary the size of the main receiving element so as to selectively and accurately tune to any frequency within an operating band of frequencies, and improved and simple means to rotate the antenna in a horizontal plane. The means for varying the dimensions of the antenna element consist of an improved, light-weight, simple and inexpensive, driving mechanism leading to increased efficiency, cheaper and simpler construction and a decrease of the loading effect on the antenna.

An object of this invention is to provide an improved high-frequency antenna whose main receiving element may be dimensionally varied to tune the antenna to any frequency within a predetermined band of operating frequencies.

Another object of this invention is the provision of an adjustable antenna utilizing a folded dipole as the main antenna element.

A further object of this invention is the provision of an adjustable antenna including an improved mechanism by which the dimensions of the main antenna element may be remotely varied to provide for selective tuning over a predetermined band of operating frequencies.

Another object of this invention is the provision of an adjustable antenna including an improved, light-weight, and inexpensive driving mechanism which nevertheless provides very little loading effect on the antenna.

Still another object of the invention is the provision of an adjustable antenna including an improved driving mechanism of simple and inexpensive construction, whereby the dimensions of an antenna element may be dimensionally varied and whereby the antenna element may be rotated in the horizontal plane.

Referring to the drawings:

Fig. 1 is an elevation, partially in section, showing the antenna and the driving mechanism therefor;

Fig. 2 is a plan view of the housing containing the driving mechanism; and

Fig. 3 is a plan view, partially in section, of the antenna and a portion of the driving mechanism.

Referring to Figs. 1 and 3, there is provided an external antenna housing formed by a central portion 9 and a cover plate portion 39 and having two horizontal coaxial elongated portions 11 and 12 extending outwardly therefrom. The two horizontal coaxial elongated portions 11 and 12 are of a length determined by the band of operating frequencies for which the antenna is to be designed. A lack of space on the figures permits only a fragmentary showing of the elongated portions 11 and 12, and it should be noted at this point that the antenna is symmetrical about its central portion 9. Consequently the following description, which will relate to the structure on one side of the central portion 9, is to be interpreted as including similar elements on the right hand portion of the central portion 9. The elongated portions 11 and 12 are shaped to provide internal guiding chambers such as that illustrated at 13 in Fig. 3. Contained within the elongated portions 11 and 12 and defining a portion of the guiding chambers are guiding segments such as 14 in the guiding chamber 13. This guiding segment 14 is secured to the central housing portion 9 and is spaced from the upper and lower surfaces of the horizontal, elongated portions 11 and 12 as at 16 and 17.

The external antenna housing, comprising the central portion 9, the cover plate 39, the elongated portions 11 and 12, and the guiding segment 14, is preferably molded or constructed from a non-conducting, light-weight, weather-resistant plastic, such as a suitable vinyl or polyester type of plastic.

Disposed within the horizontal, coaxial, elongated portions 11 and 12 is the main receiving element. The presently preferred embodiment of the main receiving element, as illustrated in the drawings, is a folded dipole of flexible conducting material, such as a suitable metallic tape 18. This metallic tape is preferably secured to the housing at a central point such as 19 (see Fig. 3) by any suitable means such as the screws 20 and 21. The tape 18 is disposed in the space 17 between the guiding segment 14 and the surface of the elongated portion 11 and extends outwardly into the guiding chamber 13. In the guiding chambers the tape, being of a flexible character is arcuately turned and extended inwardly adjacent to the surface of the guiding segment 14 in the space 16 where it is passed over the driving members such as the pawls 47, 48, 49 and 50, and the unextended portions retained in coiled array in the cylindrical tape receptacles such as the storage bins 65 and 66.

The metallic tape 18 utilized to form the folded dipole may be suitably formed from a flexible strip of steel or other suitable material, such as beryllium copper, similar in characteristics to the tapes used in metallic rulers and measuring devices. The tape should be sufficiently flexible and resilient to permit an arcuate turning back upon itself as at 24 in Fig. 3. In addition the tape should be such that it rests in compressive sliding contact against the surfaces forming the guiding chamber 13 in the horizontal elongated portion 11 and its corresponding member formed by the horizontal elongated portion 12. It has been found that a narrow steel or beryllium copper strip of approximately .005–.007 inch in thickness possesses suitable characteristics for operational use.

As illustrated in Fig. 1, the tape 18 contains a series of equally spaced perforations 22 to permit the engagment of the tape 18 by the pawls 47, 48, 49 and 50. In the presently preferred embodiment of the invention as illustrated in the drawings, the perforations 22 are centrally disposed on the tape 18, however, the perforations

could be disposed adjacent to either edge of the tape. The series of perforations 22 terminate at each end in a perforation of greater length such as that at 23 on Fig. 1. The terminal perforations 23 should be approximately three times the length of the intermediate spaced perforations 22. The reason for utilizing the enlarged terminal perforations 23 will be explained at a later point in the specification.

Included in the antenna construction is an improved drive mechanism peculiarly adapted to an antenna drive, requiring a simple, light-weight and inexpensive construction. This peculiarly adaptable drive mechanism will now be described in detail.

Referring now to Figs. 1 and 2, the driving mechanism for dimensionally varying the length of metallic tape 18 contained within the guiding chamber 13 and its corresponding member on the other side of the central housing portion 9, is contained within a separate and adjacent housing 26. The housing 26 may be constructed of any suitable light-weight, weather-resistant material. Contained within the housing 26 is a prime mover, which, in presently preferred embodiment illustrated in the drawings, is shown as a reversible electric motor 27. This motor 27 should be of a type that permits rapid starting and stopping. The motor 27 is mounted in the housing 26 by suitable mounting members such as the sleeves 25*a* and 25*b* encompassing the mounting bolts 25*c* and 25*d*.

Mounted on the shaft 27*a* of the motor 27 is a driving pinion 28. The pinion 28 meshes with and drives a gear 29 mounted on a shaft 30. The shaft 30 is encompassed at its opposite end by a solenoid 31 and is supported by a bearing mounted in the solenoid and generally designated at 32. The solenoid 31 is supported by the bearing plate 31*a*. Loosely mounted on and free to rotate about the shaft 30 is a driving worm 34. When the solenoid 31 is energized, the clutch member 33 and the integral sleeve 33*b* which encircles the shaft 30 and extends downwardly into the solenoid 31 which may be splined to the shaft 30 for rotation with it, moves along the shaft 30 and engages the driving worm 34. The driving worm 34 is thus connected to the rotating shaft 30 through the clutch member 33 and rotates therewith. The clutch member 33 is provided with projections such as 33*a* which engage corresponding depressions such as 34*a* in the driving worm 34. The driving worm 34 meshes with and drives a worm gear 35 securely mounted on an enlarged portion 37 of a shaft 36. The enlarged lower portion 37 of the shaft 36 is rotatably mounted in lower portions of the housing 26, and the end of the shaft 37 is seated in a low-friction bearing such as the ball bearing 38. Through the above-described gear train, any rotation of the reversible motor 27 results in a rotation of the shaft 36 whenever the solenoid is energized and the clutch member 33 is in engagement with the driving worm 34.

The upper end of the shaft 36 is rotatably mounted in a cover plate 39 which forms a part of the main antenna housing. Spaced inwardly from the end of the shaft 36 is a driving pin 40 which engages a key slot 41 in the gear 42. Rotation of the shaft 36 causes the driving pin 40 to engage and rotate the gear 42 in a corresponding direction. The gear 42 engages and counter-rotates a companion gear 43 of similar size and shape. The gear 43 is mounted on a stub shaft 44, one end of which is rotatably mounted in and supported by the cover element 39. By the above-described gearing arrangement, any rotation of the shaft 36 results in an equivalent counterrotation of the shaft 44. Also mounted on the shaft 36 and adjacent to the gear 42 is an eccentric 45 having a circular periphery. Similarly mounted adjacent to the gear 43 is a second eccentric 46 of similar shape and size. The eccentrics 45 and 46 are secured to the shafts 36 and 44 and, if so desired, may be cast integral with the gears 42 and 43. Mounted on the eccentric 45 is a pushing pawl 47 and an adjacent pulling pawl 48. The pawls are mounted on the circular periphery of the eccentrics with a frictional fit which will permit relative movement between the eccentric and the pawl if the pawl is restrained in its normal movement. The eccentric 45 is shaped to provide a reciprocating movement to the ends of the pawls 47 and 48. The end of the pushing pawl 47 is shaped to present a steep portion 60 to the edge of a perforation on the tape on the outwardly moving pushing stroke. Adjacent thereto is a slanting portion 59 which will slide over the edges of the perforations on the tape on the return stroke of the pushing pawl 47 without imparting movement to the metallic tape 18.

The shaft 44 and the eccentric 46 mounted thereon also mount a pushing pawl 49 and a pulling pawl 50 of a construction and mounting similar to the pawls 47 and 48. The configuration of the pulling pawl 50 and also the configuration of the corresponding pawl 48 mounted on the shaft 36 is clearly illustrated in Fig. 3. The end of the pulling pawl 50, which engages the tape 18, is shaped to present a gently sloping portion 63 to the edges of the perforations on the outwardly moving stroke. This sloping portion 63 will slide over the perforations on the tape 18 without imparting movement thereto. Adjacent the gently sloping portion 63 is the engaging edge 64 which engages the edges of the perforations on the inwardly moving stroke and imparts movement to the tape. As the gripping portion 64 engages the edge of the perforations in tape 18 on each return stroke, the metallic tape will be withdrawn from the guiding chamber 13 in an amount equal to the length of the stroke of the pulling pawls 48 and 50.

The enlarged perforations on the tape, such as 23, limit the feeding action in advancing and retarding the antenna elements. The elongated perforations permit the pawls to move in their normal path but offer no engaging surface or edge and thus terminate the movement of the tape.

It should be noted that the pushing and pulling pawls must be mounted so that the tape engaging ends are disposed in a straight line. While this may be accomplished by providing a suitable offset mounting for each of the pulling pawls or by forming each of the pulling pawls with a suitable bend in its arm to accomplish the desired positioning, the presently preferred embodiment, as shown in the drawings, consists in off-setting the tapes 18 a distance equal to the width of a pawl.

Included in the antenna drive mechanism is a construction to selectively position both pushing pawls or both pulling pawls in operative engagement with the perforations on the antenna element.

The selective positioning means includes the stop collars 52 and 54 mounted on the shafts 36 and 44 respectively. Encompassing the shafts 36 and 44 and compressively disposed between the stop collars 52, 54 and the gears 42 and 43 respectively are spring members 51 and 53. These spring members are normally under compression and press the gears 42 and 43 and the adjacent eccentrics 45 and 46 bearing the pawls 47 through 50 against the abutting surface 67 of the cover element 39. The resultant compression of the springs 51 and 53 results in a frictional surface contact between the pawls adjacently mounted on each of the eccentrics such as, for example, the pawls 47 and 48 on the eccentric 45.

Referring now particularly to Fig. 3, the selective positioning action of the above described spring members 51 and 53 will be described in detail.

If the shaft 36 is rotated in a counterclockwise direction, the shaft 44, geared thereto, is counterrotated in a clockwise direction. The rotation of the shaft 36 in a counterclockwise direction causes the pawl 47, due to its frictional mounting and the effect of the spring loading described above, to move in a counterclockwise direction out of engagement with the tape 18. This counterclockwise movement of the pawl 47 will be arrested by the stop pin 55 protruding from the housing 9. In addition, the counterclockwise rotation of the shaft 36 will cause the pawl 48 to move in the same direction. The pawl 48 thus moves into engagement with the metallic tape 18 coincidentally with the movement of the pawl 47 out of engagement with the metallic tape 18. As the shaft 36 rotates in a counterclockwise direction, the shaft 44 is counterrotated and thus turned in a clockwise direction. The clockwise rotation of the shaft 44 turns the pawl 49 so as to remove it from engagement with the tape 18. The clockwise movement of the pawl 49 is terminated by the stop pin 57 protruding from the housing 9. The clockwise rotation of the shaft 44 also moves the pawl 50 into engagement with the tape 18 coincidentally with the movement of the pawl 49 out of engagement with the tape. Summarizing the above, it is seen that a counterclockwise rotation of the shaft 36 effectively disengages both pushing pawls, i. e. pawls 47 and 49, from operative engagement with the tape and coincidentally moves both pulling pawls, i. e. pawls 50 and 48, into operative engagement with the tape 18.

In a similar manner, a clockwise rotation of the shaft 36 will disengage both pulling pawls, i.e. pawls 48 and 50, from engagement with the metallic tape 18 coincidentally with the engagement of both pushing pawls, i.e., pawls 47 and 49 thereto. The stop pins 56 and 58 will limit the movement of the pulling pawls 50 and 48.

The presently preferred drive mechanism described above is peculiarly adapted to its inclusion as an integral part of an adjustable antenna due to its simplicity, efficient operation and simple and inexpensive construction.

The pawls 47 through 50 may be suitably constructed of any strong, rigid, light-weight, nonconducting material and conveniently may be punched from a suitable pressed-fibre board or similar material. It should be noted that as these pawls are preferably constructed of material having suitable insulating qualities, isolation of the antenna tape from the remainder of the antenna drive mechanism offers no insulation problems. In addition, the gears and eccentrics together with the shafts 36 and 44 may also, if desired, be made of a suitable light-weight plastic.

Included in the housing 9 and disposed adjacent to the pawls 47 through 50, are the tape receptacles provided to contain the unextended portions of the metallic tape 18 in a compact coiled array. In the presently-preferred embodiment as illustrated in the drawings, a simple, efficient, and light-weight construction is employed utilizing no moving parts. There is provided two cylindrical tape receptacles 65 and 66 of a depth determined by the width of metallic tape utilized for the antenna element. Mounted on the inner periphery of the cylindrical tape receptacles 65 and 66 are a plurality of inwardly disposed spring members, such as 68. The spring members 68 are roughly S-shaped and are mounted in the receptacles 65 and 66 so as to present an arcuate surface to the moving tape 18. These members 68 may be suitably punched from a strip of spring steel and said strip may be mounted on the inner periphery of said receptacles 65 and 66 so that the members 68 engage the tape adjacent the perforations to form the unextended portions of the metallic tape 18 into a tight coil. As the length of the antenna disposed within the elongated guiding chambers 11 and 12 is shortened, the diameter of the coils in the receptacles 65 and 66 will be increased.

The increase in width of the coil presses against the tension of the spring members 68 and moves the free ends of said members to a position closer to the periphery of the cylindrical tape receptacles 65 and 66. As the diameter of the coil in the receptacles decreases, the characteristics of the spring members 68 maintain a tightly wound coil.

While spring tensioned reels may be used if desired, the presently preferred and above-described coil mechanism has the advantages of light-weight and efficient operation due to a lack of moving parts and is peculiarly adapted to an antenna structure of the type described.

Integrally associated with the antenna drive mechanism is an improved means for rotating the antenna in the horizontal plane. The lower housing 26 is provided with suitable mounting brackets 70 for mounting the antenna on a pole or other suitable mount.

The motor 27, described in detail above, is utilized to provide necessary power for rotating the antenna in the horizontal plane. As described above, the pinion 28 mounted on the shaft 27—*a* of the motor 27 engages and rotates the gear 29 mounted on the shaft 30. Mounted adjacent the gear 29 on the shaft 30 is a pinion 71. The pinion 71 engages and drives a gear 72 mounted on a separate shaft 73. The shaft 73 is supported in a bearing mounting by the solenoid assembly 74 which in turn is mounted on the bearing plate 31*a*. Mounted on the shaft 73 in non-rotative engagement is a driving worm 75 which is thus free to turn relative to the shaft. Adjacent the driving worm 75 is a clutch plate 76, having projections thereon such as 76*a*, which is slidably mounted together with a plane member 76*b* which encircles the shaft 73 and extends downwardly into the solenoid 74, on the shaft 73 and turns therewith. The clutch plate 76 and the plane 76*b* are responsive to energization of the solenoid assembly 74, and when said solenoid assembly 74 is energized, the clutch plate 76 moves along the shaft 73 and the projections 76*a* thereon engage corresponding depressions 75*a* on the driving worm 75 and rotates said worm 75 in conjunction with the shaft 73. The driving worm 75 is in continual engagement with a large worm gear 77.

The worm gear 77 is securely and non-rotatably mounted on the hub 78 by a locking pin 79. The hub 78 is integrally formed by the antenna housing 9 which extends downwardly into the non-rotating drive mechanism housing 26 and rotatably encompasses the shaft 36. The hub 78 is supported in part by the gear 35 but rotates independently therefrom. The antenna housing 9, together with the horizontal elongated portions 11 and 12 containing the antenna element, is rotated in the horizontal plane by the driving action of the worm 75 engaging the worm gear 77. The actuation of the clutch plate 76 by the energization of the solenoid 74 provides a simple and effective control for antenna rotation.

In order to prevent undue twisting of the electrical leads (not shown) to the motor 27 and to the antenna elements, means are included to prevent rotation of the antenna beyond a 360° swing. Mounted on the large worm gear 77 is a protruding pin 80 which engages and trips a limit switch 81. The limit switch 81 is mounted on a cover plate 82 closing the upper portions of the lower housing 26. The limit switch 81 is suitably connected to the motor 27 to reverse the direction of rotation when tripped.

The cover plate 82 is provided with a flanged portion 83 which encircles the upper enlarged cylindrical portion 84 of the rotatable hub 78. The joint between the cover plate 82 and the upper enlarged cylindrical portion 84 of the rotatable hub 78 is covered by a flexible waterproof sleeve such as 85 mounted on the hub 78, as at 86.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of this invention, together with the elements which I now consider the best embodiments thereof, but I desire to have it understood that the structure disclosed is only illustrative and the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combinations and relations described, some of these may be altered and modified without interfering with the more general results outlined and the invention extends to such use within the scope of the appended claims.

What is claimed is as follows:

1. An adjustable high-frequency antenna, comprising guiding means shaped to provide two elongated guiding chambers for an expansible folded dipole antenna element, said elongated guiding chambers defining a loop-shaped path for said dipole having an extent representing a position of maximum remoteness for the end of the folded dipole, an expansible folded dipole of flexible, conducting tape having a series of spaced perforations thereon disposed in U-shape and in compressive sliding contact with the surfaces of the guiding chambers, said flexible tape secured to the guiding means intermediate the elongated guiding chambers, and means for advancing successive portions of the tape remote from the turn of the U thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the U-shaped extent of the member in the guiding chambers, including, a drive housing member, a reversible electric motor contained within said drive housing, a first drive shaft geared to and rotated by said motor, a second drive shaft geared to said first drive shaft and counter-rotated thereby, a pushing pawl and a

pulling pawl eccentrically mounted on each of said shafts and positioned to engage the perforations on said tape, loading means responsive to one direction of rotation of said first shaft to selectively position both pushing pawls in operative engagement with the perforations on said tape and responsive to the other direction of rotation of said first shaft to selectively position both pulling pawls in operative engagement with the perforations on said tape.

2. An adjustable high-frequency antenna, comprising, rotatable guiding means shaped to provide two elongated guiding chambers for an expansible folded dipole antenna element, said elongated guiding chambers defining a loop-shaped path for said dipole having an extent representing a position of maximum remoteness for the end of the folded dipole, an expansible folded dipole of flexible, conducting tape having a series of spaced perforations thereon, the first and last perforations of said series being of greater length than the intermediate perforations, said folded dipole being disposed in U-shape and in compressive sliding contact with the surfaces of the guiding chambers, said flexible tape secured to the guiding means intermediate the elongated guiding chambers, means for advancing successive portions of the tape remote from the turn of the U thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the U-shaped extent of the member in the guiding chambers, including, a reversible prime mover, a first drive shaft rotated by said prime mover, an adjacent second drive shaft geared to said first drive shaft and counterrotated thereby, a pushing pawl and a pulling pawl eccentrically mounted on each of said shafts and positioned to engage the perforations on said tape, said pushing and pulling pawls being mounted on eccentrics shaped to cause the ends of said pawls to reciprocate along a predetermined path, spring loading means responsive to one direction of rotation of said first shaft to selectively position both pushing pawls in operative engagement with the perforations on said tape, whereby said pushing pawls engage successive perforations on said tape and advance said tape into the elongated guiding chambers, and responsive to the other direction of rotation of said first shaft to selectively position both pulling pawls in operative engagement with the perforations on said tape, whereby said pawls engage said perforations on said tape and retract said tape from said guiding chambers.

3. The adjustable antenna in accordance with claim 2, including, means for rotating the antenna element in the horizontal plane, comprising, a third shaft geared to and rotated by said prime mover, gearing means secured to said rotatable guiding means and rotated by said third shaft, and solenoid actuated clutching means intermediate said third shaft and said prime mover.

4. The adjustable antenna in accordance with claim 2, including, means for storing the unextended portions of said flexible tape, comprising, a pair of cylindrical receptacles contained within said guiding means, a plurality of inwardly extending spring members mounted on the peripheries of said cylindrical receptacles and positioned to maintain the unextended portions of said flexible tape in coiled array.

5. An adjustable high-frequency antenna comprising a rotatable antenna housing member of non-conducting material shaped to provide two coaxial, elongated, guiding chambers for an expansible folded dipole antenna element, said elongated guiding chambers defining a loop-shaped path for said dipole having an extent representing a position of maximum remoteness for the end of the folded dipole, an expansible folded dipole of flexible, conducting tape having a series of spaced perforations thereon disposed in U-shape and in compressive sliding contact with the surfaces of the guiding chambers, said flexible tape secured to the antenna housing member intermediate the elongated guiding chambers, means for advancing successive portions of the tape remote from the turn of the U thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the U-shape extent of the member in the guiding chambers, comprising, a non-rotatable housing member, a reversible electric motor contained within said non-rotatable housing, a first drive shaft geared to and rotated by said motor, solenoid actuated clutch means intermediate said motor and said first drive shaft to control the rotation of said first shaft, a second drive shaft geared to said first drive shaft and counterrotated thereby, a pushing pawl and a pulling pawl eccentrically mounted on each of said shafts and positioned to engage the perforations on said tape, loading means responsive to one direction of rotation of said first shaft to selectively position both pushing pawls in operative engagement with perforations on said tape and responsive to the other direction of rotation of said first shaft to selectively position both pulling pawls in operative engagement with the perforations on said tape, and means for rotating the antenna in a horizontal plane, including a third shaft within said non-rotatable housing member geared to and rotated by said reversible electrical motor, second solenoid actuated clutching means intermediate said motor and said third drive shaft to control the rotation of said third shaft, a gear mounted on said rotatable antenna housing member responsive to rotation of said third shaft whereby said antenna housing is rotated in the horizontal plane.

6. An adjustable high-frequency antenna comprising a rotatable antenna housing member of non-conducting material shaped to provide two coaxial elongated guiding chambers for a dipole antenna element, said elongated guiding chambers defining a path for said dipole having an extent representing a position of maximum remoteness for the end of the dipole, a dipole of flexible conducting tape having a series of spaced perforations thereon disposed within the guiding chambers, means for advancing successive portions of the tape remote from the ends thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the extent of the member in the guiding chambers, including, a non-rotatable housing member, a reversible electric motor contained therein, a first drive shaft geared to and rotated by said motor, a second drive shaft geared to said first drive shaft and counterrotated thereby, a pushing pawl and a pulling pawl eccentrically mounted on each of said shafts and positioned to engage the perforations on said tape, loading means responsive to one direction of rotation of said first shaft to selectively position both pushing pawls in operative engagement with perforations on said tape and responsive to the other direction of rotation of said first shaft to selectively posi-

tion both pulling pawls in operative engagement with the perforations on said tape.

7. The adjustable antenna in accordiance with claim 6 including, means for rotating the antenna element in the horizontal plane, comprising, a third shaft geared to and rotated by said motor, gearing means secured to said rotatable antenna housing member and rotated by said third shaft, and means for selectively engaging said third shaft and said gearing means.

8. The adjustable antenna in accordance with claim 6, including, means for storing the unextended portions of said flexible tape, comprising, a pair of cylindrical receptacles contained within said antenna housing member, a plurality of inwardly extending spring members mounted on the peripheries of said cylindrical receptacles and positioned to maintain the unextended portions of said flexible tape in coiled array.

9. An adjustable high frequency antenna, comprising, an antenna housing member of non-conducting material shaped to provide two coaxial, elongated, guiding chambers for a dipole antenna element, an expansible dipole of flexible, conducting tape having a series of spaced perforations thereon disposed within said guiding chambers, means for advancing successive portions of the tape remote from the ends thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the extent of the element in the guiding chambers, including, a reversible motor, a pair of antenna advancing elements to engage and intermittently advance said tape into said guiding chambers, a pair of antenna withdrawing elements to engage and intermittently withdraw said tape from said guiding chambers, gearing means intermediate said antenna advancing and withdrawing elements and said motor and means to selectively position said antenna advancing and withdrawing elements in operative engagement with the perforations on said tape.

10. The adjustable antenna in accordance with claim 9 including, means responsive to said reversible motor to rotate the antenna in the horizontal plane.

11. An adjustable high frequency antenna, comprising, a rotatable antenna housing member of non-conducting material shaped to provide two coaxial, elongated, guiding chambers for an expansible folded dipole antenna element, said elongated guiding chambers defining a loop-shaped path for said dipole having an extent representing a position of maximum remoteness for the end of the folded dipole, an expansible folded dipole of flexible, conducting tape having a series of spaced perforations thereon, the first and last perforations of said series being of greater length than the intermediate perforations, said folded dipole being disposed in U-shape and in compressive sliding contact with the surfaces of the guiding chambers, said flexible tape secured to the antenna housing member intermediate the elongated guiding chambers, means for advancing successive portions of the tape remote from the turn of the U thereof, into and out of the guiding chambers, to elongate and shorten, correspondingly, the U-shaped extent of the member in the guiding chambers, including, a non-rotatable housing enclosing the lower portion of said rotatable antenna housing member, a reversible motor contained within said non-rotatable housing, a pair of antenna advancing elements to engage said perforations and intermittently advance said tape into said guiding chambers, a pair of antenna withdrawing elements to engage said perforations and intermittently withdraw said tape from said guiding chambers, gearing means intermediate said antenna advancing and withdrawing elements and said motor, means to selectively position said antenna advancing and withdrawing elements in operative engagement with the perforations on said tape, and means to rotate the antenna in the horizontal plane, comprising, gearing means secured to said rotatable antenna housing member, means intermediate said gearing means and said reversible motor including selective clutching means to mechanically link said gearing means with said reversible motor.

12. An adjustable high frequency antenna, comprising guiding means for an antenna element, an expansible antenna element of flexible conducting tape having a series of spaced perforations thereon contained within said guiding means, means for advancing successive portions of the tape into and out of the guiding means, to elongate and shorten, correspondingly, the extent of the element in the guiding means, including, driving means, an antenna advancing element responsive to said driving means to engage and intermittently advance said tape into the guiding means, an antenna withdrawing element responsive to said driving means to engage and intermittently withdraw said tape from said guiding means, gearing means intermediate said driving means and said antenna advancing and withdrawing elements, means to selectively position said antenna advancing and withdrawing elements in operative engagement with the perforations on said tape, and means responsive to said driving means for rotating said antenna in the horizontal plane.

WALTER J. SMITH, JR.

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