Aug. 7, 1923. 1,464,168

W. T. BOOTH ET AL

ANTENNA SYSTEM

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Fig. 1.

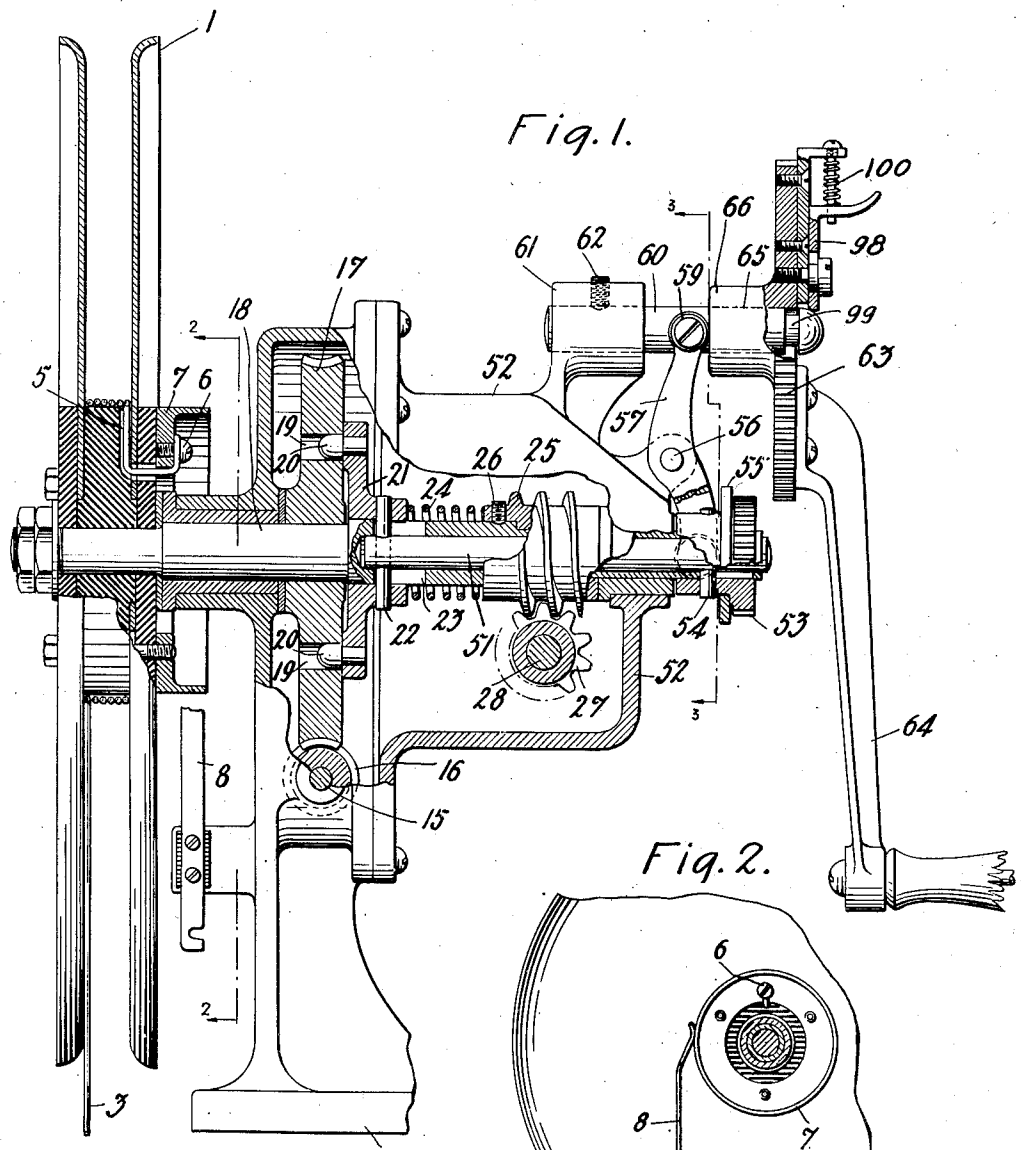
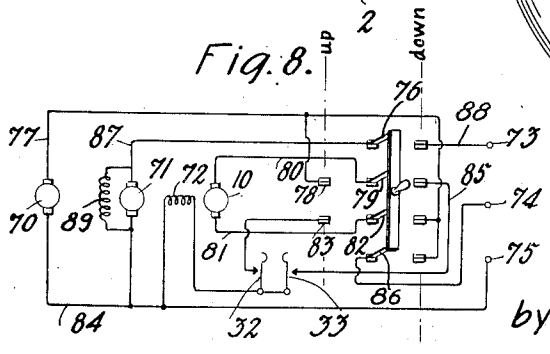


Fig. 2.

Fig. 8.



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Fig. 3.

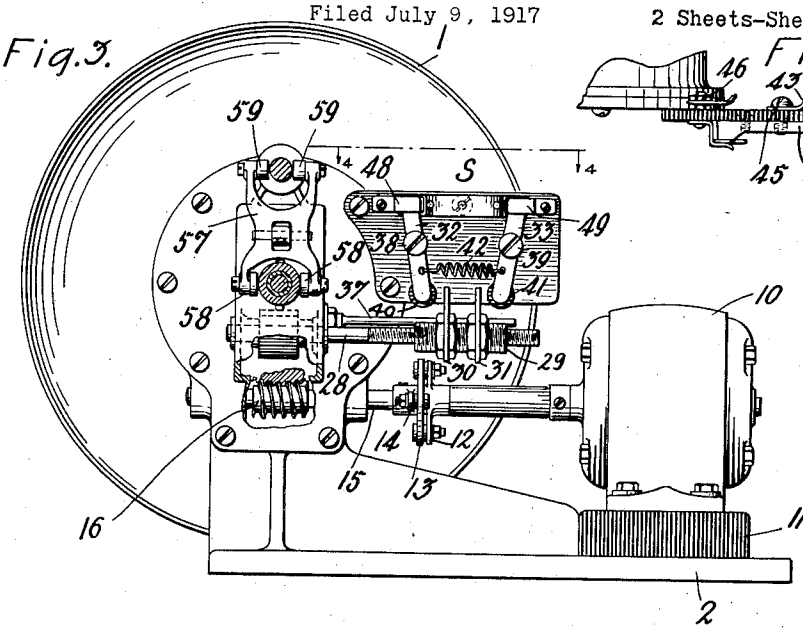


Fig. 4.

Fig. 5.

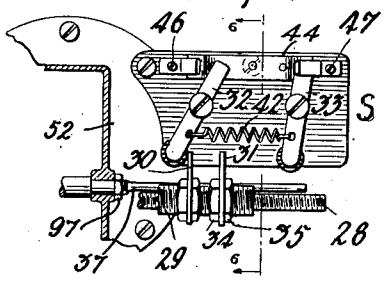


Fig. 6.

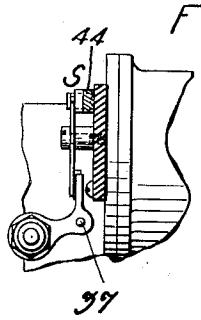
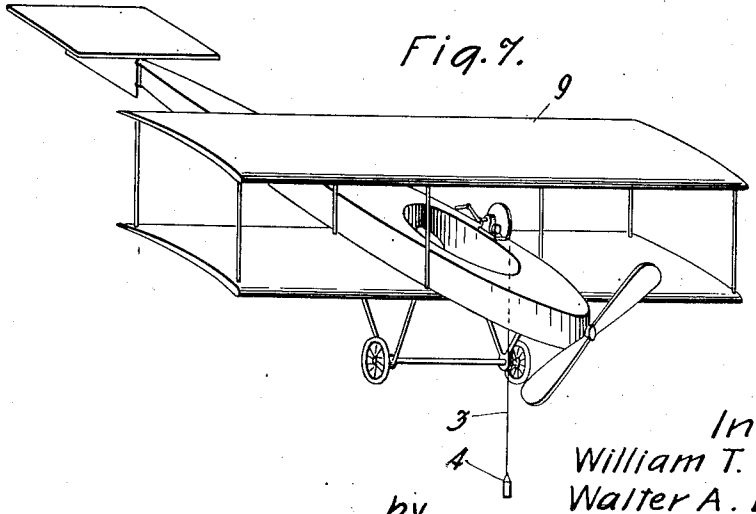


Fig. 7.



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Patented Aug. 7, 1923. 1,464,168

UNITED STATES PATENT OFFICE.

WILLIAM T. BOOTH, OF EAST ORANGE, NEW JERSEY, AND WALTER A. BOYD, OF BROOKLYN, NEW YORK, ASSIGNORS TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ANTENNA SYSTEM.

Application filed July 9, 1917. Serial No. 179,472.

To all whom it may concern:

Be it known that we, WILLIAM T. BOOTH and WALTER A. BOYD, citizens of the United States, residing at East Orange, in the county of Essex and State of New Jersey, and at Brooklyn, in the county of Kings and State of New York, respectively, have invented certain new and useful Improvements in Antenna Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to wireless signaling systems, and more particularly to the adaptation of such systems to aeroplanes and the like. It has been proposed to provide an aeroplane with an antenna which may depend from the aeroplane while signaling, and which may be retracted or reeled in when the signaling is completed.

The present invention has for an object to provide means for automatically reeling the antenna in or out, so that the reeling operation shall automatically stop when the antenna has reached its limit of travel in either direction.

This is accomplished by winding the antenna on a reel which is turned by an electric motor. A limit switch is provided for the motor so that when the reel has been turned the necessary amount, the motor automatically stops.

Another object of the invention is to provide means supplementary to the motor for reeling the antenna in case the motor fails to operate.

To this end the invention provides a crank which may be coupled to the reel to operate the same. When the crank is moved to the coupling position, the motor is automatically uncoupled from the reel. The crank may then be turned to operate the reel without interference from the inoperative motor. The motor limit-switch is always coupled to the reel, so that these elements retain their proper relative positions regardless of whether the motor or the crank is used to operate the reel. This, of course, insures that after operating the reel by the crank, when the motor is subsequently rendered operative and coupled to the reel, the automatic switch will function at the proper times.

For further details of the invention reference has been made to the drawings, in which—

Fig. 1 is an elevation of the reel and its operating means partly in cross-section;

Fig. 2 is a section on line 2, 2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a cross-section on line 3, 3 of Fig. 1 looking in the direction of the arrows;

Fig. 4 illustrates a detail of the limit-switch as shown by a section on line 4, 4 of Fig. 3 as seen from above;

Fig. 5 illustrates the limit-switch in one position;

Fig. 6 is a section on line 6, 6 of Fig. 5 looking to the left;

Fig. 7 illustrates the reel motor mounted in position in an aeroplane; and

Fig. 8 shows the motor control system.

Referring to Fig. 1 the reel 1 and its operating means are mounted on a suitable base 2. Wound on the reel 1 is the antenna 3, at the lower end of which is provided a suitable weight 4 (Fig. 7). Referring again to Fig. 1, the other end of the antenna passes through a groove 5 in the body of the reel and is clamped by means of a screw 6 to the slip-ring 7. Bearing on this slip-ring is a brush 8 by means of which connection may be made to the signaling apparatus.

The reel 1 is adapted to be driven by an electric motor 10 (see Fig. 3), which is insulated from the base 2 by means of the insulating support 11. The shaft of the motor 10 is provided with a spider 12 which is clamped to a leather disc 13, intermediate portions of the insulating disc 13 being clamped by a complementary spider 14 which is mounted on the shaft 15. The shaft 15 is coupled to the reel 1 through the worm 16 and worm-wheel 17 (Fig. 1) which is loosely mounted on the reel shaft 18. In order to rigidly connect the worm wheel 17 to the reel shaft 18, the former is provided with a plurality of apertures 19 which are adapted to be engaged by lugs 20 on a spider arm 21, which is keyed to the shaft 18 by means of the pin 22 and slot 23. The lugs 20 on the spider arm 21 are normally forced into the apertures 19 by means of the compression spring 24 which bears against the spider arm 21 and against the worm 25 fastened to the shaft 18 by means of the set screw 26.

The rotation of the worm 25 controls the operation of the limit-switch S (Figs. 3 and 5) by means of the worm gear 27 mounted on the shaft 28 (Fig. 1). Referring to Figs. 3 and 5 the rotating shaft 28 carries a traveling nut 29 on which are mounted dogs 30 and 31, which are adapted to operate the switch elements 32 and 33 respectively. The position of each of the dogs 30 and 31 may be adjusted by suitably positioning the nuts 34 and 35 which clamp the opposite sides of these dogs. In order to make the dogs more rigid they are apertured as shown in Fig. 6 to ride on a stationary rail 37. As shown in Fig. 5 the rail 37 is clamped to the wall of the housing 52 by means of a nut 97 threaded on the rail. The switch elements 32 and 33 are pivoted at 38 and 39 respectively, and their inner ends are provided with abutments 40 and 41 respectively which extend in the path of the dogs 30 and 31 respectively. The inner ends of the switch elements 32 and 33 are provided with a tensioning spring 42 which normally keeps the switches closed. The circuit is completed through the lead 43 (Fig. 4) fastened to the switch block 44 by means of a screw 45, and through either of the terminals 46 or 47 which are also connected to the switch block 44, through the switch clips 48 and 49 respectively, and the upper ends of the switches 32 and 33.

When the motor 10 has turned the reel 1 for the proper number of revolutions, the traveling nut 29 is moved longitudinally to cause the dog 30, for instance, to move into position to open the switch element 32 and when the circuit is closed for operating the reel in the other direction the traveling nut 29 moves the dog 31 into position to open the switch 33, thereby automatically stopping the motor by cutting off the current and allowing it to come to rest, as will be described later in connection with Fig. 8.

Referring again to Fig. 1, the means which is supplementary to the motor 10 for operating the reel 1 will now be described. The pin 22 is fastened in a shaft 51 which projects out through the enclosing casing 52, and is provided at its outer end with the pinion 53. This pinion is fastened to the shaft 51 by means of the pin 54, and the inner side of the pinion 53 is provided with a washer 55. Pivotally mounted on the casing 52 at 56 is the lever 57. the opposite ends of which are bifurcated as shown in Fig. 3. Each of the lower extremities of the lever 57 is provided with an abutment 58 adapted to engage the inner face of the washer 55. The upper extremities of the lever 57 are provided with similar abutments 59 which straddle the stud 60 fixed in the lug 61 upon the housing 52 by means of the set screw 62. The gear 63 has fastened thereto a handle 64 for turning the same. The central circular bore 65 of the gear 63 is about the same size as the diameter of the stud 60 so that the gear 63 may rotate on this stud. Fig. 1 shows the gear positioned on the stud, and on pushing the gear inwards the inner face 66 of the gear contacts with the abutments 59, thereby pushing the upper end of lever 57 inwardly and the lower end thereof outwardly. The outward movement of the lower end of lever 57 pushing against the disc 55 pulls the shaft 51 and the spider arm 21 so that the lugs 20 are moved from the apertures 19. This permits the worm wheel 17 and the worm 16 upon the motor shaft to remain stationary, while the reel shaft 18 is being rotated by the handle 64. The inward movement of the gear 63 and the outward movement of the pinion 53 are arrested by the gear 63 coming into contact with the friction washer 55, at which time the gear 63 will be in mesh with the pinion 53 which is fastened to the reel shaft 18. The gears 53 and 63 may be locked in their meshing position by any suitable means, for instance, by the catch 98 which is adapted to be forced into the groove 99 in stud 60 by means of the spring 100. The handle 64 may be turned to rotate the reel 1 while the motor remains stationary.

As the worm 25 is fixed to the reel shaft 18, the limit-switch operating dogs which are controlled by the rotation of the worm 25 will always retain their proper relative positions with respect to the number of revolutions that the reel 1 has made.

Referring now to Fig. 8, the generators 70 and 71, which have a common field winding 89, are adapted to furnish current to the terminals 73, 74 and 75 on the wireless sending set. The generator 70 is a nine-volt machine which also supplies current to the reel motor 10. The automatic switch for motor 10 is shown diagrammatically, 32, 33 representing the pivoted switch elements shown in the other figures. These switch elements are connected in series with the field 72 of the motor 10, so that the automatic switch stops the motor by opening its circuit. When the switch 76 is in position for raising the antenna, the generator 70 is connected only to the motor 10,—the wireless sending set being disconnected from the generators in this position of the switch for two reasons: first, it is not desired to operate the sending set while the antenna is being reeled in; secondly, the capacity of generator 70 is such that it could not reel in the antenna and supply the sending set at the same time. When switch 76 is in position for raising the antenna, the generator 70 supplies current to the motor 10 as follows: the positive terminal 77, terminal 78, switch blade 79, lead 80, through the motor 10, lead 81, switch blade 82, terminal 83, switch arm

32 (which would then be closed), field winding 72, to negative terminal 84 of the generator 70. The motor 10 would operate until the antenna was reeled up, at which time the motor would automatically stop, due to the opening of switch 32.

When the switch 76 is moved to the position to lower the antenna, the generator 70 supplies current over lead 77, switch blade 82, lead 81, through the armature of motor 10, lead 80, switch blade 79, lead 85, the automatic switch 33, field winding 72, to the negative terminal 84. The motor 10 is supplied with current until the antenna is reeled out, at which time the automatic switch opens the circuit of the motor by opening the switch 33. The motor automatically stops at the proper time, and when the automatic switch has opened the plate 33, the plate 32 is held closed by means of the spring 42, so that the motor circuit will be completed when the switch is moved to the "up" position.

When the switch 76 is in position for lowering the antenna, the terminals 73, 74 and 75 are energized as follows: The generator 70 supplies current over the lead 77, through the switch blade 86 to the terminal 74 of the sending set. The generator 71 which is a 500-volt machine is connected to the terminal 73 of the set over the lead 87, blade 76, and the lead 88. The negative terminals of both of the generators are connected to the lead 84, which is connected to the terminal 75 of the set.

The motor 10 is of that type of small power motor which has a speed limit of a definite and fixed value which will consequently limit the speed of reeling or unreeling to a definite fixed value as determined by the speed reduction of the worm gear. The speed of unreeling will not be increased by increased pull upon the reel by the partly unreeled antenna because of the fact that the connection is through a worm gear. Furthermore, when either of the switches 32 or 33 are operated to stop either the action of reeling or unreeling, the motor does not come to rest instantly, but owing to the inertia of its armature and shaft, gradually comes to rest as the stored up energy is lost through friction. This checks the antenna gradually. When the motor is stopped in the normal way by action of the switches 32 and 33, no sudden stoppage of the antenna will occur.

While the antenna and means for operating the same are shown as applied to an aeroplane as in Fig. 7, it is obvious that the invention or certain features thereof may be used in other aerial vessels or elsewhere if desired. Novel features inherent in the invention are defined in the appended claims.

What is claimed is:

1. The combination with an aerial vessel of an antenna therefor adapted to be projected from and drawn back to said aerial vessel, a motor for controlling the projected length of said antenna, and means including the reel and operating means therefor supplementary to said motor for controlling the projected length of said antenna, said antenna being insulated from the operating means for said reel.

2. The combination with an aerial vessel of an antenna therefor adapted to be reeled in or out, a motor for reeling said antenna, an automatic switch for controlling the extent of rotation of said motor, and auxiliary means under the control of the operator for reeling said antenna in case said motor fails to operate.

3. The combination of an antenna, a reel therefor, a motor for operating said reel, a limit-switch controlled by said motor for determining the "up" and "down" positions of said antenna, electrical mains, a generator adapted to energize said motor and said mains, and a switch for connecting said generator either to said mains and said motor for "down" operation or to said motor for "up" operation.

4. The combination of a signaling system with a generator, mains for connecting said generator and said system at times, a motor for controlling the operative condition of an element of said system, and a two-way switch adapted in both closed positions to connect said generator to said motor and adapted in one only of said positions to connect said generator to said mains.

5. In a signaling system, an element adapted to be moved back and forth between an operative and an inoperative position, a reel for so moving said element, a motor for operating said reel, a limit switch adapted to be controlled by said motor, and means for operating said reel and said limit-switch independently of said motor.

6. In a signaling system, an element adapted to be moved from one position to another and conversely, a reel for so moving said element, a motor, means for detachably coupling said motor to said reel, supplementary means for operating said reel, and means controlled by said supplementary means for uncoupling said motor from said reel.

7. In a signaling system, a signaling conductor, means for extending and retracting said conductor comprising a reel, a motor for operating said reel, means for detachably coupling said motor to said reel, a limit-switch adapted to be controlled by said motor, supplementary means for operating said reel and said switch, and means controlled by said supplementary means for uncoupling said motor from said reel.

8. The combination of an aerial vessel,

an antenna therefor adapted to be reeled in or out, a motor for reeling said antenna, a worm-gear operatively connecting said motor and said antenna, and means for automatically stopping said motor at desired limits of travel of said antenna.

9. A signaling system comprising an antenna, a reel for said antenna, a motor for operating said reel, a limit switch controlled by said motor, means for supplying current to said motor, and means for completely insulating the frame of said motor from said antenna and said reel.

10. In combination, an aerial vessel, a signaling system for communicating with or from said vessel, said system comprising a signaling conductor, retracting and extending means for said conductor, a power operated device for operating said means, and a common source of electrical energy for operating said means and furnishing energy to said system for the operation thereof.

11. In combination, a movable structure, a communicating system mounted thereon including a signaling conductor, extending and retracting means for said conductor, power operated means for operating said first mentioned means, and automatically acting means for causing gradual cessation of action of said power operated means when said signaling conductor has been sufficiently retracted or extended.

12. In combination with a signaling system, a source of power for signaling, a signaling conductor, extending means therefor, mains for connecting said source to said system, and common movable means whereby said source may be connected to said system and whereby said extending means may be operated.

13. The combination of means for use in signaling systems comprising a power device for adjusting a signaling conductor, means for limiting the extent of such adjustment, and auxiliary means for adjusting said conductor, said auxiliary means being operative without disturbing the relation existing between said power device and said limiting means.

14. In combination, an aerial vessel, an antenna, means for extending and retracting said antenna comprising a series motor and means for transferring motion from said motor to said antenna, but not reversely, whereby the inherent speed limiting characteristic of the motor limits the speed of delivery of the antenna.

15. In combination, an aerial vessel, a reel mounted thereon, a weighted antenna adapted to be extended from and retracted to said vessel by being unwound from and wound upon said reel, and an organization of mechanism including means for driving said reel and for automatically limiting the speed of unwinding of said antenna.

16. In combination, an aerial vessel, a reel mounted thereon, an antenna adapted to be extended from and retracted to said vessel by being unwound from and wound upon the said reel, and means independent of the pull exerted by said antenna upon said reel for regulating the unwinding speed of said reel.

17. In combination, an aerial vessel, a reel mounted thereon, an antenna, and an organization of mechanism comprising means for extending said antenna from and retracting it to said vessel by unwinding it from and winding it upon said reel and for limiting the speed at which said reel may be rotated.

18. In combination, an aerial vessel, a rotatable member, an antenna, and an organized mechanism comprising means for extending said antenna from and retracting it to said vessel by winding it upon said member and for limiting the speed and gradually checking the extension of said antenna when it is extended to the desired amount.

19. In combination, an aerial vessel, a reel mounted thereon, operating means for said reel, and means combining said reel therewith whereby when said antenna is being delivered at a certain desired speed increased pull on said antenna is ineffective to increase the speed of delivery thereof.

20. The combination of an aerial vessel with an antenna, a reel upon which said antenna is to be wound, driving means for said reel and coupling means connecting said reel and driving means whereby said driving means drives said reel but whereby power applied to said reel cannot drive said driving means.

21. An aerial vessel, an elongated metallic conductor adapted to be extended from said vessel to constitute an antenna system, and mechanism for extending and retracting said conductor from and to said vessel, said mechanism including speed-limiting means acting to limit the operating speed of said mechanism.

22. An aerial vessel, an antenna, and an organization of mechanism including retracting and extending means for said antenna mounted on said vessel, automatically-acting means to limit the distance of extension of said antenna and gradually check the extension of said antenna.

23. The combination of an aerial vessel; a reel mounted thereon; a flexible member having one end connected to the reel; a weight on the other end of said member; and means for automatically limiting the speed of delivery of the flexible member from the reel to a predetermined value.

24. In combination, an aerial vessel,

mechanism mounted thereon including rotatable antenna retaining means, antenna extending means operable to cause the extension of said antenna from said retaining means and comprising an organization of mechanism for limiting the speed of delivery of said antenna to a predetermined maximum velocity.

In witness whereof, we hereunto subscribe our names this 5th day of July A. D., 1917.

WILLIAM T. BOOTH.
WALTER A. BOYD.