

Sept. 12, 1950

D. I. McKEE ET AL
PRESET FOR ANTENNA WIRE

2,521,737

Filed July 8, 1944

6 Sheets-Sheet 1

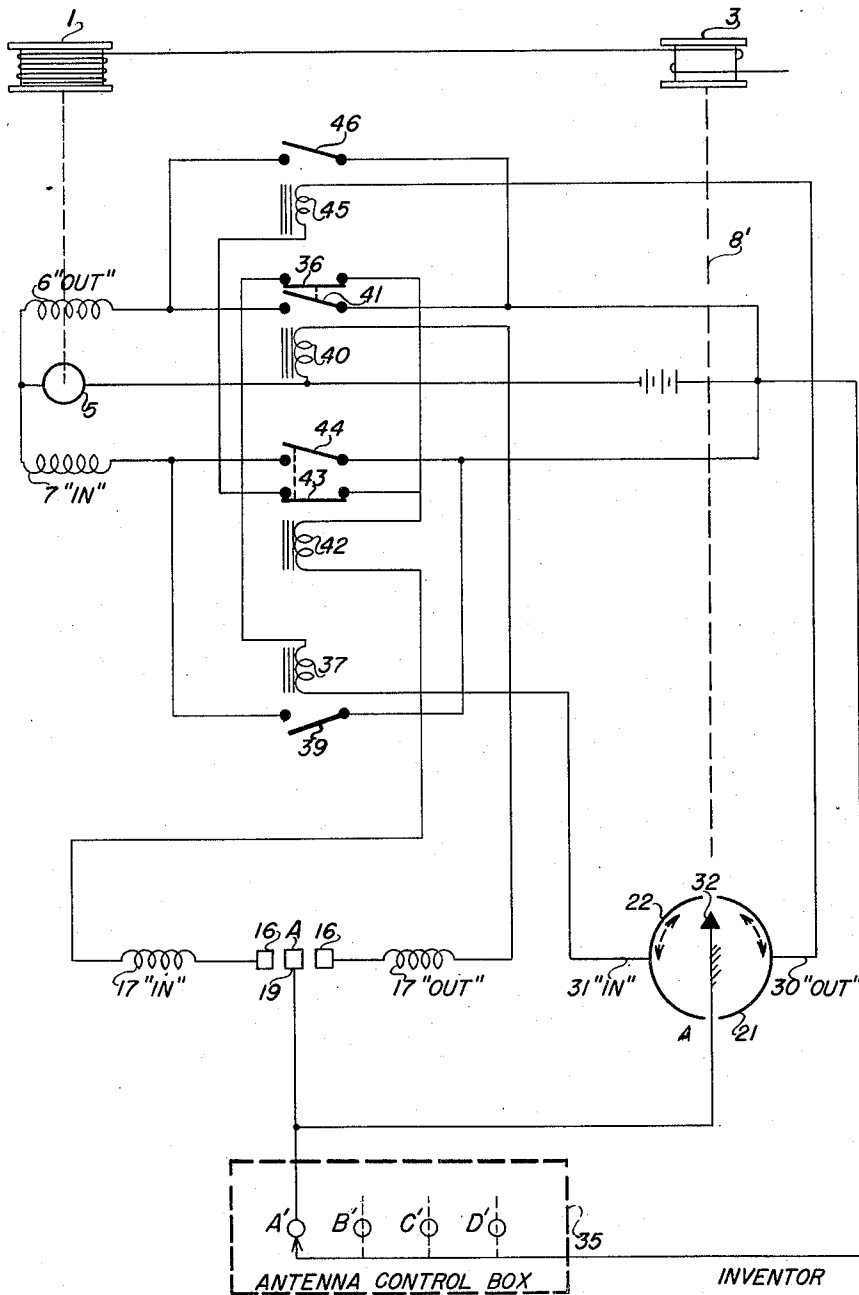


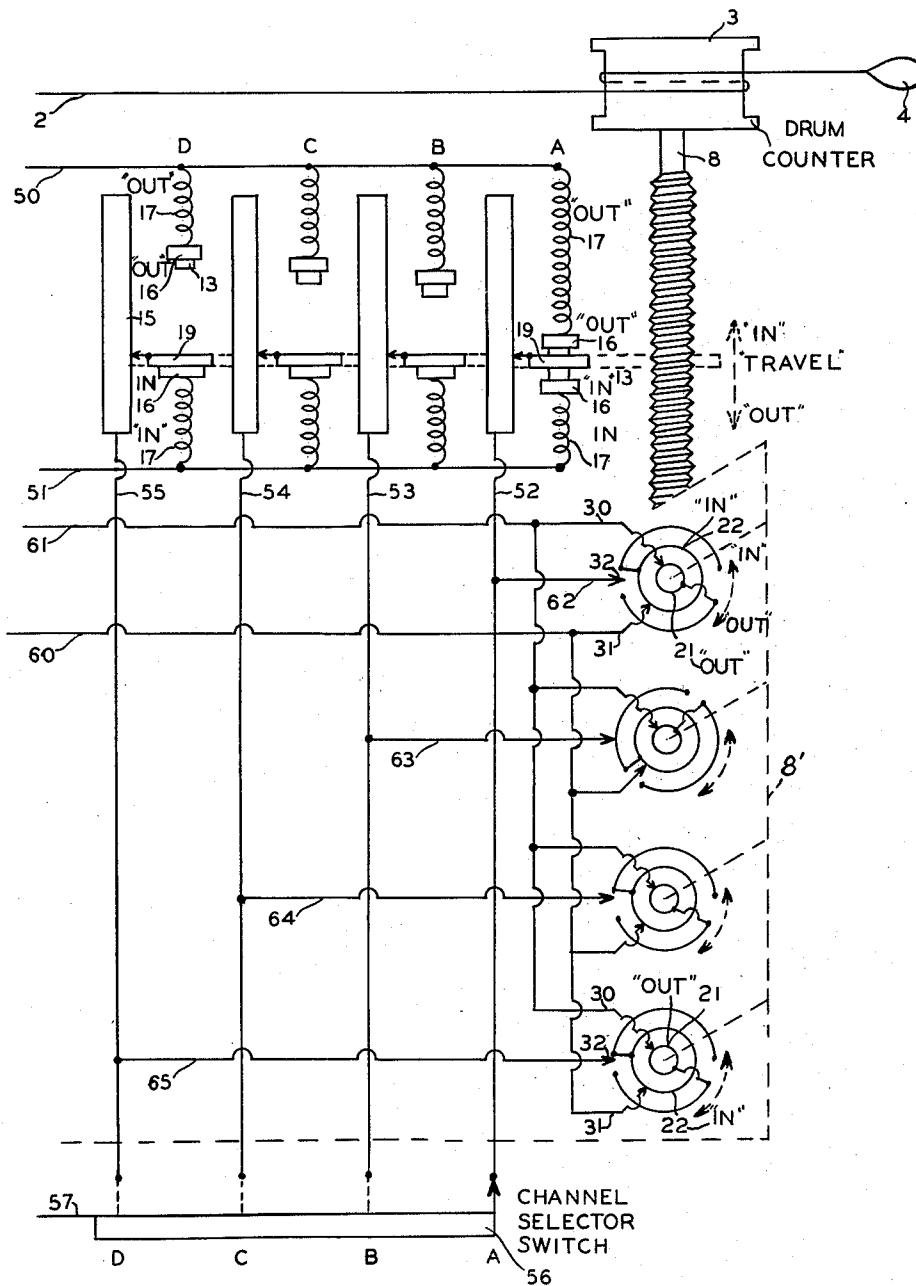
FIG 1

INVENTOR
ROBERT E. KESTER
HENRY R. SMITH
DWIGHT I. McKEE
By *William D. Hall*
ATTORNEY

D. I. McKEE ET AL
PRESET FOR ANTENNA WIRE

6 Sheets-Sheet 2

6 Sheets-Sheet 2



INVENTOR.
ROBERT E. KESTER
HENRY R. SMITH
DWIGHT I. MCKEE

By William D. Hall
ATTORNEY

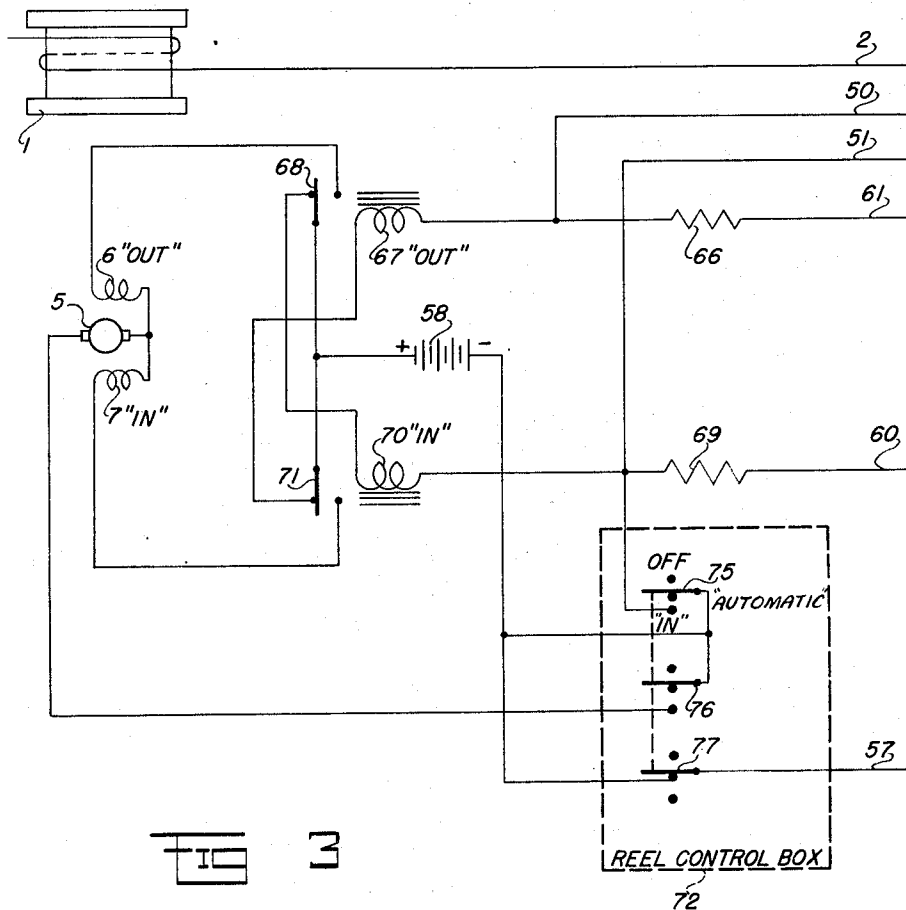
Sept. 12, 1950

D. I. MCKEE ET AL
PRESET FOR ANTENNA WIRE

2,521,737

Filed July 8, 1944

6 Sheets-Sheet 3



INVENTOR

ROBERT E. KESTER

DWIGHT I. MCKEE

HENRY R. SMITH

By *William S. Hall*
ATTORNEY

Sept. 12, 1950

D. I. McKEE ET AL
PRESET FOR ANTENNA WIRE

2,521,737

Filed July 8, 1944

6 Sheets-Sheet 4

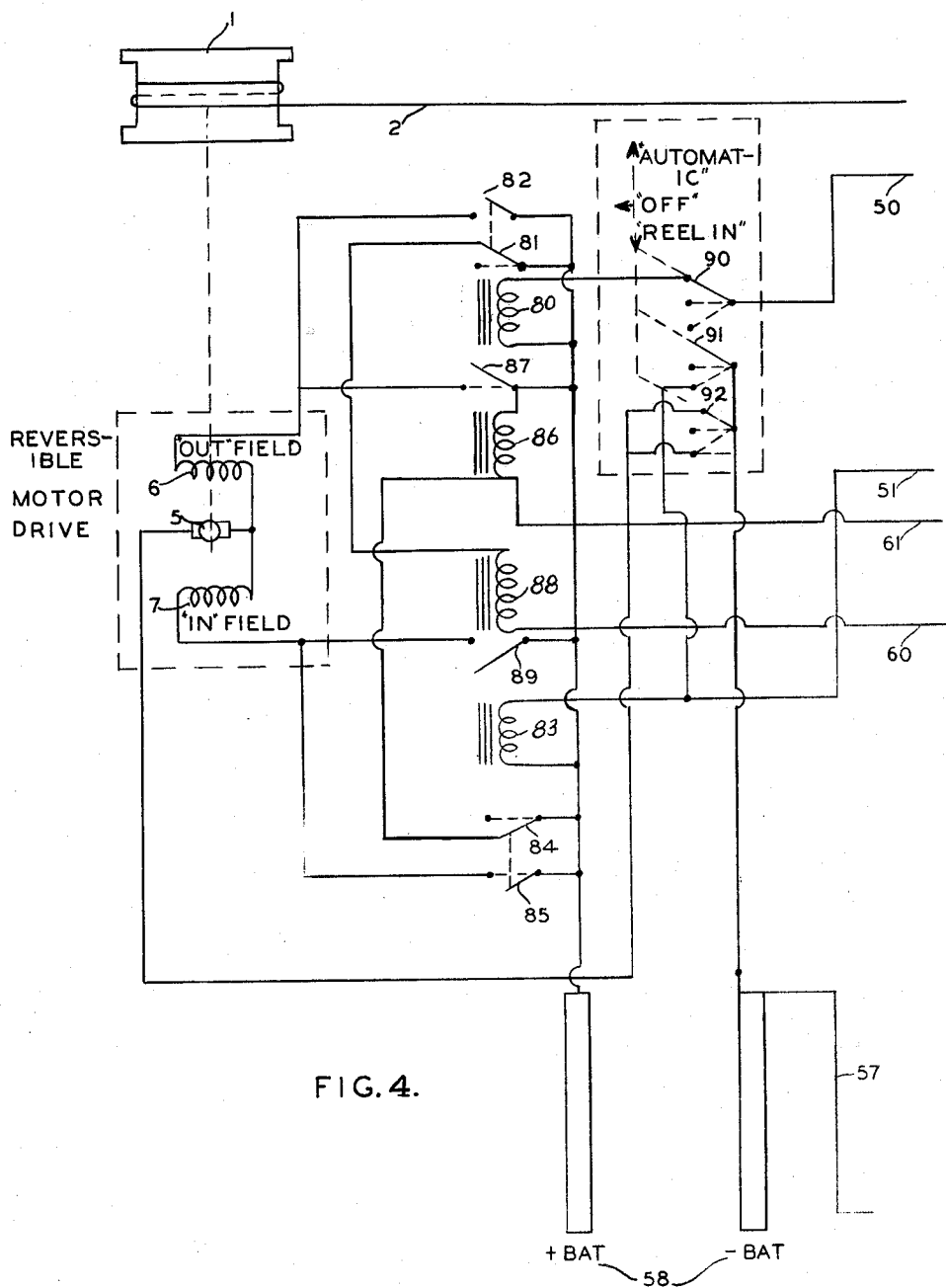


FIG. 4.

BY

INVENTOR.
ROBERT E. KESTER
HENRY R. SMITH
DWIGHT I. McKEE
By *William D. Hall*
ATTORNEY

Sept. 12, 1950

D. I. MCKEE ET AL
PRESET FOR ANTENNA WIRE

2,521,737

Filed July 8, 1944

6 Sheets-Sheet 5

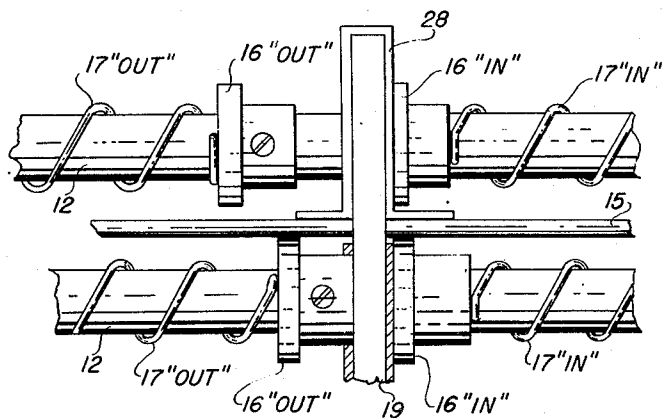


Fig. 7

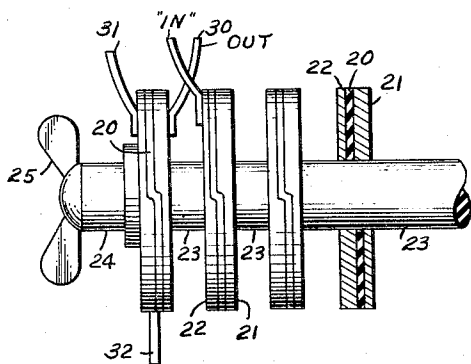


Fig. 5

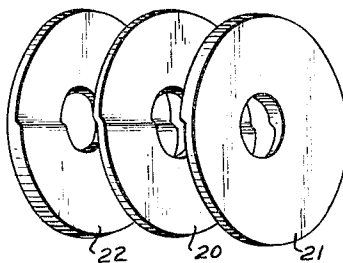


Fig. 5A

INVENTOR
ROBERT E. KESTER
HENRY R. SMITH
DWIGHT I. MCKEE
By: William D. Hall
ATTORNEY

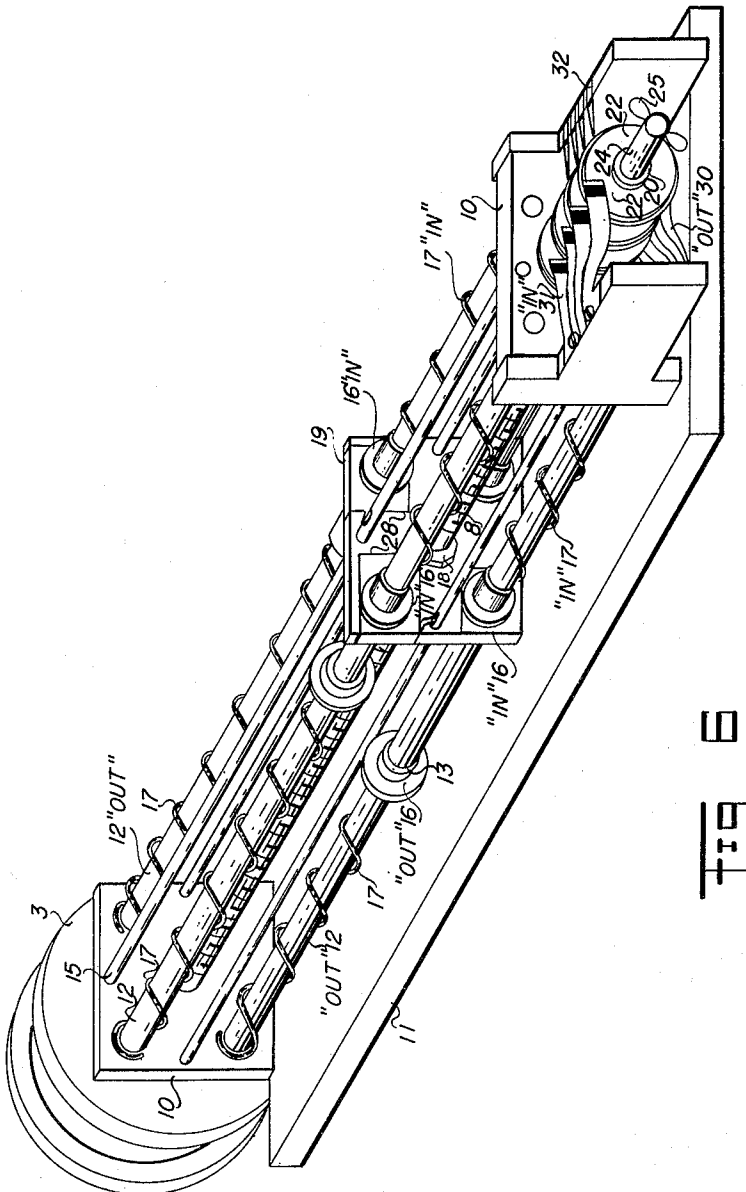
Sept. 12, 1950

D. I. MCKEE ET AL
PRESET FOR ANTENNA WIRE

2,521,737

Filed July 8, 1944

6 Sheets-Sheet 6



6
12

INVENTOR
ROBERT E. KESTER
HENRY R. SMITH
DWIGHT I. MCKEE
By *William D. Hall*
ATTORNEY

UNITED STATES PATENT OFFICE

2,521,737

PRESET FOR ANTENNA WIRE

Dwight I. McKee, Robert E. Kester, and
Henry R. Smith, Dayton, Ohio

Application July 8, 1944, Serial No. 544,126

2 Claims. (Cl. 33—136)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to airborne radio antenna equipment and more particularly to a preset radio antenna paying-out and reeling-in mechanism and system.

Airborne radio antennas at the present time are customarily released by use of a hand-operated switch on a reel control box bearing the indications "out," "in," and "off." The reel control box may be equipped with an indicating device informing the operator of the length of antenna wire that is reeled out. For optimum reception, the length of the released antenna wire should bear an accurate relation to the wavelength of the electrical impulses that are transmitted and received.

The older forms of antenna-length indicating devices have operated in units of revolutions of the antenna spool. Where many layers of antenna wire are superimposed upon an antenna spool, the first layer is of considerably less length than the last layer of wire upon the spool. The errors in this older method of computation of the length of released antenna wire, where the computation is on the basis of number of revolutions of the antenna spool, vary directly with the number of spool revolutions.

The objects of the present invention include the provision of a device for accurately controlling the length of the antenna wire that is unreeled from a plane in flight, so that this length may bear a definite optimum relation to the wavelength of the radio message-bearing electrical impulses that it is to transmit or receive; an improved device for reeling out and taking in antennas from airborne equipment, automatically or by manual control, as preferred; and an improved antenna release that is adapted to be pre-adjusted so that a plurality of predetermined lengths of antenna wire, capable of optimum signal transmission or reception, can be depended upon.

With the above and other objects in view which will be apparent to those who are informed about and are familiar with the problems and limitations in the field of airborne antennas and the like, suitable illustrative embodiments of the present invention in the forms of circuit diagrams illustrating the electrical connections for an assembly are shown in the accompanying drawings wherein:

Fig. 1 is a simplified circuit diagram limited

2

to one channel member and vernier assembly of one form of the present invention;

Fig. 2 is a detailed circuit diagram of a multiple channel and vernier assembly common to the several illustrated forms of the invention;

Fig. 3 is a circuit diagram of a further form of a motor, relay and switch part of a circuit that supplements the part of the circuit that is shown in Fig. 2;

Fig. 4 is a circuit diagram of another form of motor, relay and switch part of the circuit that supplements the part of the circuit shown in Fig. 2;

Fig. 5 is an enlarged fragmentary plan view of the vernier portion of a mechanism that is shown in Fig. 6;

Fig. 5A is an exploded view of the disk shown in Fig. 5;

Fig. 6 is a perspective view of an illustrative antenna preset mechanism part of the present invention;

Fig. 7 is an enlarged fragmentary representative elevation of the mid-portion of the mechanism that is shown in Fig. 6.

Referring to the drawings, a motor-driven antenna reel 1 (Fig. 3) has an antenna wire 2 wound thereon with one or more loops of equal length passing over a wire driven, length-indicating drum 3 (Fig. 2) and from the drum 3 through a fairlead (not shown) to a stop (not shown) that engages an antenna weight 4 that is attached to the free end of the antenna wire 2, which serves to hold the antenna wire 2 taut when suspended in the slipstream from a plane. A motor rotor 5 is part of a motor that has split field coils, as an "out" field coil 6, and an "in" field coil 7, so that the rotor 5 operates in reverse direction for reeling the antenna out or in with change in the energization of its field coils. The rotation of the motor rotor 5 both feeds out and reels in the antenna wire 2.

The energization of the motor outfield coil 6 pays out the antenna wire 2 over the wire-measuring drum 3 that is gripped without slippage by the loop of antenna wire 2 that passes therearound due to the combined gravity and wind drag upon the antenna weight 4. The rotation of the drum 3, that preferably is a definite length, such as 12 inches, for example, in circumference, causes the rotation of an externally-threaded shaft 8, part of a channel-determining mechanism. The continuation of the shaft 8 and the assembly under its control are indicated by a dash line 8'.

The shaft 8 has its ends journalled in insulat-

ing end plates 10 that are mounted upon a supporting base 11, which end plates and base also support a plurality of insulating rods 12. Each insulating rod carries a collar 13, the adjustable position of which longitudinally of the insulating rods may be firmly established in any desired manner, as by the use of set screws or the like that thread radially of the collar 13 to engage the rods 12. The positions of the collars 13 on the rods 12 and adjustment of verniers to be described later determine the exposed lengths of antenna wire 2. In the device shown four different lengths of antenna wire 2 are provided for. A plurality of conducting rods 15 also extend between the end plates and parallel to the insulating rods 12 with their ends firmly mounted in the end plates 10.

One of a pair of flanged contacts 16 is disposed upon each side of each collar 13. The flanged contacts 16 are adapted to slide freely away from the collars 13 longitudinally of the insulating rods upon which they are mounted, against the yielding force of a pair of opposed spirally-wound conducting springs 17 that are also mounted in pairs upon each of the insulating rods.

An internally-threaded nut 18 makes threaded engagement with the shaft 8 and carries a contact plate 19 with it. The contact plate 19 is apertured to permit the free passage of the collars 13 therethrough but to engage the flanges on the contacts 16. Electrical conducting material 28 is disposed upon both sides of the contact plate 19. When the antenna wire 2 is completely reeled in, all four contacts 28 on plate 19 are in contact with the "out" contacts 16 and "out" springs 17.

When the antenna wire is being payed out over the measuring drum 3, the threaded shaft 8 is rotating and the contact plate 19 travels longitudinally of the channel mounting until an insulating collar 13 is encountered by one of the flanged contacts 16, causing that flanged contact to break connection with the contact plate 19. If plate 19 continues its motion the other flanged contact on the same insulating rod 12 will be engaged by the contact plate 19.

Each contact 28 carried by the contact plate 19 serves one pair of flanged contacts 16 upon one insulating rod, and continues in a pair of brushes that make wiping engagement against an adjacent one of the conducting rods 15.

A plurality of vernier contact discs are rotatably adjustably mounted upon an unthreaded end of the shaft 8 and rotate therewith. The vernier discs individually comprise an insulating plastic circular flat core 20 with two pieces of electrically-conducting plated or copper or brass sheet metal side plates 21 and 22, that are out of contact with each other, riveted upon the flat faces of the flat core 20, shown in Fig. 5. Segments continuing from the outer edges of the side plates 21 and 22 are bent to overlie the peripheral edges of the cores to provide electrically interrupted edge contacts for the vernier discs. The vernier cores make insulating engagement with the shaft 8. A plurality of insulating washers 23 are keyed to the shaft 8 against rotation but free to slide axially thereof. The washers serve to properly space the vernier discs from each other. An insulating cylinder 24 fits loosely upon the end of the shaft 8 and is adapted for being clamped against the outermost vernier disc, with or without an insulating washer 20 interposed therebetween, as preferred, by suitable

means, such as a thumbscrew 25 or the like, to clamp the vernier discs and washers tightly together in preadjusted positions which are retained while the device is in operation.

One set of brushes 30, that are connected to the "out" circuit, wipe against the vernier side plates 21. Another set of brushes 31, that are connected to the "in" circuit, wipe against the vernier side plates 22. A third set of brushes 32 are mounted to wipe against the peripheral edges of the vernier discs to alternately engage the segments of the side plates 21 and 22 that overlie the peripheries of the vernier cores during the rotation of the vernier discs as the shaft 8 is caused to rotate by the travel of the antenna wire 2. The sets of brushes 30, 31, and 32 are mounted to be rigid with respect to the end plates 10 and base 11.

Circuit wires are connected individually to the ends of the conducting rods 15, to the conducting springs 17, and to the ends of the sets of brushes 30, 31, and 32.

The simplified circuit that is shown in Fig. 1 of the accompanying drawing is limited to a single channel "A" and its vernier disc. A particular channel is selected by pressing a button or otherwise engaging a switch upon an antenna control box indicated by dash lines in Fig. 1 as comprising channel selecting buttons A', B', C', and D'.

The general scheme of operations comprises presetting the collars 13 on the rods 12. Each rod 12 may bear calibration marks, to indicate the position at which collar 13 is to be set to preselect the length of antenna wire 2 to be unreeled. The setting of each of the four collars 13 shown determines a length of antenna wire that can be unreeled. The depression of one of the four buttons A', B', C', or D' on the control box 35 determines which of the four lengths of antenna wire 2, as determined by the settings of the collars 13 on the rods 12, will then be unreeled. The depression of the control button A' applies positive potential through the contact 28 on plate 19, the initially engaged "out" contact 16, and "out" conducting spring 17, to the relay 40 to close the main "out" switch 41 and open the switch 36. Closing the switch 41 causes the motor rotor 5 to operate the antenna reel 1 in the "out" direction and feed out the antenna wire 2 over the wire driven drum 3. Vernier controlled "out" switch 46 is alternately opened and closed through the vernier "out" contact 21 that alternately contacts brush 32 as shaft 8 rotates and thereby energizes the relay 45, but has no additional effect. The main "in" switch 44 is normally open and remains so and vernier controlled "in" switch 39 is also normally open and remains so. Main "in" relay 37 is prevented from becoming energized by the open switch 36. When the antenna wire arrives at its predetermined length, the engagement between the "out" contact 16 and the contact 28 is broken, deenergizing the relay 40, opening switch 41 and closing switch 36. In this condition contact 28 is not in engagement with either "out" or "in" contact 16. Both main "out" and "in" switches 41 and 44 are open and both vernier relay circuit switches 36 and 43 are closed. The vernier "out" contact 21 maintains contact with brush 32 up to $\frac{1}{2}$ revolution after contact 28 leaves the "out" contact 16. The motor "out" field winding 6 is energized through switch 46 instead of switch 41 during the operating of the vernier. When contact 21 leaves brush 32, switch 46 opens and the reel 1 may stop

5

or be stopped before vernier contact 22 engages brush 32. Generally the motor will coast past this position through the operation of inertia. Accordingly the antenna will reel out more than is desired, shaft 8 will rotate so that vernier "in" contact 22 will make contact with brush 32. This will close switch 39 through the operation of relay 37 and the motor "in" field winding 7 will be energized and the antenna will be reeled in until brush 32 breaks contact with contact 22. Inertia may cause the antenna to reel out more than specified above so that contact 28 makes contact with the main "in" contact 16 and the main "in" conducting spring 17. Then the motor "in" field winding 7 is energized through switch 44 which is closed by operation of relay 42. Relay 42 opens switch 43 so that any contact between brush 32 and vernier "out" contact 21 will not have any effect. The antenna is reeled in until contact 28 is disengaged from "in" contact 16, relay 42 is deenergized, switch 44 is opened and switch 43 is closed. The vernier "in" contact 22 maintains contact with brush 32 up to $\frac{1}{2}$ revolution after contact 28 leaves "in" contact 16 and the motor "in" field winding 7 is energized through switch 39 instead of switch 44. The antenna will be reeled in until brush 32 breaks contact with vernier "in" contact 22. The relays and switches under the control of the main contacts and the vernier contacts operate in a braking manner on the reeling of the antenna and this damped oscillatory winding of the antenna in and out will continue until the system comes to rest with contact 28 between main "in" and "out" contacts 16, and similarly with vernier brush 32 out of contact with both vernier "in" and "out" contacts 21 and 22. In this position of the contacts both of the switches 39 and 46 are open, both of the main switches 41 and 44 are open, both of the motor field coils are deenergized and the predetermined length of the antenna wire 2 for the channel A is exposed.

In a similar manner the predetermined length of the antenna wire 2 under the control of the channel buttons B', C' or D' may be exposed. When a new setting of the antenna wire is to be made the corresponding channel button B', C' or D' is depressed. Since either the "in" or the "out" contact 16 of the new wire length selector circuit is in engagement with the contact 28, the main switches are closed as in the prior illustration and the selected length of antenna wire 2 is unreeled. One of the buttons A', B', C', or D' may be used for completely retracting the antenna wire 2 or a separate conventional circuit, not shown, between the antenna control box 35 and the motor field windings 6 and 7, may be used for this purpose. The engagement of the "out" flanged contact 16 with the contact plate 19 energizes the "out" relay 40. The energization of the "out" relay 40 closes an "out" motor switch 41 that energizes the "out" field 6 of a motor, causing the motor to reel out the antenna 2. The energization of the "out" relay 40 also opens a switch 36 that is ganged with the switch 41. The opening of the switch 36 prevents energization of the relay 37. Any contact between brush 32 and vernier "in" contact 22 with rotation of shaft 8 is prevented from having any effect.

The antenna wire 2 is reeled out from the reel 1 over the drum 3 which rotates the shaft 8. The rotation of the threaded shaft 8 causes the contact plate 19 to travel longitudinally of the shaft 8, and rotates the vernier discs on the end of

6

the shaft 8. The rotation of the vernier disc of the "A" channel alternately causes the engagement by the brush 32 of the "out" plate 21 and the "in" plate 22. When the "out" plate 21 contacts the brush 32, the solenoid 45 is energized to close the switch 46.

The contact plate 19 continuously maintains connection with an "out" flanged contact 16 as the contact plate 19 and contact 16 travel longitudinally of the insulation rod upon which the "out" contact 16 is slidably mounted, until the insulating collar 13 that is firmly mounted upon the insulating rod engages the "out" flanged contact 16 and holds it out of further engagement with the contact plate 19, deenergizing the "out" relay 40. When the vernier disc "in" plate 22 contacts the brush 32 during the rotation of the verniers and prior to the deenergization of the relay 40, no current flows because the switch 36 is open. The deenergization of the relay 40 permits the motor "out" switch 41 to open and the vernier "in" switch 36, that is ganged to the switch 41, to close by spring tension.

The contact between the "out" vernier plate 21 and the brush 32 energizes the relay 45 through the spring closed switch 43 to battery negative, which closes the switch 46. The closing of the switch 46 momentarily continues the energization of the motor "out" field 6 and the continued paying out of the antenna wire 2.

When the clutch and brake mechanism is not used, the "in" reeling action occurs. A usual clutch and brake mechanism may, if preferred, disengage the reel 1 from motor rotor 5 and brings the reel 1 to a stop in a fraction of one revolution before brush 32 is engaged by vernier "in" plate 22. When the relay 42 is energized by the continued rotation of the threaded shaft 8 until the "in" contact 16 engages the conductor on the plate 19. Then "in" motor switch 44 is closed and a vernier "out" switch 43 that is ganged therewith is opened. The closure of the switch 44 energizes the motor "in" field 7, causing the motor to reel in the antenna wire until contact 28 on plate 19 opens connection with "in" contact 16. When the switch 43 is open, it prevents relay 45 from being energized whenever, as shaft 8 rotates, there is a connection of brush 32 with the "out" plate 21 on the vernier. The switch 36, now being closed, permits current to flow through the relay 37, closing the switch 39, when the vernier "in" plate 22 engages the brush 32. The motion of the antenna wire 2 is arrested with a predetermined effectual length exposed when the clutch and brake mechanism is not utilized and when the vernier "out" plate 21 and the vernier "in" plate 22 stop rotating out of contact with the brush 32, which then rests upon an insulated area upon the periphery of the particular vernier disc involved. The predetermined length of the antenna wire 2 is then exposed from the aircraft for the sending or the receiving of signals and is determined by the positioning of the fixed collars 13 upon the insulation rods 12 and the adjustment of the verniers on the shaft 8. This apparatus has been found experimentally to be accurate to within three inches of the desired lengths, depending upon the accuracy of the adjustments made and the limitations of the apparatus. The equipment is adapted for one or a plurality of antenna lengths, as illustrated for the group of four antenna lengths that is shown and described herein.

In the battery of four channels that is shown in the accompanying drawings, a conductor 50

forms a common connection for the "out" ends of four "out" conducting springs 17. A conductor 51 provides common connection for the "in" ends of four "in" conducting springs 17. The conductors 52, 53, 54, and 55 individually connect the four conducting rods 15 to four terminals A, B, C, and D of a channel selector switch 56, any one of the terminals of which may be selectively connected by a common conductor 57 to the negative pole of a battery 58 shown in Fig. 3. A conductor 60 provides a common connection for a set of vernier "in" plate 22 brushes 31 that conform in number to the plurality of channels used, four in this instance. A conductor 61 provides a common connection for a set of vernier "out" plate 21 brushes 30 that conform in number with the number of channels used. A plurality of conductors 62, 63, 64, and 65 provide individual connections between the conductors 52, 53, 54, and 55 respectively, leading from the individual channel conducting rods 15, and the brushes 32 that individually wipe against the peripheries of the vernier discs carried by the shaft 8.

The motor and relay assembly that is shown in Fig. 3 of the accompanying drawings is supplementary to the channel and vernier assembly that is shown in Fig. 2. The conductor 50 from the "out" ends of the "out" springs 17 is joined with the conductor 61 from the brushes contacting the "out" plates 21 of the vernier between a voltage controlling resistor 66 and an "out" relay 67 that is adapted for operating a motor "out" field switch 68. The conductor 51 from the "in" ends of the "in" conducting springs 17 is joined with the conductor 60 between a voltage dropping resistor 69 and an "in" relay 70 that is adapted for operating a motor "in" field switch 71. The resistors 66 and 69 serve to prevent the action of one or the other of the relays 67 or 70 when the sense of the vernier action is opposed to the rough adjustment action. Voltage is supplied simultaneously to both relay coils 67 and 70 in this circumstance. To one relay coil the voltage is supplied directly from the battery 58 and to the other relay coil voltage is supplied through one of the resistors. The relay to which voltage is supplied directly will be energized. Conductor 51 is a direct connection to the plurality of "in" contact springs 17.

When the vernier action opposes the rough adjustment action initially, either the "out" relay winding 67 or the "in" relay winding 70 is energized, depending upon which one of the relays receives a sufficient voltage to trip it when the other relay receives an inadequate tripping voltage because of the series resistor 66 or 69. In the absence of resistors 66 and 69 the action in the circuits shown in Fig. 3, would be indeterminate.

As shown on the supplementary circuit diagrams in Figs. 2 and 3 of the drawings, assuming the antenna wire 2 to be in, and the A' button depressed, positive potential from the battery 58 may follow two paths through the switches 68 and 71 when these switches are in their normal spring controlled positions shown. Positive potential from the positive terminal of the battery 58 may pass through the switch 71 to "out" relay winding 67, through conductor 50, that by-passes resistor 66, to "out" conducting spring 17, "out" contact 16, contact 28 on plate 19, conducting rod 15, conductor 52, channel selector switch 56, and returned through conductor 57 to the negative terminal of the battery 58. This provides full battery voltage to the "out" relay winding 67, 75

opening the switch 68 to "in" relay coil 70 and connecting positive terminal of battery 58 to motor field 6, thereby applying full battery potential thereto. The other path is from the positive terminal of battery 58 through switch 68, "in" relay winding 70, resistor 69, conductor 60, vernier brush 31, to vernier "in" contact 22. The only time this circuit is complete to battery negative terminal is when vernier brush 32 engages vernier "in" contact 22. The circuit is then completed through conductor 52, channel selector switch 56, conductor 57 to negative battery terminal. As long as the circuit through the first path is closed the current in that path controls the operation of relay 67, but when the first circuit is open the second takes control. The resistances 66 and 69 are high enough to prevent operation of the relays by the vernier contacts when the vernier circuit is in opposition to the rough adjustment circuit but the resistances 66 and 69 are low enough to permit control of the relays by the vernier when the rough adjustment circuit is open. In general the lower voltage is applied to the unwanted side of the circuit. The vernier discs are adjusted by loosening the thumbscrew 25, adjusting the vernier discs on the shaft 8, and then securing the vernier discs in place by tightening the thumbscrew 25. The vernier discs, as shown in Fig. 2, are not in any predetermined positions.

The positive pole of the battery 58 is connected to the fixed terminal of the motor "out" field switch 68 and to the fixed terminal of the motor "in" field switch 71. The switches 68 and 71 are normally in the closed position shown. The negative pole of the battery 58 is connected to the fixed poles of the three position switches 75 and 76 and to the center contact of three-position switch 77, which switches are associated with the "off," "automatic" and "in" connections respectively, on a reel control box 72 that is indicated in dotted outline.

When the reel control box indicator is at the "off" position, the ganged switches 75, 76 and 77 are open or make no connections between the negative pole of the battery 58 and the motor rotor 5 or the "in" reeling relay 70 or the connection 57 to the automatic "in" and "out" reel control switching system shown in Fig. 2.

When the reel control box indicator is placed at the "in" position, the switch 75 connects the negative pole of the battery 58 with the conductors 51 and 60. This connection energizes the relay 70 to close the switch 71 toward the relay winding 70 and to energize the motor "in" field coil 7 and reel in the antenna wire. This connection to the conductor 51 applies negative potential to, or grounds the terminal ends of the "in" springs 17 and to the conductor 60 energizes or grounds the vernier "in" plates 22. The switch 76, that is ganged with the switch 75, joins the negative pole of the battery with the motor rotor 5. The switch 77, that also is ganged with the switch 75, is open or its connection between the negative pole of the battery 58 and the conductor 57 is broken.

When the reel control box indicator is placed at the "automatic" position, the switches 75, 76 and 77 are in the positions indicated in Fig. 3 of the drawings. In the "automatic" position the switch 75 is open, the switch 76 joins the motor rotor 5 with the negative pole of the battery 58. The switch 77 also applies negative potential through the conductor 57 and conductors 52, 53, 54 and 55 to the conducting rods 15 of the channels. In the "off" and "in" connections of the

switch 77, the connection 57 to the negative terminal of the battery 58 is interrupted. This connection to conductor 57, together with the connections of the positive pole of the battery 58 through the switch 68 and the relay 70 and through the conductor 60 to the "in" plates 22 of the vernier discs, sets up the automatic circuit through the channels and vernier. The positive pole of the battery 58 is also connected through the switch 71 and the relay 67 and through the conductor 61 to the "out" plates 21 of the vernier discs, further establishing the circuit through the channels and vernier. The mechanism so connected functions for obtaining a particular length of exposed antenna wire selected from the channels shown substantially as heretofore described for an individual length of antenna wire.

Another modification of the motor and relay assembly is shown in Fig. 4 of the accompanying drawing and is, like the preceding embodiments, supplementary to the channel and vernier assembly that is shown in Fig. 2. In this diagram the conductor 51 energizes the master relay 83 that operates the ganged switches 84 and 85. The conductor 51 energizes the vernier relay 86 that operates the switch 87. The conductor 60 energizes the vernier relay 88 that operates the switch 89. The positive pole of the battery 58 is connected to one terminal of the relays 80 and 83 and to the fixed terminals of the switches 81, 82, 84, 85, 87, and 89. The terminal of the relay 86 that is not connected to the conductor 51 is connected to a releasable contact of the switch 84. The polarity applied to the relay coils 86 and 88 may be reversed if desired in the control circuit. Releasable connections of the switches 82 and 87 are connected to the motor "out" field 6. Releasable connections of the switch 85 and of the switch 89 are connected to the motor "in" field 7. The rotor 5 of the motor is connected to the "in" and "automatic" poles of switch 32.

In operation, when the reel control box is set at "automatic" contact between the contact plate 19 and the "out" flanged contact 16 continues through the "out" spring 17, and conductor 50 to energize the relay 80. The energized relay 80 opens the switch 81, breaking connection with the "in" plates 22 of the vernier discs through the relay 88 and conductor 60, and closes the switch 82 that energizes the motor "out" field 6. The motor rotor 5 then functions to feed out the antenna wire 2 from the antenna reel 1 and over the drum 3.

The antenna wire 2 continues to be fed out until the travel of the contact plate 19 breaks its connection with the "out" flanged contact 16 which deenergizes the motor "out" field 6 and closes the switch 81. If the velocity of the drum 3 is sufficient to cause the contact plate 19 to engage the "in" flanged contact 16 for the selected channel determining the desired length of the antenna wire 2, the relay 83 is energized to open the switch 84 and to close the switch 85 which energizes the motor "in" field 7. The connections through the switches 87 and 89 to the motor field coils 6 and 7 and through the switches 81 and 84 to the vernier discs, adjust the antenna wire 2 to within a reasonable limit of its desired length, depending upon the accuracy of the positions of the collars 13 upon the insulating rods 12, the vernier adjustments, and the operative limitations of the devices.

In the modification shown in Fig. 4 a plurality of ganged manually-operated switches 90, 91 and 92, have been added. The suggested manual

switches comprise adjustments for "automatic," "off," and "reel in" settings. As shown in the Fig. 4 diagram, the fixed post of the switch 90 is connected with the conductor 50. The fixed posts of the switches 91 and 92 are connected to the negative post of the battery 58. The switch 90 has one movable contact adapted to be connected to the negative terminal of the relay 80 as shown, its other two connections being open. The switch 91 has one movable contact adapted to be connected to the conductor 51, its other two connections being open. The switch 92 has two movable contacts adapted to be connected to the motor rotor 5 and one connection that is open.

In operation, the ganged switches 90, 91 and 92 are changeable simultaneously from the "automatic" position shown in the circuit diagram to the indicated positions.

When in the "automatic" position, the switch 90 energizes the relay 80 from the "out" flanged contacts 16 when the latter are engaged to cause the antenna wire 2 to be reeled out. In the "automatic" position the switch 91 is open or not connected and the switch 92 connects the negative post of the battery 58 with the motor rotor 5. On these positions the length of the antenna wire 2 is adjusted automatically in the manner that has been previously described.

When in the "off" position, all of the switches 90, 91, and 92 are disconnected.

When in the "reel in" position, the switch 90 is disconnected; the switch 91 energizes the relay 83 to open the switch 84, and to close the switch 85 and to energize the motor "in" field 7 and reel in the antenna wire 2; and the switch 92 connects the motor rotor 5 to the negative post of the battery 58.

In common with the other motor relay circuits that are disclosed herein, this circuit serves to quickly and accurately adjust the length of an antenna wire to a desired plurality of predetermined lengths.

It will be understood that the devices and circuit diagrams that are disclosed herein and the individual parts thereof have been submitted for the purposes of illustrating and describing the present invention, and that various changes, substitutions, and modifications therein and the particular use cited, may be made without departing from the scope of the invention as defined by the appended claims.

What we claim is:

1. A radio antenna wire preset system comprising, in combination, an antenna wire, a rotatable antenna reel to which an attached end of said antenna wire is secured and upon which said antenna wire is wound, a motor having split field coils for reversing the direction of operation of the rotor part thereof and being coupled to said reel for winding or unwinding said antenna wire, an antenna weight secured to an unattached end of said antenna wire, an antenna wire regulating drum of known circumferential dimension interposed between said antenna reel and said antenna weight, a rotatable threaded shaft upon which said drum is non-rotatably mounted, a carriage plate having at least one electrical contact and being threadably mounted on said shaft to be controlled by the travel of said antenna wire through the operation of said shaft to be moved longitudinally along said shaft, a pair of vernier contacts adjustably mounted in opposed relationship upon said shaft to be rotated therewith for cooperating with said one contact in adjusting the exposed length of said antenna wire to a pre-

11

determined length, a pair of main contacts mounted at spaced points along said shaft in position to make connection with said one contact in accordance with the position of said carriage plate along said shaft, a plurality of first relay windings connected respectively between said one contact and one of said main contacts to be selectively energized by the engagement of said main contacts, a plurality of first switches arranged to be selectively controlled in their operation by said first relay windings and coupled to said field coils for controlling the paying out and the reeling of said antenna wire in accordance with the connection between said one contact and one of said main contacts, an additional contact mounted to make connection alternately with said vernier contacts, a plurality of second relay windings respectively connected between one of said vernier contacts and said additional contact to be selectively energized with the rotation of said shaft, a plurality of second switches connected respectively to said field coils and arranged to be controlled by said second relay windings for finely controlling the paying out and reeling in of said antenna wire, and conditioning means coupled between said first and second relays and switches to render said second relays and switches effective to control said motor only when said first relays and switches are ineffective.

2. A radio antenna wire exposed length adjusting mechanism, comprising in combination an antenna wire, an exposed antenna wire regulating drum around which one or more turns of the antenna wire is wound in non-slipping engagement, an externally threaded shaft mounted to be rotated by said drum, an adjustable mechanism operated by said shaft for controlling roughly the exposed length of antenna wire passing over said drum, said adjustable mechanism including a carriage plate having at least one electrical con-

12

tact and threadably mounted on said shaft to be moved longitudinally therealong with rotation of said shaft and a pair of main contacts mounted at spaced points along said shaft in position to make connections with said one contact, a vernier mechanism operated by said shaft for controlling finely the exposed length of antenna wire passing over said drum, said vernier mechanism including a pair of vernier contacts rotatably mounted in opposed relationship on said shaft and an additional contact mounted adjacent said shaft in position to be coupled alternately to said vernier contacts, an antenna carrying reel, a motor coupled to operate said reel and having split field coils for reversing the direction of operation of the rotor part thereof, a pair of first coupling means each between one of said split field coils and one of said main contacts for controlling the operation of said motor in accordance with the position of said carriage plate along said shaft, a pair of second coupling means each between one of said vernier contacts and one of said field coils for finely controlling the operation of said motor, and conditioning means coupled between said first and second coupling means for rendering said second coupling means effective only when said first coupling means is ineffective and said carriage plate is between said main contacts.

DWIGHT I. MCKEE.
ROBERT E. KESTER.
HENRY R. SMITH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,249,836	Lear	July 22, 1941
2,351,411	Doughty	June 13, 1944