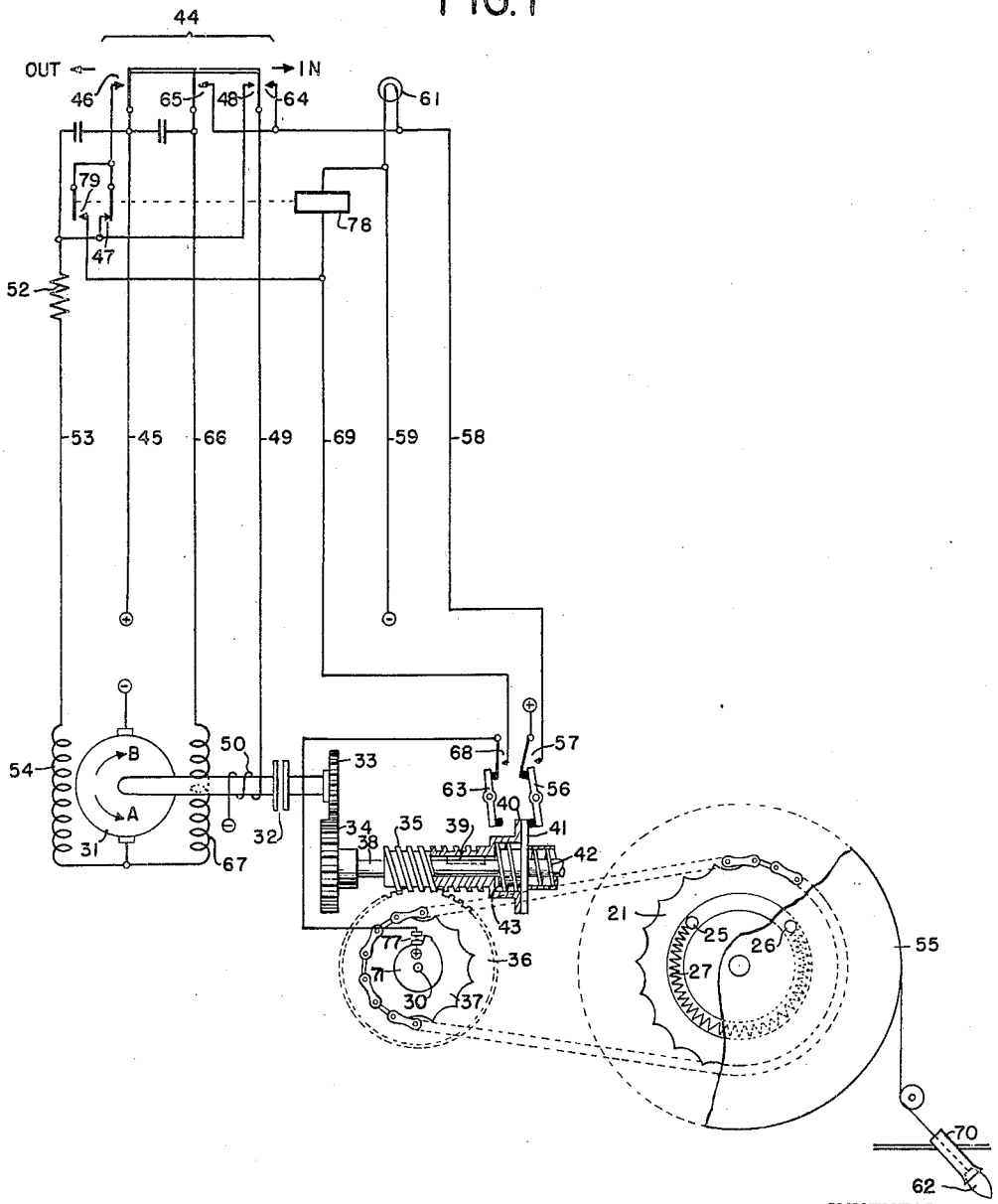
Feb. 7, 1950 E. S. PETERSON 2,496,890

REELING SYSTEM

Filed Oct. 3, 1945 2 Sheets-Sheet 1

FIG. 1



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REELING SYSTEM

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FIG. 2

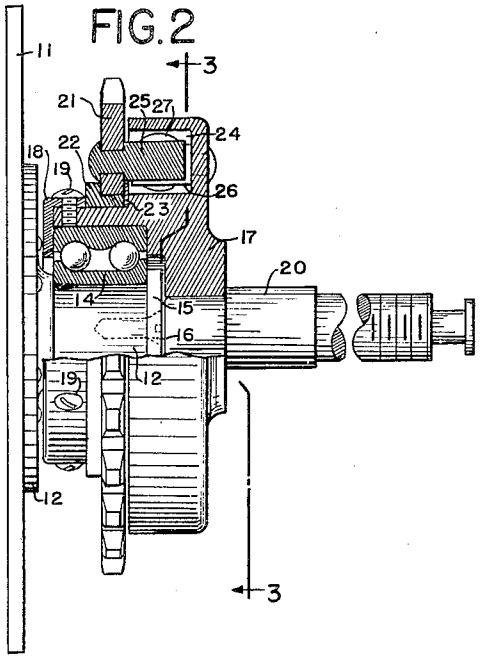


FIG. 3

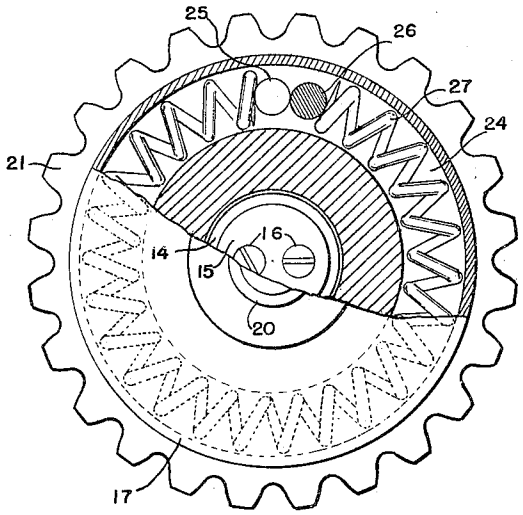


FIG. 5

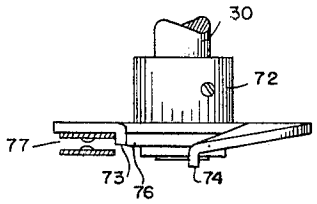


FIG. 4

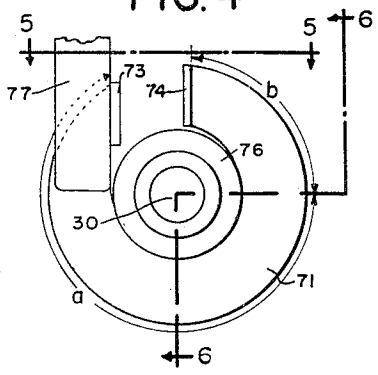
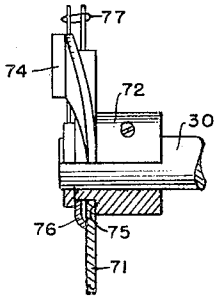


FIG. 6



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UNITED STATES PATENT OFFICE

2,496,890

REELING SYSTEM

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Application October 3, 1945, Serial No. 620,148

10 Claims. (Cl. 242—54)

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This invention relates in general to reeling systems and more particularly to remote control reeling arrangements for a trailing wire radio antenna of the type used in aircraft.

One such arrangement is disclosed in my prior United States Patent No. 2,374,892, issued May 1, 1945, on which the present invention is an improvement. In that patent, a motor driven reel situated anywhere in the aircraft could be controlled from a remote point, say by the pilot or radio operator, to extend or retract the antenna at will. It has been observed that under certain circumstances the act of bringing the reel to a halt imposes a strain both upon the antenna wire and upon the reeling mechanism; one of the objects of the present invention therefore is to provide a resilient member for reducing such strains, thereby to overcome any tendency of the antenna wire to break under the circumstances noted, as well as to cushion the shock which halting the antenna otherwise would impose upon the reeling mechanism. In keeping with this object, a novel yieldable coupling is provided between the reel and the mechanism which rotates the reel, this coupling permitting the reel to halt either before or after the driving mechanism comes to rest, as the circumstances require.

As in my prior patent, arrangements are provided for halting the reel automatically under certain abnormal conditions. It has been found these conditions are simulated momentarily whenever the driving mechanism is rendered operative to begin reeling out the antenna, and accordingly another object of the invention is to insure that the reel is not halted under the latter circumstances. For this purpose a novel slip cam is provided which is effective, during the transient conditions attending the starting of the reel, to prevent the reel from being halted due to the similarity of those conditions to the abnormal conditions under which it is desired to have the reel halted automatically.

Other objects and features will be apparent from the following description of one embodiment of the invention, reference being made to the accompanying drawings, in which

Fig. 1 is a schematic illustration of an antenna reel embodying the invention, together with the circuit connections for controlling same,

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Fig. 2 is a view partly in cross section showing the spindle on which the reel is mounted, and the sprocket and spring connection by which the reel is driven,

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2, part of the member 17 being cut away for purposes of illustration,

Fig. 4 is a front elevation of a preferred form of the slip cam according to the invention, and

Figs. 5 and 6 are views partly in cross section taken along the lines 5—5 and 6—6, respectively, of Fig. 4.

Referring first to Figs. 2 and 3, the arrangement for supporting the reel comprises a base plate 11, to which a flanged bearing post 12 is rigidly affixed by screws or rivets. This bearing post supports a bearing 14, the inner race of which is clamped tightly to the post by a washer 15 and two screws 16. The outer bearing race fits into a suitable recess in the member 17, and is held in place by a circular bearing cup 18 which is secured to the member 17 by screws 19. Rigidly affixed to member 17 is a spindle 20 upon which the antenna reel (not shown) is adapted to be mounted so that it will rotate with member 17.

A sprocket 21 is provided which is rotatable with respect to member 17, being prevented from axial movement, however, by a retaining ring 22 and a spacing washer 23. This sprocket covers an annular recess 24 in member 17. A pin 25 affixed to the sprocket, and a similar pin 26 affixed to member 17 extend into this recess, and are normally urged together as shown in Fig. 3 by a compressed helical spring 27.

The arrangement for rotating sprocket 21 thereby to turn the reel mounted on spindle 20 is shown schematically in Fig. 1. This comprises a reversible, series-wound, direct current motor 31 and an associated electromagnetic clutch 32. When the clutch is engaged, the motor will rotate gear 33 and pinion 34 thus to turn worm 35; worm 35 rotates worm wheel 36, which turns a sprocket 37 mounted on the same shaft as the worm wheel and consequently rotates sprocket 21 via the chain shown.

It will be noted that the worm 35 is splined to shaft 38 so that it is free to slide in an endwise direction thereon although the key 39 prevents it from rotating with respect to the shaft. On one

end of the worm and integral therewith is an "out limit" disc 40, an "in limit" disc 41 being slidably mounted on shaft 38 adjacent to the same end of the worm. A helical spring 42 urges the "in limit" disc to the left, and a somewhat lighter helical spring 43 between the "in limit" disc and worm 35 urges the worm to the left. When the antenna is fully retracted, as shown, both springs are compressed, but they are unable to displace either disc to the left because to do so they would have to rotate worm wheel 36 in a counterclockwise direction, such rotation being prevented by the somewhat stronger spring 27 which tends to rotate the worm wheel in a clockwise direction.

In order to extend the antenna the operator simply moves switch key 44 to its "out" position, whereupon the following circuit is completed: positive battery, conductor 45, contacts 46, 47 and 48, conductor 49, the magnetic clutch winding 50 and negative battery. This causes clutch 32 to be engaged. At the same time a circuit is completed from positive battery over conductor 45, contacts 46 and 47, resistor 52, conductor 53, field winding 54 and motor 31 to negative battery, which causes the motor to begin turning in a direction indicated by arrow A. Since the clutch is operated, gear 33 begins to rotate with its top coming toward the observer, and accordingly pinion 34 (hence worm 35) rotates with its top going away from the observer.

When the worm rotates in this direction, it necessarily follows that one of two things must happen: Either the worm must begin to move to the left on shaft 38 (assuming that the worm wheel 36 remains stationary and acts as a rack for the rotating worm) or else worm wheel 36 must begin to turn in a clockwise direction (assuming that the rotating worm remains in its original position on shaft 38). Were it not for spring 27 urging the two sprockets and worm wheel 36 to rotate in a clockwise direction, it is clear that the worm would move to the left under the influence of spring 42. Spring 27 is stronger, however, and consequently worm wheel 36 and the two sprockets begin to turn in a clockwise direction, allowing spring 27 to expand. This movement continues, reel 55 remaining stationary, until the pin 25 carried by the sprocket comes into contact with pin 26.

At some point during the expansion of spring 27, the force which it exerts upon worm wheel 36 becomes smaller than the force which spring 42 exerts upon worm 35, and accordingly the rotating worm moves to the left followed by the "in limit" disc 41, until the hub of the "in limit" disc abuts against the end of key 39. This permits lever 56 to assume a vertical position, whereupon contact 57 completes an obvious circuit over conductors 58 and 59 for lighting lamp 61.

It will be noted that the weight 62 attached to the end of the antenna causes the latter to exert a tangential pull on reel 55 which tends to rotate the reel in a clockwise direction. As indicated above, the tension of springs 27 and 42 prevent the reel from turning during the initial rotation of worm 35, but with pins 25 and 26 engaging one another and with the "in limit" disc 41 abutting against key 39, thees two springs can no longer resist the tendency of the reel to rotate under the influence of weight 62. The reel therefore begins to turn in a clockwise direction, paying out the antenna.

The weight 62 is sufficiently heavy to turn the reel and the worm wheel normally at as high a

speed as the rotating worm will permit. In effect, then, the weighted antenna unreels itself, the worm functioning as a motor driven governor or escape device which merely controls the speed at which unreeling takes place. The tangential pull of the antenna is present throughout the whole time that the antenna is unreeling, and this force, transmitted to the worm through the worm wheel 36 urges the worm to the right, maintaining the "out limit" disc in contact with the "in limit" disc. The force is not sufficient to overpower spring 42, however, and therefore the hub of the "in limit" disc remains in contact with key 39, maintaining the two limit discs in a position equi-distant between levers 56 and 63.

It will be appreciated that the mass of the reel 55 and of the antenna wound thereon is so distributed as to give the reel considerable inertia, and that, accordingly, an appreciable interval will elapse before the weight 62 can accelerate the reel from a state of rest to its full speed. In the period immediately preceding the start of the reel's rotation (i. e., the period during which the spring 27 expands to take up the lost motion between sprocket 21 and the reel) motor 31 will have had time to reach substantially its full speed. The rapidly rotating worm 35 therefore will continue to move to the left along shaft 38 during the initial slow rotation of the reel, but as the reel gains speed the worm will be returned to the right until the "out limit" disc 40 reaches its aforesaid position intermediate between levers 56 and 63, where it remains throughout the balance of the unreeling process, as indicated above. This transient axial movement of the worm during the period that the reel is accelerating causes the "out limit" disc to engage and rotate lever 63, thereby momentarily closing contact 68, but this has no effect due to the fact that contact 77 is open at this time.

Preferably an indicator of the kind disclosed in my prior patent will be provided so that the operator may know at all times during the unreeling process just how much of the antenna has been payed out. When he wishes to halt the reel he needs only to restore switch key 44 to normal, thereby opening the motor circuit at contact 46 and opening the clutch circuit at contacts 46 and 48. Although the motor 31 may coast for a short interval after its circuit is interrupted, the rotation of shaft 38 is halted quickly due to a brake (not shown) associated with the driven element of clutch 32. This of course stops the rotation of worm 35, so that worm wheel 36 and sprockets 37 and 21 can rotate no further. Due to their inertia, reel 55 and weight 62 will come to a halt more gradually, the spring 27 being compressed momentarily whereby it serves to cushion the shock of stopping so that no undue strain is imposed either upon the antenna wire or upon the driving mechanism.

While the antenna is thus extended, it may be used in the conventional way for radio communication. When the operator is ready to reel the antenna in, he simply throws switch 44 to its "in" position and leaves it there, whereupon the positive battery connected to conductor 58 by contact 57 is extended over contact 64 and conductor 49 to operate the clutch 32 and is also extended over contact 65 and conductor 66 to energize field winding 67 and motor 31. Accordingly the motor begins to turn in the direction indicated by arrow B. Clutch 32 being operated, gear 33 begins

to rotate with its top going away from the observer, which causes pinion 34 and worm 35 to rotate with their tops coming toward the observer. This rotates wheel 36 and sprockets 37 and 21 in a counterclockwise direction. Through the medium of spring 27, sprocket 21 drives reel 55 in a counterclockwise direction, the spring compressing momentarily to absorb the initial strain of getting the reel into motion.

After a period, the weight 62 will be pulled into the mouth of the fairlead 70, and, being unable to advance into the constricted throat portion thereof, will prevent the reel from rotating farther. Sprocket 21 continues to rotate, however, and this compresses spring 27. As the spring is compressed, the load on worm wheel 36 increases until the rotating worm 35 finally finds it easier to move to the right along shaft 38 against the force of spring 42 than to compress spring 27 further. This causes the "in limit" disc 41 to engage and turn lever 56, opening contact 57, which thereupon halts motor 31, releases the magnetic clutch 32 and extinguishes lamp 61. The driving mechanism thus comes to rest with the various parts once more positioned as shown.

Attention now is directed to Figs. 4–6, inclusive, which show details of a cam member 71 which is designed to be mounted upon shaft 30 by means of a collar or hub 72 rigidly affixed to the shaft. Generally circular in shape, the cam has a flat portion *a* and a sloping portion *b*, which terminates respectively in the upturned lugs or ears 73 and 74. The cam is free to rotate with respect to the hub; it is held in frictional engagement with a shoulder 75 on the hub, however, by a spring washer 76, the end of the hub being spun or flared outwardly over the washer to hold it in place.

When shaft 30 rotates in a clockwise direction (Fig. 4) the cam 71 also will rotate until lug 74 catches on the end of one of the springs of the contact set 77. Then during the continued rotation of shaft 30 in a clockwise direction, the contact spring and lug 74 will hold cam 71 stationary. It will be noted that just before the cam comes to a halt, the sloping portion thereof (*b*) is effective to close contact 77. If the rotation of shaft 30 now is reversed cam 71 again will begin rotating therewith; first it will open contact 77 and then it will come to a halt as lug 73 catches on the side of the spring of contact set 77, as shown. In other words, the cam rotates with shaft 30 during approximately its first revolution in either direction, and remains stationary throughout the remaining rotation of the shaft. As a result of that first revolution, the cam either opens or closes contact 77 depending upon the direction of rotation, the contact being maintained as initially operated throughout the balance of the shaft's rotation.

The purpose of cam 71 and contact 77 now will be explained with reference to Fig. 1, wherein they are shown schematically. If switch 44 is moved to its "out" position while the aircraft is on the ground, reeling out will be initiated as hereinbefore described, and let it now be further observed that at or near the end of the first revolution of shaft 30 cam 71 will close contact 77.

When, in the course of unreeling, the weight 62 reaches the ground it obviously no longer tends to rotate the reel in a clockwise direction. This reduction in the antenna's tangential pull on the reel (which, transmitted to worm 35 through worm wheel 36, has thus far maintained spring 43 compressed) now permits spring 43 to cause the rotating worm to move to the left. Accordingly the "out limit" disc 40 engages lever 63 and rotates it to close contact 68, which completes the following circuit: positive battery, contacts 77 and 68, conductor 69, relay 78, conductor 59 and negative battery. Relay 78 operates, and at contact 79 completes a locking circuit for itself which extends over contact 46 to positive battery on conductor 45. At contact 47 the circuits for magnetic clutch 32 and motor 31 are opened whereupon the reel quickly comes to a halt, preventing the antenna from becoming tangled on the ground.

Similarly, if the antenna should, while unreeling, become snagged on some projecting part of the aircraft, or if the weight 62 should become detached from the antenna, there will not be sufficient clockwise rotational pull on the reel to keep spring 43 compressed. Under such circumstances, spring 43 will cause the rotating worm to move to the left along shaft 38 until the "out limit" disc 40, by closing contact 68, operates relay 78 and thereby halts the mechanism.

In fact it should be clear that if the rotational pull on the reel due to the drag of the antenna and weight 62 is reduced materially below its normal value for any reason whatever contact 68 will be closed. Actually, this condition is simulated whenever switch 44 is moved to its "out" position to initiate a reeling out operation, because, as pointed out previously, in the brief interval during which the reel is being accelerated from a standstill to its full speed the rotating worm 35 moves to the left on shaft 38 under the influence of spring 43, causing lever 63 momentarily to close contact 68.

This transient closing of contact 68 during the starting of the reel occurs before shaft 30 has completed three-quarters of a revolution, hence before cam 71 closes contact 77. By the time that contact 77 is closed by cam 71 as a result of the first revolution of shaft 30, the transient condition will have subsided and contact 68 will be open. In other words, by maintaining contact 77 open during the first three-quarters of a revolution of shaft 30, cam 71 insures that the driving mechanism will not be halted erroneously by the "out limit" disc 40; then the cam closes contact 77, making it possible for the "out limit" disc thereafter to halt the reeling out process automatically if the antenna's rotational pull on the reel is reduced materially below its normal value.

Having fully described my invention, what I believe to be new and desire to have protected by Letters Patent is set forth in the appended claims.

What is claimed is:

1. In an antenna reel mechanism, the combination with a reel for the antenna wire, of drive means for said reel comprising a reversible motor, a drive shaft, a worm splined on said shaft and slidable longitudinally thereof, a gear wheel meshing with said worm, and a yieldable spring through which the rotation of said wheel is transmitted to said reel; and means including said spring and a second spring acted upon by said worm for storing up energy under drive of the motor to retain the antenna under tension when in retracted position.

2. In an antenna reel mechanism, the combination with a reel for the antenna wire, of drive means for said reel comprising a reversible motor, an intermediate member, a lost motion driving connection between said motor and said intermediate member, and a second lost motion driving connection between said intermediate mem-

ber and said reel; and means including a spring in each lost motion connection for storing up energy under the drive of said motor to retain the antenna under tension when in retracted position.

3. In an antenna reel mechanism, the combination with a reel for the antenna wire, of drive means for said reel comprising a reversible motor, an intermediate member, a lost motion driving connection between said motor and said intermediate member, and a second lost motion driving connection between said intermediate member and said reel; means in each said connection for taking up at least part of the lost motion in that connection during the initial operation of said motor to reel out the antenna from a retracted position; an electrical contact operated variably by the take-up means in one of said lost motion connections in accordance with the torque imposed upon said reel by said antenna; a second electrical contact operated variably by said intermediate member; and a circuit for said motor controlled conjointly by said two contacts.

4. In a system for rotating a reel to wind and unwind a filamentous member, a reversible motor, an intermediate driving member, a lost motion connection between said motor and said intermediate member, a second lost motion connection between said intermediate member and said reel, whereby said reel is rotated by said motor through said two lost motion connections, an electrical contact operated by said intermediate member, and a circuit for said motor controlled by said contact.

5. In a system for rotating a reel to wind and unwind a filamentous member, a shaft, a reversible motor for rotating said shaft in either direction, a worm splined on said shaft and slidable longitudinally thereof, a gear meshing with said worm, means for transmitting a rotative force to said reel from said gear upon rotation of the latter, an electrical contact controlled by said worm in accordance with its longitudinal movement on said shaft, another electrical contact controlled by said gear in accordance with its rotation, and a circuit for said motor controlled by said two contacts.

6. In a system for rotating a reel to wind and unwind a filamentous member which is under tension due to a force applied to the free end thereof, a shaft, a reversible motor for rotating said shaft in either direction, a circuit for operating said motor, a worm splined on said shaft and slidable longitudinally thereof, a gear meshing with said worm, a connection between said gear and said reel whereby said gear causes said reel to rotate in a direction corresponding to the direction of rotation of said gear, means for sliding said worm longitudinally on said shaft responsive to a predetermined change in the force applied to the free end of said filamentous member, means thereupon operated by said worm for interrupting said motor circuit, and means for disabling said last means during a predetermined initial rotation of said reel in such a direction as to unwind said filamentous member.

7. In a system for rotating a reel to wind and unwind a filamentous member, a shaft, a reversible motor for rotating said shaft in either direction, a worm splined on said shaft and slidable longitudinally thereof, a gear meshing with said worm, a connection between said gear and said reel whereby said gear causes said reel to rotate in a direction corresponding to the direction of rotation of said gear, a cam, means so connecting

said cam with said gear that the cam moves with said gear during the initial rotation of said gear in either direction and then remains stationary during the ensuing rotation of said gear, an electrical contact operated by said cam during such movement thereof, a second electrical contact operated by said worm in accordance with its longitudinal movement on said shaft, and a circuit for said motor controlled by said two contacts.

8. In a system for rotating a reel to wind and unwind a filamentous member, a reversible motor, an intermediate driving member, a lost motion connection between said motor and said intermediate member, a second lost motion connection between said intermediate member and said reel, whereby said reel is rotated by said motor through said two lost motion connections, a cam, means so connecting said cam with said intermediate member that the cam moves with said intermediate member during the initial movement of said intermediate member in either direction and remains stationary during the ensuing movement of said intermediate member, an electrical contact operated by said cam after a predetermined movement thereof, and a circuit including said contact for controlling said motor.

9. In an antenna reel mechanism, the combination with a reel for the antenna wire, of drive means for said reel comprising a reversible motor, an intermediate member, a lost motion driving connection between said motor and said intermediate member, and a second lost motion driving connection between said intermediate member and said reel; means in each said connection for taking up at least part of the lost motion in that connection during the initial operation of said motor to reel out the antenna from a retracted position; an electrical contact operated variably by the take-up means in one of said lost motion connections in accordance with the torque imposed upon said reel by said antenna; a cam, means so connecting said cam with said intermediate member that the cam moves with said intermediate member during the initial movement of said intermediate member in either direction and remains stationary during the ensuing movement of said intermediate member, an electrical contact operated by said cam upon such movement thereof, and a circuit for said motor controlled conjointly by said two contacts.

10. In combination with a shaft which is rotatable in either direction, a washer-like member mounted on said shaft so that the major portion thereof is disposed in a plane perpendicular to the axis of said shaft, means frictionally coupling said member to said shaft so that it tends to rotate therewith, said washer-like member containing a substantially radial slot and having the portion on one side of said slot displaced slightly from said plane so that it forms an inclined continuation of said major portion of said member, a follower tensioned against one face of said member so that it is moved by said member, upon rotation, along a path substantially parallel to the axis of said shaft, an upturned lug on said major portion adjacent to said slot adapted to engage said follower after a certain rotation of said member in one direction thereby to prevent said member from rotating further with said shaft, and an upturned lug on said inclined portion adapted to engage said follower after a certain rotation of said member in the

opposite direction thereby to prevent said member from rotating further with said shaft.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
720,442	Keyser	Feb. 10, 1903
767,825	McIntyre	Aug. 16, 1904
931,327	Manzel	Aug. 17, 1909
1,213,698	Sharp et al.	Jan. 13, 1917
1,350,540	Blood	Aug. 24, 1920
1,457,711	Mikkelson	June 5, 1923
1,828,569	Kellogg	Oct. 20, 1931
2,178,482	List	Oct. 31, 1939
2,251,418	Pavlik	Aug. 5, 1941
2,286,173	Maxon	June 9, 1942
2,330,076	Ochsenbein	Sept. 21, 1943
2,374,892	Peterson	May 1, 1945

FOREIGN PATENTS

Number	Country	Date
702,134	Germany	Jan. 31, 1941