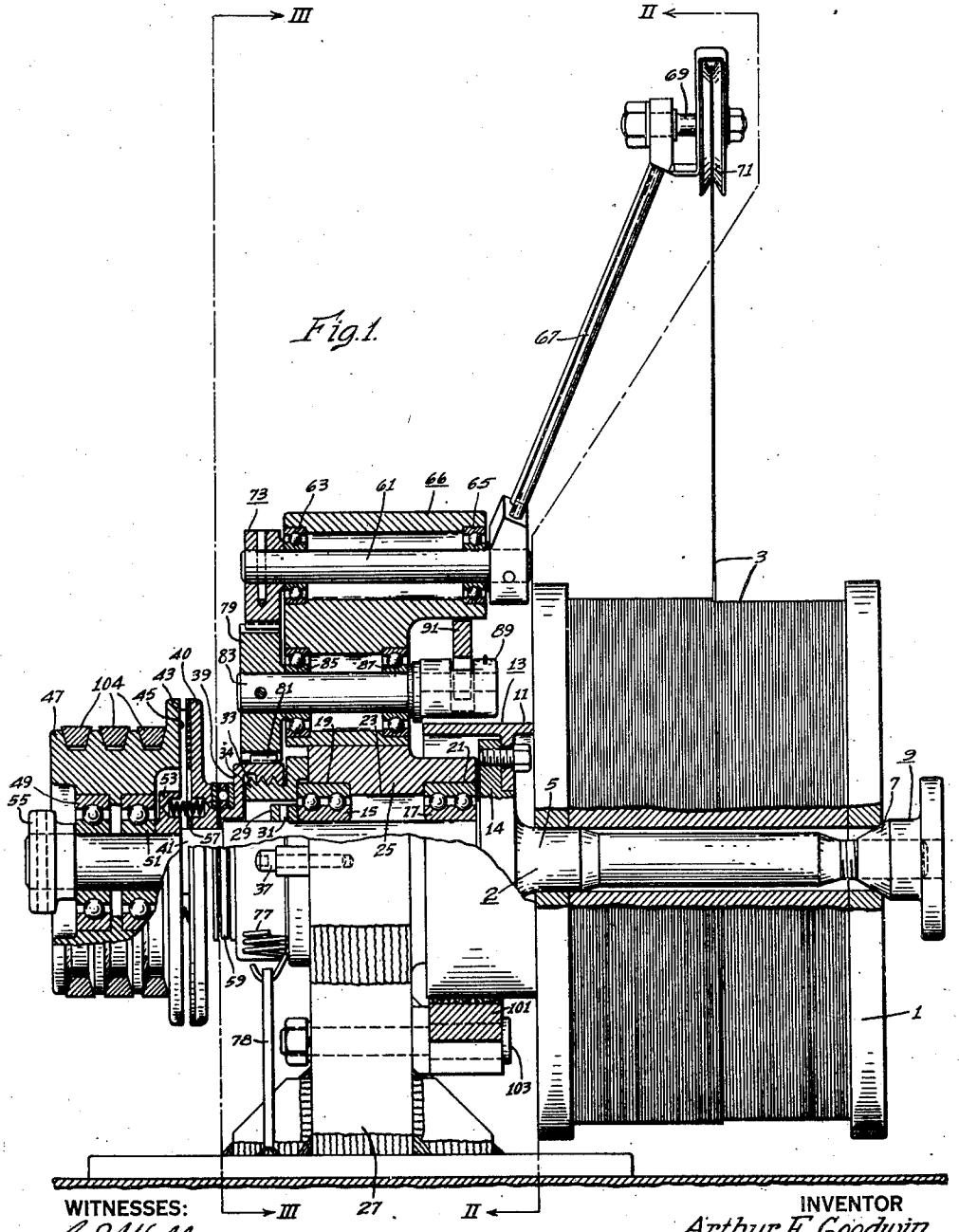
Oct. 24, 1944. A. E. GOODWIN 2,361,192

POWER DRIVE REELER

Filed Sept. 30, 1941 2 Sheets-Sheet 1

Fig. 1.



WITNESSES:

C. J. Weller.

Wm. J. Ruano

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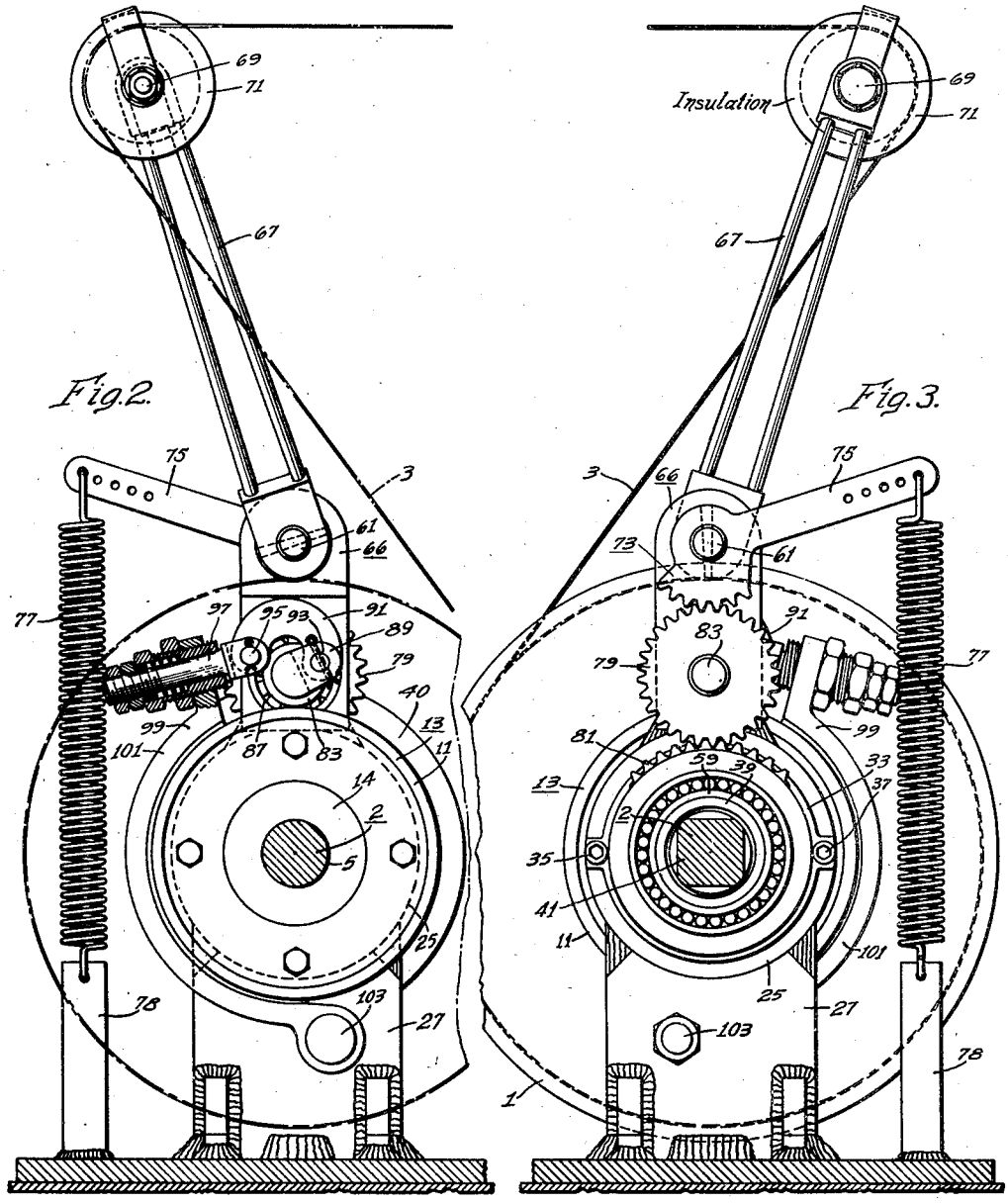

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UNITED STATES PATENT OFFICE

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POWER DRIVE REELER

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Application September 30, 1941, Serial No. 412,983

3 Claims. (Cl. 242—45)

My invention relates to unreeling or reeling devices; more specifically, and by way of example, my invention relates to unreeling apparatus employed in winding operations.

My invention is of general application and may be employed in any unreeling or reeling operation wherein material demand speeds are being continuously and rapidly accelerated and decelerated.

My invention is particularly adapted, however, to high speed winding or unwinding of light weight material having a wound shape of irregular form wherein wire demand speeds are rapidly changing in a high degree and the inertia of the spool and wire wound thereon require forces to be exerted by the wire which increase wire tension and resulting stresses therein to a value far in excess of the maximum allowable thereby tending to unduly stretch or break the wire.

An object of my invention is to provide a means for maintaining a predetermined tension on material being either reeled or unreeled from a spool or drum.

A more specific object of my invention is to provide a driving means for a spool or drum for unreeling or reeling wire, rope or any strip-like material, said driving means being responsive to slight tension variations of said material to accelerate or decelerate said spool or drum to effect a substantially uniform tension of said material.

A still more specific object of my invention is to provide a driving means for rotating a spool for reeling or unreeling wire, said driving means comprising adjustable tension means for maintaining a predetermining tension in said wire, said tension means being also responsive to slight variations in tension of said wire to effect acceleration or deceleration of said spool by the control of the pressure of engagement of a clutch and/or the braking pressure of a brake in said driving means to maintain within small limits the predetermined tension of said wire.

Further objects and advantages will become more apparent from a study of the following specification when considered in conjunction with the accompanying drawings, in which:

Figure 1 is a side view partly in section of my power drive reeler;

Fig. 2 is a sectional view taken on the line II—II of Fig. 1; and

Fig. 3 is a sectional view taken on the line III—III of Fig. 1.

In order that the benefits of my inventive power drive unreeler or reeler may be more readily understood and appreciated, a brief discussion of the difficulties in devices of the prior art which my invention overcomes is hereinafter made.

Previously it has been impractical in some winding operations to directly unreel wire or other material from a rotating spool or drum when the weight of the spool and material wound thereon required unwinding forces in excess of the tension required in the material. This condition exists especially at high speeds, for example, during winding of coils the wound shape or form of which is irregular wherein wire demand speed is rapidly accelerating and decelerating. It is obvious that the inertia of the spool will resist changes in acceleration, increasing the wire tension in excess of the maximum allowable, causing elongation or even breaking of the wire and at the same time damaging the wound product by imbedding turns of wire. During deceleration periods the inertia of the spool and wire will cause the spool to deliver wire in excess of the demand speed. From the foregoing it will be seen that the wound wire, assuming no wire breakage, will have unequal stresses therein due to the fluctuating wire tension, which may cause distortion upon removal of said wire from its form. In addition, cross-section dimensions may vary because of the stretch or elongation of the wire.

The spinner type for uncoiling wire from a stationary spool has been used extensively in prior art devices in many forms. It consists essentially of a light arm and eyelet through which the wire is uncoiled from the end of a stationary spool. This type due to the lightness of weight of the rotating arm and eyelet reduces the starting impact during acceleration and also prevents delivery of the wire in excess of demand speed; it also satisfactorily maintains the proper tension which prevents wire elongation. This system, however, is disadvantageous in that it slightly damages the exterior surface of the wire where it contacts the eyelet surface. A twist of one turn for each spool turn is also imparted to the wire affecting winding operations and the final coil form.

My invention as hereinafter described corrects the aforementioned difficulties by providing a constant predetermined wire tension, and by rotating the spool in a manner to unreel the wire without twisting the wire.

Referring to the drawings, I have shown a spool or reel 1 on which there is wound wire 3. The spool is mounted on a shaft or spindle 2 and is centered on its left side by the enlarged portion 5 of the shaft 2, and on its right side by the conical surface 7 of the locking nut 9 which

threadedly engages the end of the shaft 2. When securely positioned on the shaft 2, the spool 1 is snugly positioned against the edge 11 of the brake drum 13 bolted to a flange 14 of the shaft 2. Static friction forces developed in the contact of the conical surface 7 of the nut 9 with the spool plus those developed in the spool and brake drum edge contact are sufficiently large to provide a positive rotation of the spool 1 with the shaft. The shaft is rotatably mounted in bearings 15 and 17 positioned axially of the shaft in annular recesses or grooves 19 and 21 in the ends of the bore 23 of bearing housing 25 securely mounted on a base 27, and locked against axial movement by the engagement of the base of the flange 14 and the ring or collar member 29 with the inner races of the ball bearings 15 and 17. The ring or collar member 29 is secured to the shaft by a tapered pin 31. A ring member 33, having a reduced diameter, threaded portion 34 is positioned concentrically about the shaft and secured by the bolts 35 and 37 to the end of bearing housing 25 and is threadedly engaged by an internally threaded clutch actuating member 39. A clutch plate 40 slidably mounted on a square section 41 of the shaft 2, has mounted to its face friction forming material such as brake lining 43 for engaging a cooperating face 45 of the driving pulley or flywheel 47, driven from some external source such as an electric motor (not shown) by the tapered belts 104. The pulley 47 floats circumferentially on ball bearings 49 and 51 on the left-hand end of shaft 2, and is axially positioned between the ring element 53 and a collar 55 pinned to the extreme end of the shaft. A plurality of compression springs, one of which is shown at 57, are mounted in suitable recesses or bores in the ring element 53 and in the clutch plate 40. Interposed between clutch plate 40 and the clutch actuating member 39 is a thrust bearing ring 59. A shaft 61 rotatably mounted in bearings 63 and 65 in housing 66 has pinned at its right end a tension arm 67 on the extremity of which is rotatably mounted in bearings not shown on a stub shaft 69 a pulley 71 of some light weight material such as Micarta. To the left end of shaft 61 is pinned a gear sector 73 having integrally formed therewith an arm 75 engaged at a predetermined position along its length (determined by the position of the specific hole of a plurality of holes through which the end of the spring engages) by a tension spring 77 which in turn is secured to the base by a vertically mounted strip 78 welded at its one end to the base 27 and at its other end engaging the lower end of the tension spring 77. Any other suitable means may be used for adjusting the tension of spring 77, such as a screw-threaded adjusting means at the top of strip 78. Gear sector 73 meshes with gear 79 which, in turn, meshes with a gear sector 81 integral with the clutch actuating member 39. Gear 79 is pinned to a shaft 83 which floats in bearings 85 and 87 in the housing 66 and has at its right end an integrally formed crank arm 89. A link 91 pivoted at 93 within the forked end of said crank arm and pivoted at 95 in the forked end of a stud 97 resiliently mounted to the movable end 99 of the brake shoe 101 pivoted at 103 transmits crank arm movement to the brake shoe for brake actuation. Axial movement of the stud 97 is confined within very small limits, the purpose of such mounting being to soften brake application. The wire is led around the pulley in such a manner that wire tension may be adjusted by the spring 77 to some predetermined value. As shown in the drawings the machine is in a state of repose; that is, wire tension is at a minimum and there is as a result no clutch engagement. Upon increasing wire tension to some predetermined value the tension arm 67 will be rotated counterclockwise to effect clutch engagement and simultaneously reduce the braking pressure thereby effecting substantially free and direct drive of shaft 2.

The system operates as follows. The flywheel 47 is driven at a speed which during maximum clutch engagement will so rotate the spool of material that the peripheral velocity of the wire wound on the spool will be in excess of the maximum wire demand speed. With the tension arm adjusted by the tension spring to provide a predetermined wire tension, wire demand speeds requiring this predetermined tension will leave the tension arm undisturbed. Wire demand speeds developing wire tension in excess of the predetermined tension will move the tension arm 67 counterclockwise (see Fig. 3) which rotation through the gear sector 73, gear 79 and gear sector 81 on the clutch actuating member 39 will rotate said clutch member counterclockwise to thread it off the ring member to the left and, through thrust bearing 59, transmit this motion to the clutch plate thereby moving it into engagement with its cooperating surface 45 of the flywheel 47 with a pressure that is proportional to the demand speed or tension of the wire. Simultaneously, the crank arm or brake actuating arm 89 is moved or rotated to reduce the braking pressure. As the result of said clutch engagement with said flywheel the spool is accelerated to provide wire delivery therefrom equal to the wire demand speed. Conversely as wire demand speeds decrease, the tension arm will move clockwise, and, through the above-mentioned mechanism will reduce clutching pressure while simultaneously increasing the braking pressure to decelerate the spool and reduce wire delivery therefrom to correspond to the reduced demand speed.

The operations of my power driven unreeler or reeler described above are performed in fractions of a second and serve to maintain, during high speed operation, wire delivery from the spool at speeds that vary only slightly from the predetermined demand speed. The tension arm has purposely been built light to maintain wire forces which must overcome its inertia at a minimum value while roller bearings have been used throughout to prevent friction losses from introducing errors into the system thereby confining wire tension forces for operating my device within very small limits.

I am, of course, aware that others, particularly after having had the benefits of the teachings of my invention, will devise other devices embodying my invention, and I, therefore, do not wish to be limited by the descriptive disclosure hereinbefore made or the specific showings made in the drawings, but wish to be limited only by the scope of the appended claims.

I claim as my invention:

1. In combination with a reel having a wire-like material wound thereon, means including a drum-like mass forming one element of a clutch and a movable friction element forming the other element, for driving said reel, a rotatable actuating arm having a pulley at one end about which pulley a portion of said wire-like material is entrained thereby rotating said arm in one direction

in proportion to the tension applied to said wire portion, adjustable spring means for biasing said arm in an opposite direction, gear means mechanically coupling said actuating arm and friction element so as to propel said friction element longitudinally of said drum-like mass against the side thereof so as to progressively increase the pressure of engagement of the clutch in proportion to progressive increases in said applied tension, a brake for retarding the rotation of said reel, mechanical means including a resilient link interconnecting said brake and actuating arm so arranged that the braking pressure is gradually decreased as the tension of said wire-like portion is increased.

2. In combination with a reel having a wire-like material wound thereon, a support, a shaft journaled in said support for supporting and driving said reel, driving means rotatably mounted on said shaft, a clutch element keyed to rotate with said shaft and slidably mounted thereon for frictionally engaging said driving means, clutch operating means in screw-threaded engagement with said support adapted upon rotation thereof to actuate said clutch element, an actuating arm pivotally mounted on said support having a pulley at its extremity about which a portion of said wire-like material is entrained thereby pivoting said arm in one direction in proportion to the tension applied to said wire portion, spring means for biasing said actuating arm in an opposite direction, gear means interconnecting said actuating arm and said clutch operating means for rotating the clutch operating means, a brake drum secured to said shaft, a brake shoe having one end thereof pivotally secured to said support for engaging the brake drum, a resilient link mounted on the other end of said brake shoe, a crank arm operated by said gear means, a link interconnecting the crank arm and said resilient link, said crank arm being disposed to effect application of said brake shoe on said brake drum oppositely to engagement of said clutch element with said driving means.

3. In combination with a reel having a wire-like material wound thereon, a support, a shaft journaled in said support for supporting and driving said reel, a pulley having sufficient mass to function as a flywheel rotatably mounted on said shaft, means for driving said pulley, a clutch element keyed to rotate with said shaft and slidably mounted thereon for frictionally engaging said driving means, clutch operating means in screw-threaded engagement with said support adapted upon rotation thereof to actuate said clutch element, an actuating arm pivotally mounted on said support having a pulley at its extremity about which a portion of said wire-like material is entrained thereby pivoting said arm in one direction in proportion to the tension applied to said wire portion, spring means for biasing said actuating arm in an opposite direction, gear means interconnecting said actuating arm and said clutch operating means for rotating the clutch operating means, a brake drum secured to said shaft, a brake shoe having one end thereof pivotally secured to said support for engaging the brake drum, a resilient link mounted on the other end of said brake shoe, a crank arm operated by said gear means, a link interconnecting the crank arm and said resilient link, said crank arm being disposed to effect application of said brake shoe on said brake drum oppositely to engagement of said clutch element with said driving means.

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