

June 16, 1925.

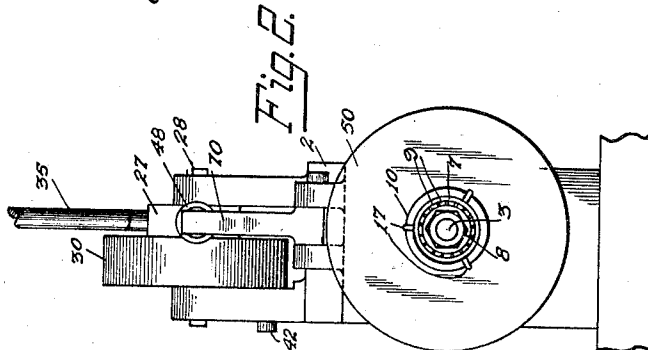
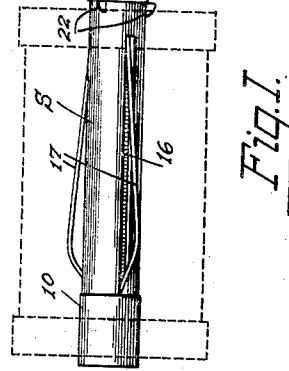
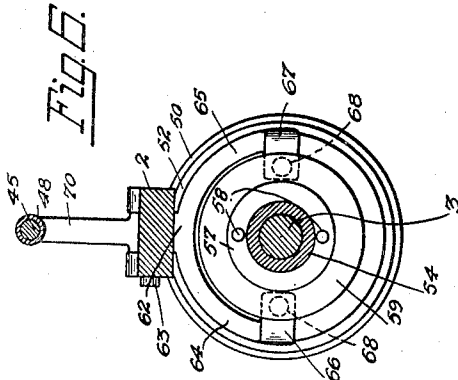
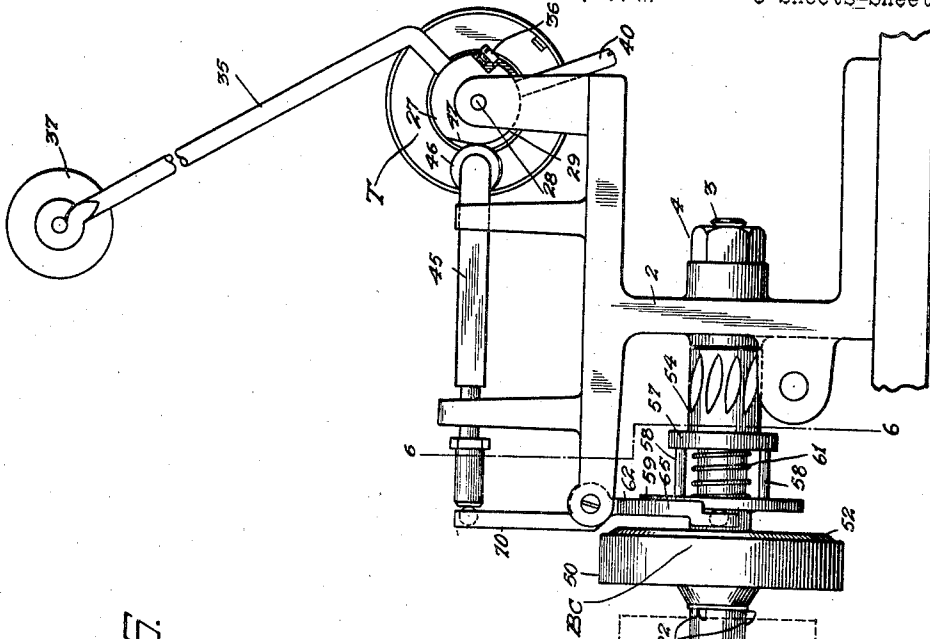
1,541,969

E. J. KOZAK

WINDING MACHINE

Filed June 30, 1922

3 Sheets-Sheet 1



Inventor:
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June 16, 1925.

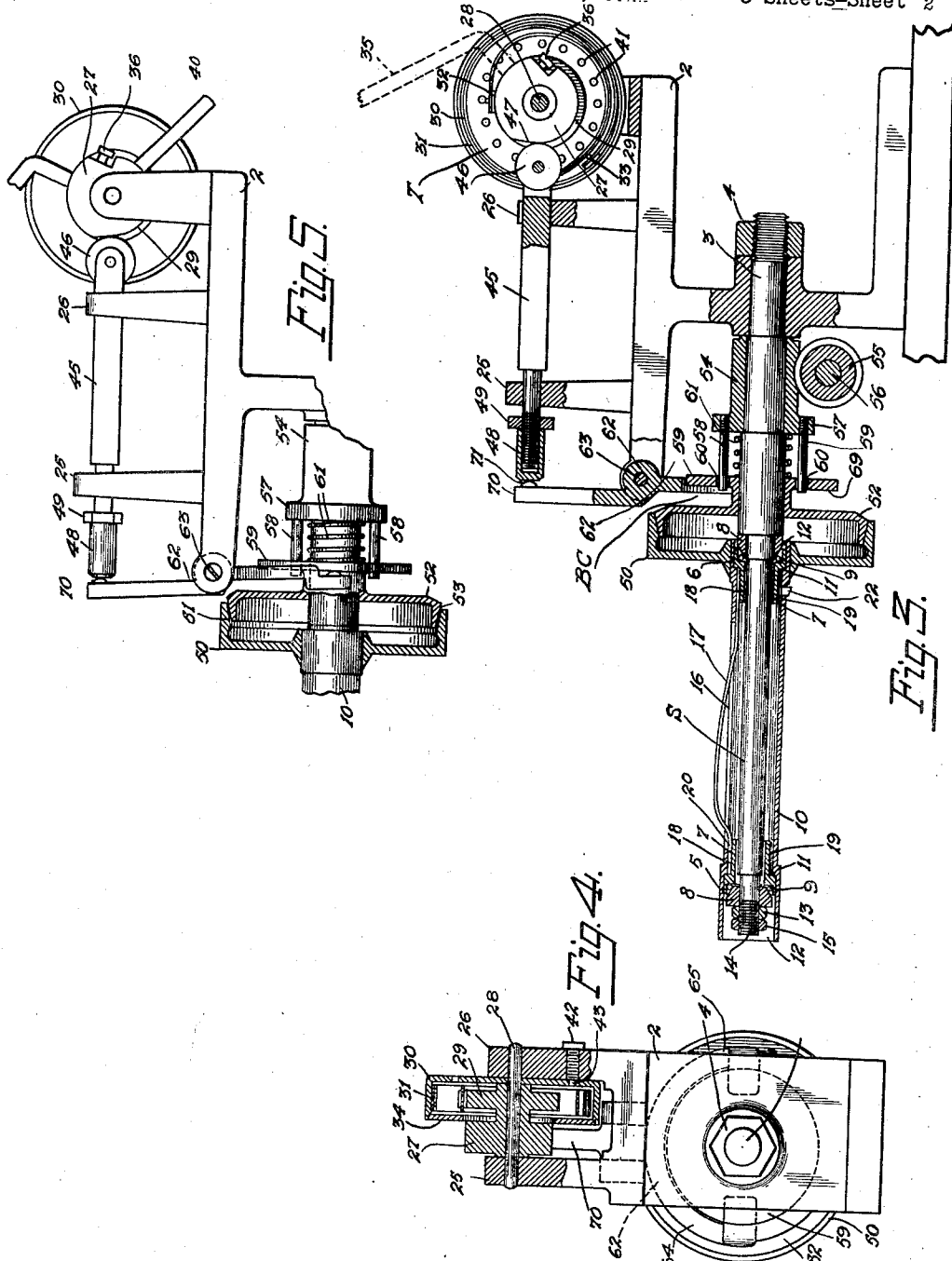
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E. J. KOZAK

WINDING MACHINE

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3 Sheets-Sheet 2



Inventor:
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June 16, 1925.

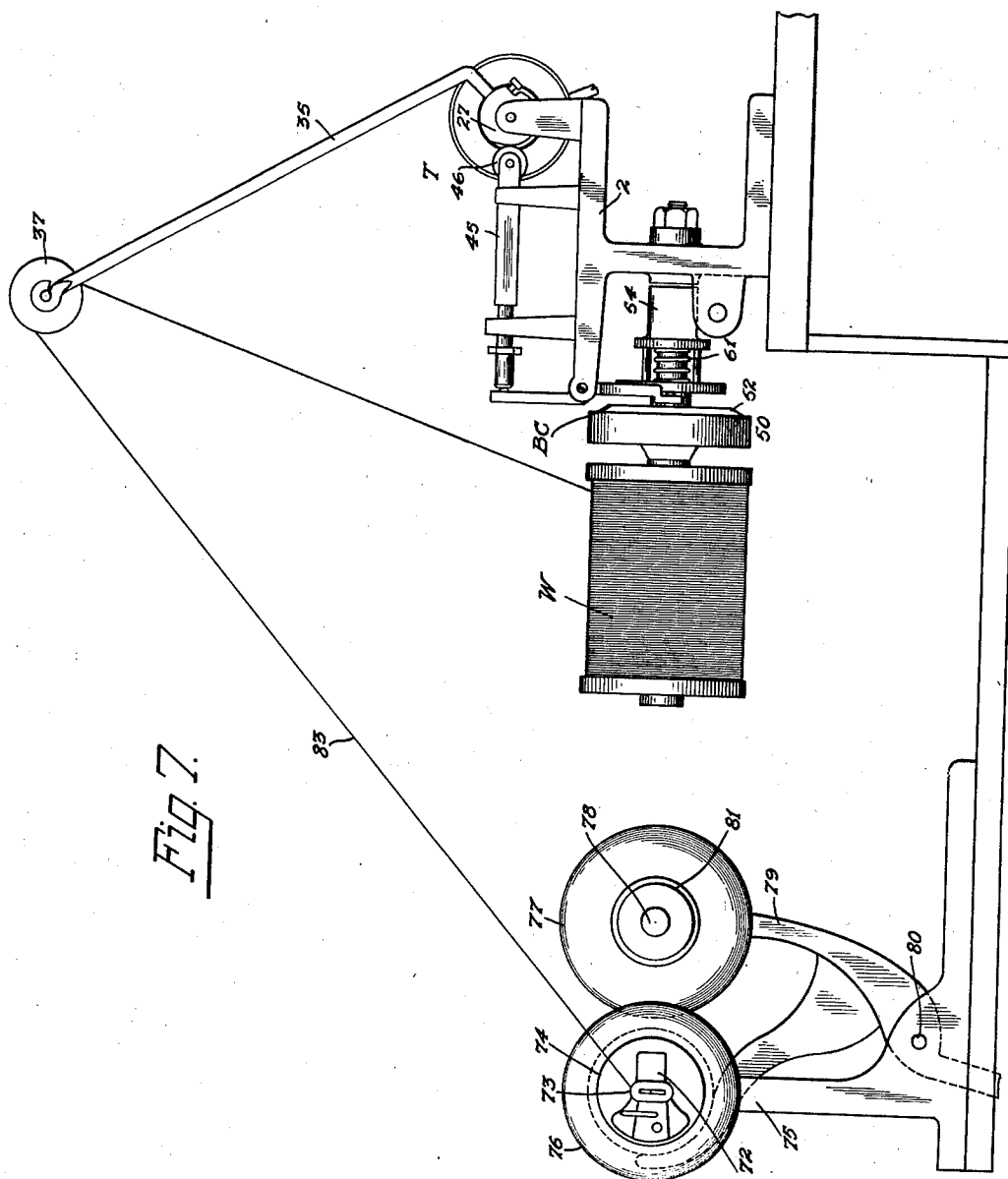
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E. J. KOZAK

WINDING MACHINE

Filed June 30, 1922

3 Sheets-Sheet 3



Inventor:
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By *Attorney.*

Patented June 16, 1925.

1,541,969

UNITED STATES PATENT OFFICE.

EDWARD J. KOZAK, OF CICERO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

WINDING MACHINE.

Application filed June 30, 1922. Serial No. 571,920.

To all whom it may concern:

Be it known that I, EDWARD J. KOZAK, a citizen of the United States, and resident of Cicero, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Winding Machines, of which the following is a specification.

My invention relates to coil-winding machines, and has to do more particularly with winding machines of the class which are used for winding coils, such as receiver coils or the like, and the main object of my invention is to provide an improved winding machine in which electromagnets made from insulated wire may be wound at high speed and at the same time maintain a substantially constant tension in the traveling strand which is being wound on the coil.

In winding the electromagnets it is important to keep the tension on the wire throughout the winding operation as nearly constant as possible, especially so when small coils, such as receiver coils or the like are being wound with a fine gauge wire. In the winding machine of my invention, I provide a winding mandrel or chuck suitably operated by motor-driven means, and the only connection between the winding mandrel or chuck and the tensioning device which carries the supply spool is the strand of wire itself. For the purpose of controlling the tension of the wire or strand being wound, I provide a new and improved tensioning device whose controlling action is exercised at two main points, namely, at the winding point of the mandrel or at the point of supply of the strand.

A feature of my invention is the provision of a sensitive take-up device in which every variation in the rate of travel of the strand at the point of winding is instantly responsive to every decrease or increase of the speed of travel of the strand and will effect the corresponding necessary variations in the speed of travel of the supply means through the actuation of a novel cone clutch braking means.

Other features of my invention not hereinbefore referred to will be hereinafter described and claimed in the ensuing specification and claims.

For a more complete understanding of my invention, reference may be had to the accompanying drawings, in which like reference characters in the several views of the

drawings denote like parts, and in which—

Fig. 1 is a side elevation of the winding machine of my invention;

Fig. 2 is a left-end view of Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2 to more clearly illustrate the construction of the mechanism;

Fig. 4 is a right-end view of Fig. 1;

Fig. 5 is a view similar to Fig. 1, but only showing a portion of the mechanism to illustrate the automatic operation of the tensioning means of my invention;

Fig. 6 is a sectional view along the line 6—6 of Fig. 1;

Fig. 7 is a side elevation of the machine of my invention illustrating it in association with coil chuck and its power-driving means.

Referring now more in detail to my invention as illustrated, it comprises a supporting frame 2 upon which the mechanism of the winding machine of my invention is supported. I provide a spindle rod 3 which is secured to the frame 2 in any suitable manner as by means of the bolt 4 which has screw-threaded engagement with the threaded end of the rod 3 which extends through a suitable opening in the frame 2.

A spool holder S and its associated parts are provided, which is rotatably supported as a whole in bearings 5 and 6. The bearings 5 and 6 which rotatably support the spool holder S are of the well-known ball-bearing type, consisting of the usual ball race or cup 7, cone 8 and ball bearings 9. The spool holder S comprises a sleeve 10 whose interior end portions are slightly smaller in size than the diameter of the ball races 7, so as to produce a force fit, and when in position as illustrated in the drawings, they rest against the annular shoulder 11 formed by the enlarged end openings 12 in the sleeve 10. The cones 8 are fitted tightly upon the spindle rod 3, and an adjusting nut 13 having screw-threaded engagement with the threaded end 14 of the rod 3 is turned down to force the cone 8 of the bearing 5 down so that when the proper adjustment of the spool holder S is obtained, that is, adjustment against longitudinal movement, a lock nut 15 having screw-threaded engagement with the threaded end 14 of the spindle rod 3 holds the sleeve 10 in its adjusted position. The ball races 7 of bearings 5 and 6 are provided with tubular extensions 18 which extend into the sleeve 10 a short dis-

tance and whose diameters are slightly smaller than the interior diameter of the sleeve 10 to form an annular opening 19. The wall of the sleeve 10 is provided with a plurality of slots 16 which receive the spring wires 17, one end of each of said spring wires passing through the slots 16 in the rear portion of the sleeve 10 and extending into the annular opening 19 formed by the ball races 7 of bearing 6 and the sleeve 10 and being secured therein against displacement in any suitable manner. The free ends 20 of the spring wires 17 also pass through the slots 16 at the forward end of the sleeve 10 and rest in the annular opening 19 formed by the ball races 7 of the bearing 5 and the sleeve 10. A spool of wire W, when slipped over the spool holder S, forces the spring wires 17 downward to place them under tension so as to hold the spool upon the spool holder S against displacement. I also provide a plurality of prongs 22 secured to the rear portion of the sleeve 10 in any suitable manner, said prongs 22 being provided with knife edges which engage the edges of the spool opening when the same is placed upon the spool holder S. The spring wires 17 in combination with the prongs 22 prevent the rotation of the spool on the spool holder S when the machine is in operation.

The winding mechanism of my invention is also provided with a combined clutch and adjustable tension device T, which will now be described. The frame 2 is provided with a pair of supporting brackets 25 and 26 integrally formed with the said frame 2 and which brackets 25 and 26 support a portion of the adjustable tension device T. The adjustable tension device T comprises a cam block 27 which is provided with an orifice of a size to receive shaft 28. The cam block 27 has integrally formed therewith a disk portion 29 which rests in a spring barrel 30 which is also supported on the shaft 28. A suitable coil spring 31 such as a clock spring rests in the spring barrel 30, its one end being secured to a pin 32 in the disk portion 29 and its other end being secured to the spring barrel 30 by means of a pin 33. A suitable cover cap 34 is provided which encloses the spring 30 and disk portion 29. The cam block 27 rests between the spring barrel 30 and the bracket 25 and has secured thereto an arm 35 by means of a set screw 36, its free end having rotatably secured thereto a guide wheel 37. The shaft 28 rests in suitable openings in the brackets 25 and 26 and rotatably supports the cam block 27 and its parts thereon. The tension of the spring 31 is such as to hold the cam block 27 and arm 35 in the position shown in the drawing by means of a stop pin 40 whose one end has screw-threaded engagement with a suitable tapped orifice in the cam block 27, its other end engaging the frame 2. The spring barrel 30 is provided with a plurality of orifices 41, and a screw 42 having screw-threaded engagement with a tapped orifice in the bracket 26 is provided with a reduced end portion 43 which extends into one of the orifices 41 to hold the spring barrel 30 in its adjusted position. To increase or decrease the tension of the spring 31 the screw 42 is turned until its end 43 is free of the orifice 41 it was engaging. The spring barrel 30 may now be rotated to the right or left, by referring to Fig. 1, to increase or decrease the tension of the spring 31, and when the proper tension is obtained, the screw 42 is again turned until its end 43 enters one of the plurality of orifices 41 to hold the barrel 30 against movement and hold the spring 31 in its adjusted position for purposes as will presently be described.

A push rod 45 slidably supported in posts 25 and 26 integrally formed with the frame 2 is operatively associated with the cam block 27. A roller 46 is rotatably supported at one end of the push rod 45 and engages the cam face 47 of the cam block 27 to move the push rod 45 longitudinally when the cam block 27 is rotated, as will presently be described. The opposite end of the push rod 45 is threaded and is adapted to receive an adjustable thimble 48 which may be locked in any of its adjustable positions by means of a lock nut 49. This adjustable thimble 48 regulates the amount of longitudinal movement of the push rod 45, which movement is controlled by the rotation of the cam block 27, which rotation causes the cam face 47 to engage the roller 46 to move the said rod 45 longitudinally for purposes as will be presently described.

I also provide a combined brake and clutch mechanism BC which is controlled by the longitudinal movement of the push rod 45, and comprises a brake drum 50 cup-shaped in form, which is secured to the sleeve 10 by means of a drive fit. The inner circumferential face 51 of the brake drum 50 is provided with diverging sides and is operatively associated with a brake drum 52 slidably mounted upon the spindle rod 3. The outer circumferential face 53 of the brake drum 52 is provided with a converging face and the brake drum 52 is of a size to fit into the brake drum 50 so as to permit the faces of the drums 50 and 52 to engage. A pinion 54 rotatably supported on the spindle rod 3 meshes with a pinion 55 secured to a shaft 56, which extends at right angles to the spindle rod 3. The said pinions 54 and 55 are of the usual worm type and are driven by suitable power at certain times for purposes as will presently be described. The pinion 54 rotatably secured to the spindle rod 3 is provided with an integrally formed flange 57 which has secured

thereto a pair of pins 58 located diametrically opposite each other upon said flange 57. The brake drum 52 is provided with an integrally formed flange 59 which is provided with a pair of orifices 60 located diametrically opposite each other and through which the pins 58 secured to the flange 57 of the pinion 54 extend. A helical spring 61 around the spindle rod 3 rests between the flange 59 of the brake drum 52 and the flange 57 on the pinion 54. The brake drum 52 being slidably supported upon the spindle rod 3 is forced into the brake drum 50, that is, when the machine is at rest as illustrated clearly in Fig. 3.

A yoke 62 pivotally supported upon the frame 2 by means of the pivot pin 63 is provided with legs 64 and 65 which span the flange 59 of the brake drum 52, the said legs 64 and 65 being provided with laterally extended portions 66 and 67, which are provided with bearing points 68 which engage the face 69 of the flange 59 of the brake drum 52. The yoke 62 is also provided with an arm 70 extending upward, which is provided with a bearing point 71 which at all times engages the adjustable thimble 48 on the push rod 45. The push rod 45 is always held in its position as illustrated in the drawings due to the spring pressure of the spring 61 against the flange 59 as is readily apparent from the description.

Having described in detail the apparatus comprising the winding machine of my invention, I will now describe in detail the operation of the same in connection with its winding operation.

The chuck 72 for holding the coil to be wound may be of any suitable type such as illustrated in the drawing and is secured to a shaft 73 which is rotatably mounted in bearings 74 of a suitable supporting bracket 75 which is mounted upon a suitable winding bench or table. A wheel 76 secured to the shaft 73 is operatively associated with a friction wheel 77 which is rotatably mounted on a shaft 78 rotatably supported in bearings of a rocking arm 79 which is pivotally secured to the bracket 75 at the point 80. The shaft 78 also carries a pulley 81 which by means of suitable transmission such as a belt drives the shaft 78 and the friction wheel 77 secured thereto. The arm 79 is connected to a suitable starting foot pedal (not shown) which when actuated rocks the arm 79 and its parts as a whole and causes the wheel 77 to engage the wheel 76 on the shaft 73. Due to the frictional engagement between the wheels 76 and 77 the shaft 73, to which is attached the clamp 72 which holds the coil core to be wound, starts to rotate. The spool of wire 82 held upon the spool holder S has its end threaded over the guide wheel 37 and secured to a terminal of a coil to be wound. The instant that shaft

73 starts to rotate, wire is placed upon the core of the coil to be wound and the operator now guides the strand of wire 83 back and forth to place the requisite number of turns on the coil.

The instant this rotation is started, tension is placed upon the wire strand 83. The arm 35 is in the position shown in Fig. 1 before the starting pedal is actuated and held in this position by the spring 31 associated therewith, as before described, but the instant, however, that the machine is started, a tension or pull is placed upon the strand 83 caused by the rotation of the shaft 73. This tension causes the arm 35 to be moved downward due to the downward pull caused by the starting of the shaft 73 which carries the chuck 72, and as the arm 35 is secured to the cam block 27 the same is also rotated about its supporting shaft 28, causing the spring 31 to be wound tighter, thus placing additional tension upon the spring 31. As the cam block 27 is rotated in a counter-clockwise direction, with reference to Fig. 1, its cam face 47 engages the roller 46 of the push rod 45 and forces the rod 45 to the left with reference to Fig. 5. This movement of the push rod 45 to the left causes the integrally formed arm 70 of the yoke 62 to be moved to the left. The movement of arm 70 to the left causes the yoke 62 to swing about its pivot screw 63, to cause the legs 64 and 65 of the yoke 62, which engage the face 69 of the flange 59 of the brake drum 52, to force the brake drum 52 to the right against the normal tension of the spring 61. This movement partially withdraws drum 52 from the drum 50, permitting the face 53 of the drum 52 to partially disengage the face 51 of the drum 50, removing the drag from the spool holder S to permit the spool holder S and spool of wire as a whole to rotate more freely to relieve the extra strain upon the strand 83 when the machine is started. After the machine is started and has picked up speed and is rotating at a uniform speed, the combination of the arm 35 in association with the spring 31 and the brake drums 50 and 52 in association with the spring 61 will keep the strand 83 at as near a constant tension as possible.

The rocking arm 35 and its guide wheel 37 constitutes a light rocking element freely movable about its axis 28 in one direction under the influence of the tension exerted by the loop of wire from the supply spool to the coil being wound, when the machine is started and also freely movable in an opposite direction under the influence of the spring 31 which opposes the pull of the loop. The arm 35 will move upward as the tension of the strand between the point of supply and the winding point decreases and will move downward as the tension increases

and becomes effective to overcome the power exerted by the spring 31.

It sometimes happens that the wire upon the supply spool is crossed for a few turns, causing a sudden pull upon the strand that is being fed from the coil being wound. In a case of this kind, the instant the sudden pull occurs, the added strain on the strand becomes effective immediately and overcomes the tension of the spring 31, which tends to hold the arm 35 in its normal position, causing the arm 35 to be instantly drawn down against the tension of the spring 31 in the spring barrel 30, forcing the push rod 45 to the left due to the cam face 47 engaging the roller 46, causing the yoke 62 to instantly rotate about its pivot to force the brake drum 52 to the right to permit the spool holder S to run entirely free to release this strain placed upon the strand being fed to the coil. Now, when this added strain or pull has stopped due to the crossed windings having been removed during the winding operation the tension of the spring 30 is powerful enough to again move the arm 35 upward through the medium of the cam block 27 to which the arm 35 is secured. The instant the cam block 27 starts its counter rotation the push rod 45 moves to the right due to the spring 61 which was compressed upon the movement of the drum 52 to the right. The rotation of the yoke 62 in the opposite direction permits the spring 61 to act upon the face of the flange 59 to again force the drum 52 into the drum 50 again permitting the faces 53 and 52 to engage, again checking the speed of the spool holder S so as to permit the proper tension to be placed upon the strand of wire that is being fed to the coil being wound.

From the above description it may readily be seen that through the medium of the movable arm 35 which is under an adjustable spring tension in combination with a pair of brake drums 50 and 52 which are automatically disengaged or engaged the instant the arm 35 moves up or down through the agency of a yoke 62 which is always under spring tension, the tension of a strand of wire being fed to a coil may be maintained approximately constant at all times.

The pinion 54 associated with the pinion 55 is for use in rotating the spool holder S in a reverse direction, should the operator happen to place too many turns of wire on a coil. If this happens the operator releases the foot pedal and operates suitable means to rotate the shaft 56 upon which the pinion worm 55 is secured to cause the pinion 54 to rotate and due to the fact that pins 58 associated with the pinion 54 extend into openings in the flange 59 of the drum 52, causing the spool holder S to rotate in a reverse direction to take up the slack or surplus turns upon the coil. While this por-

tion of the winding machine is not a portion of my invention, I have only given a brief description of its function.

While I have illustrated and described a preferred embodiment of my invention, it is to be understood that changes and modifications will readily suggest themselves to those skilled in the art and I, therefore, aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is as follows:

1. In a winding machine, the combination with a winding mandrel, a source of supply for said machine, a rocking element having a to-and-fro movement, a cam for said rocking element, a push rod associated with said cam, and means controlled by the tension of strand between said winding mandrel and said source of supply for actuating said cam and rod for maintaining a constant tension upon said strand,

2. In a winding machine, the combination with a winding mandrel, a source of supply, a rotatable spool holder for supporting said source of supply, a rocking element supporting guiding means over which a strand of said source travels to said mandrel, a cam for said rocking element, brake means for said rotatable spool holder, and means between said cam and brake means for maintaining a substantially constant tension upon said strand between said source of supply and said winding mandrel.

3. In a winding machine, the combination with a winding mandrel, a source of supply and a rotatable holder for said source of supply, a rocking element comprising a cam and guiding means over which a strand of said source travels, a push rod operatively associated with said cam, brake means associated with said holder adapted to be actuated by said push rod when acted upon by said cam when said rocking element moves in one direction to permit the free rotation of said holder and spool.

4. In a winding machine, the combination with a winding mandrel and a rotatable holder for supplying means for supplying a strand, a rocking element pivotally supported and spring means for holding said rocking element in a position of rest, an arm for said rocking element and a guide over which the strand from said supply travels to said winding mandrel, braking means, and means including a cam and slidable rod associated therewith actuated when the arm of said rocking element moves in one direction under the influence of a tension of the loop strand between said supply and mandrel to actuate said brake means to permit the free rotation of said rotatable holder.

5. In a winding machine, the combination with a winding mandrel and a rotatable holder for supplying means for supplying a strand, a rocking element pivotally supported and spring means for holding said rocking element in a position of rest, an arm for said rocking element and a guide wheel therefor over which the strand from said supply travels to said winding mandrel, braking means, means including a cam having a slidable rod associated therewith actuated when the arm of said rocking element moves in one direction against the tension of said spring means under the influence of a tension of the loop strand between said supply and mandrel to actuate said brake means to permit the free rotation of said rotatable holder, said spring means moving said arm in the opposite direction when the tension of said loop is such as to permit said spring means to move said arm in said opposite direction to operate said means to actuate said brake means to check the free rotation of said rotatable holder.

6. In a winding machine, the combination with a winding mandrel, a source of supply and a rotatable holder therefor and a brake means associated with said holder, a rocking element including a spring for holding said rocking element at rest, a cam for said element and a push rod associated therewith, a yoke pivotally supported and spring means for holding said yoke in operative relation with said brake means and said push rod, a strand from said source of supply to said winding mandrel which when under the influence of a tension rotates said rocking element against its normal spring tension to cause said cam to move said rod to rock said yoke about its pivot to actuate said brake means to permit the free rotation of said holder to maintain a substantially constant tension upon said strand between said supply source and said winding mandrel.

7. In a winding machine, the combination with a winding mandrel, of means for supplying a strand supported on a rotatable holder, a reciprocating member including an arm supporting a loop in the strand and for controlling said loop in the strand between the point of supply and the winding point, a cam associated with said reciprocating element, a push rod in operative relation with said cam, brake means associated with said push rod, said push rod being acted upon by said cam when said reciprocating element is moved in one direction under the influence of a tension of said loop to actuate said brake means to maintain a substantially constant tension upon said strand between said winding point and said supply point.

8. A winding machine for winding coils, an element having a supply source of winding material, a member for receiving said

winding material from said supply source, a rotatable device supporting said element, a cone frictional device cooperating with said rotatable device to regulate the amount of power necessary to rotate said rotary device, a spring controlled arm controlling said frictional device, and means including said frictional device for rotating said rotary device in a retrograde direction.

9. A device of the character described including a winding spindle for winding flexible material thereon, a supply of flexible material, means for operatively associating said source of supply with said winding spindle, guiding means for guiding the flexible material from said source of supply to said winding spindle, frictional means associated with said source of supply, and a cam and rod mechanism associated with said guiding means and said frictional means for preventing an over supply of said flexible material to said winding spindle.

10. A device of the character described including a winding element adapted to have pliable material wound thereon in layers to form a coil, a spool of pliable material operatively associated with said winding element, guiding means for guiding said pliable material to said winding element, frictional means and a cam having a rod associated therewith for operatively connecting said guiding means and said spool of pliable material for controlling the supply of said pliable material to said winding element.

11. A tension device of the character described in association with a winding spindle, a source of supply, a rotatable holder for said device to support said source of supply, a pivotally supported rocking member, an arm secured to said rocking member, guide means therefor for guiding a strand from said source of supply to said winding spindle, and brake means associated with said rocking member to maintain a substantially constant tension upon said strand between said winding spindle and said source of supply.

12. A device of the character described associated with a winding spindle, a source of supply and a rotatable holder for said device to support said source of supply, a pivotally supported rocking member, an arm secured to said rocking member and guide means therefor for guiding a strand from said supply source to said winding spindle, means associated with said rocking member for holding said member at rest, brake means associated with said rotatable holder and a slidable link between said brake means and said rocking member adapted to operate said brake means due to the movement of said rocking member to maintain a substantially constant tension upon said strand between said winding spindle and said source of supply.

13. A tension device of the character described including a supporting frame, a rotatable spindle supported by said frame, a source of supply supported on said rotatable spindle and associated with a winding mandrel, a rocking member pivotally supported on said frame, and an arm secured to said rocking member and guide means therefor for guiding a strand from said supply source to said winding mandrel, means for maintaining said arm normally at rest, brake means associated with said rotatable spindle, means actuated when the arm is moved in one direction to actuate said brake means to permit free rotation of said rotatable spindle, said means actuating said brake means when said arm moves in the opposite direction to check the free rotation of said rotatable spindle.

14. A tension device of the character described including a supporting frame, a rotatable spindle supported by said frame, a source of supply supported on said rotatable spindle, a rocking member pivotally

supported by said frame, an arm secured to said rocking member and a guide wheel on said arm for guiding a strand from said source of supply to a winding mandrel, a spring for maintaining said rocking member normally at rest, brake means supported by said frame, a cam for said rocking member and a slidable link and a pivoted member operatively associating said cam with said brake means, said slidable link moved by said cam when said rocking member moved in one direction to actuate said pivoted member to effect said brake means against the tension of spring means associated with said pivoted member under the influence of a tension of said strand between said supply source and said winding mandrel to permit the free rotation of said rotatable spindle.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 28th day of June, 1922.

EDWARD J. KOZAK.