April 27, 1954 H. WIRTH 2,676,761

WINDING MACHINE

Filed Aug. 13, 1951

FIG. 1

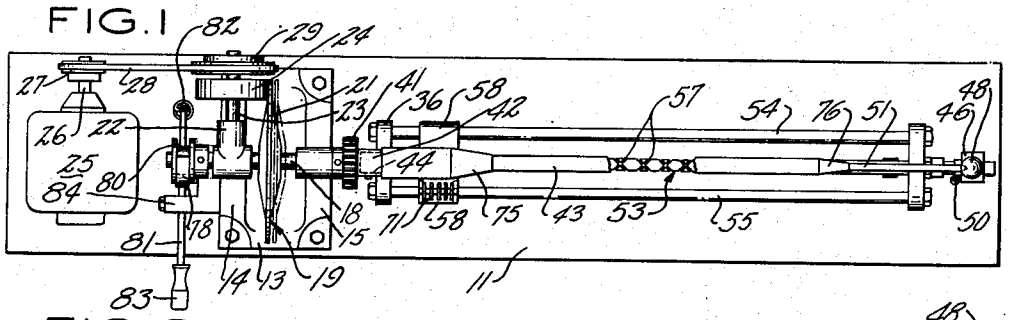


FIG. 2

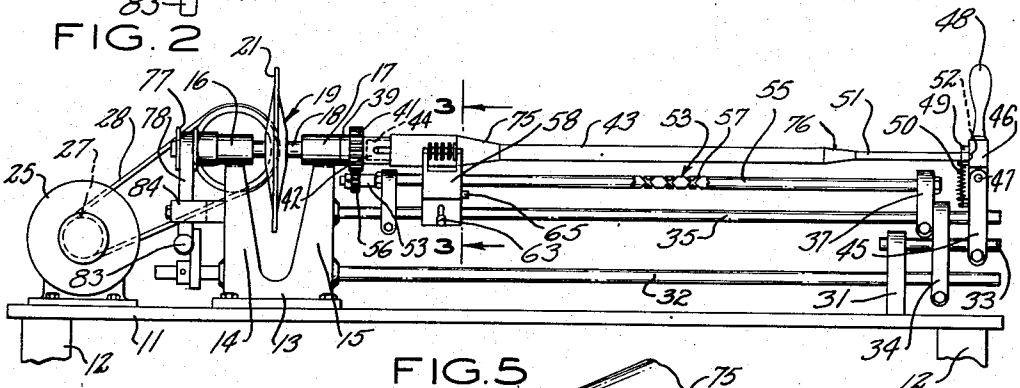


FIG. 3

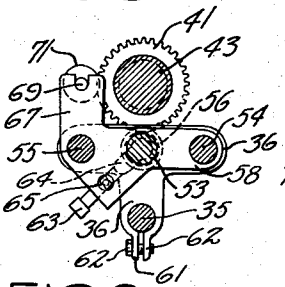


FIG. 5

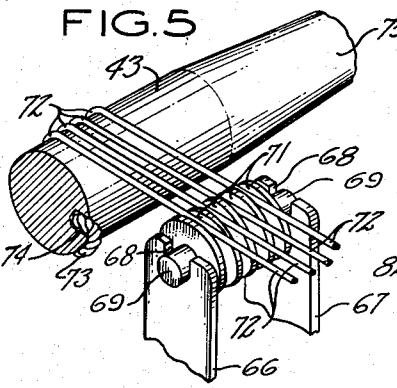


FIG. 4

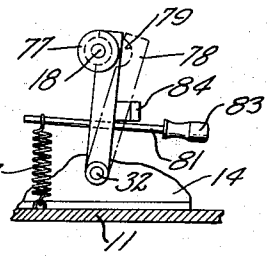


FIG. 6

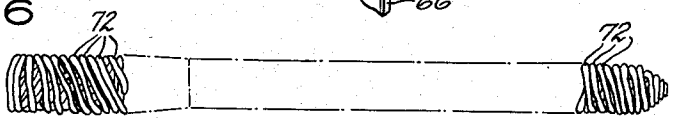


FIG. 7

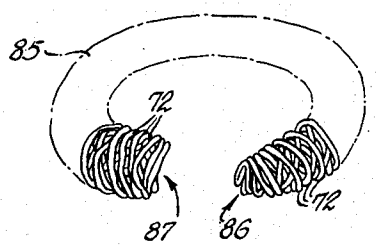
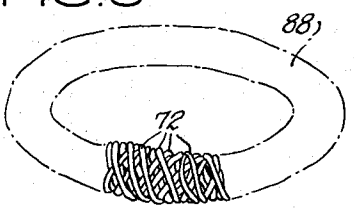


FIG. 8



INVENTOR
HANS WIRTH

BY J. Jordan Kunick
ATTORNEY

Patented Apr. 27, 1954

2,676,761

UNITED STATES PATENT OFFICE

2,676,761

WINDING MACHINE

Hans Wirth, Middletown, Conn., assignor, by mesne assignments, to Thermoid Company, Hamilton Township, N. J., a corporation of Delaware

Application August 13, 1951, Serial No. 241,599

7 Claims. (Cl. 242—7)

1

This invention relates to winding machines, and more particularly to a machine adapted to wind impregnated strands of material into helical coils which are ultimately made up into friction plates such as clutch facings and brake linings.

An object of the invention is to provide a machine which is adapted to wind strands of material in a criss-cross helical pattern upon a mandrel.

Another object of the invention is to provide a machine and method for producing improved friction facings whereby impregnated strands are wound upon an elongated mandrel by means of a novel feed mechanism to form criss-cross helical windings which are subsequently pressed and cured to form friction facings.

A further object of the invention is to provide a winding machine that is equipped with interchangeable components for producing different sizes and grades of friction facings.

Another object of the invention is to provide a winding machine that is inexpensive to manufacture, economical to operate and simple to maintain.

These and other objects of the invention will be exemplified in the following description taken in connection with the drawing, in which:

Figure 1 is a top view of the winding machine made in accordance with the principles of my invention, with some parts omitted for clarity of illustration;

Figure 2 is a side view of the machine shown in Figure 1;

Figure 3 is an end view, partly in section, taken on line 3—3 of Figure 2;

Figure 4 is an end view showing the brake mechanism in detail;

Figure 5 is an enlarged perspective detail view of the feed mechanism and a portion of the mandrel;

Figure 6 is a side view of the mandrel, somewhat enlarged, showing the disposition of some of the strands thereon;

Figure 7 is a perspective view of the windings that have been removed from the mandrel and curved to show one step in the formation of a friction facing; and

Figure 8 is a perspective view of a finished friction facing which has been formed from the windings taken from the mandrel and pressed into a flat disk.

Referring to the drawings in detail, Figures 1 and 2 show a table 11 supported on legs 12. Positioned upon and bolted to table 11 is a U-shaped frame 13 whose legs 14 and 15 extend upwardly and terminate in journal boxes 16 and 17. Supported by said journal boxes is a shaft 18 which

2

rotates freely therein. Connected to shaft 18 is a disk wheel 19 having a flat section 21 against which frictional force may be exerted to cause shaft 18 to rotate.

Connected to and extending rearwardly from journal box 16 is journal box 22 in which shaft 23 rotates. Attached to shaft 23 is a friction drum 24 whose peripheral surface is brought to bear frictionally upon the flat section 21 of wheel 19. Positioned upon and bolted to table 11 is an electric motor 25 upon whose shaft 26 is a pulley 27 connected by means of belt 28 to pulley 29 on shaft 23. The operation of motor 25 through pulleys 27 and 29, drum 24 and disk 19 brings about the rotation of shaft 18.

Positioned upon table 11 at the right of frame 13 is a block 31 supporting shaft 32 which extends to and is supported in the base of frame 13. Rigidly secured within block 31 is rod 33 which in conjunction with shaft 32 rigidly supports block 34. Connected between block 34 and frame 13 is shaft 35 to which are connected blocks 36 and 37.

That portion of shaft 18 which extends to the right of journal box 17 has an enlarged section 39 to which gear 41 is connected. The enlarged shaft section 39 extends through gear 41 and has a terminal portion 42 having a recess. A mandrel 43 has a narrowed end 44 which fits into the recess in terminal portion 42 by means of a friction fit or by means of any suitable keying arrangement whereby mandrel 43 is supported on that end and is rotated by shaft 18.

Rigidly supported by shafts 33 and 35 is a block 45 in the top of which is connected a lever arm 46 by means of a pivot pin 47. Lever arm 46 is capable of swinging to the right by means of hand pressure applied to handle 48 but it is prevented from swinging to the left of the vertical by means of the stop action of upwardly extending stop plate 49 rigidly connected to block 45. Tension spring 50 connected between arm 46 and block 45 serves to maintain arm 46 pressed against plate 49. Stop plate 49 has an aperture through which the right terminus of the narrowed end 51 of mandrel 43 is inserted and by which it is rotatably supported. Lever arm 46 has a recess 52 which is adapted to accommodate the terminus of mandrel 43, and when said arm is in the upright position it serves to lock mandrel 43 in position.

Blocks 36 and 37 support feed drive shaft 53 which is rotatable between and within said blocks which also support stationary runner shafts 54 and 55. Rigidly attached to the left end of shaft 53 is a gear 56 which meshes with gear 41 whereby

tion of mandrel 43. Between blocks 36 and 37 shaft 53 has a double helical screw recess 57 which acts as a worm gear for the traverse of the feed mechanism in both longitudinal directions.

The feed mechanism comprises a carriage 58 which is mounted upon and moves lengthwise along shafts 35, 54 and 55 which serve as runners for said carriage, while an aperture is provided in said carriage through which screw shaft 53 passes and freely rotates. (See also Fig. 3.) The aperture which accommodates shaft 35 is open on its lower periphery while downwardly extending extensions 59 and 62 which are somewhat separated from each other are connected by means of a screw bolt 62 which can be operated to vary the distance between said extensions in order to loosen or tighten the aperture around shaft 35. This arrangement is provided in order to adjust the frictional relationship between carriage 58 and shaft 35 so that the carriage may be moved with the maximum efficiency in addition to stabilizing the movement of said carriage along shafts 35, 54 and 55.

In the lower forward part of carriage 58 pin 63 extends diagonally upward and its upper end has a key 64 which is adapted to engage screw recess 57 of shaft 53. Key pin 63 is held in position by means of a lock pin 65 inserted into the side of carriage 58. Lock pin 65 engages an undercut annular recess in the shaft portion of key pin 63, thereby permitting key pin 63 to rotate so that key 64 may freely follow the helical screw recesses 57. The interaction of key 64 and recesses 57 on rotating shaft 53 forces key 64 to move from one end of the shaft to the other, thus moving carriage 58 back and forth along shafts 35, 54 and 55. When carriage 58 reaches either end of said shafts key 64 is rotated in such a manner that it engages the return set of screw recesses 57 which causes carriage 58 to return to the other end of said shaft. This process is continuous so that when the winding machine is in operation carriage 58 traverses continuously from one end of the shaft to the other.

On the front of carriage 58 there are two upwardly extending arms 66 and 67, in the tops of each of which are bearing recesses 68. Said recesses 68 accommodate the ends of shaft 69 which is free to rotate therein. Connected to shaft 69 is a series of guide disks 71 which serve as spacing guides for strands of material that are to be fed toward rotating mandrel 43. The unitary assembly of shaft 69 and disks 71 can readily be removed from recesses 68 and another shaft having different spacings between disks may be nested therein.

In operation a plurality of impregnated single or multiple ply strands 72 are passed spaced apart one from another through guide disks 71 and over mandrel 43. The ends of strands 72 are twisted together into a short braid 73 and are inserted into a slot 74 in mandrel 43 while the mandrel is stationary and the machine is inoperative. When the machine is started and mandrel 43 begins to rotate slot 74 grasping braid 73 of strands 72 pulls and winds said strands upon the mandrel while carriage 58 is moved along shafts 35, 54, and 55 by the interaction of screw shaft 53 and key 64.

As the feed mechanism moves from one end of the machine to the other the strands 72 are laid down in a helical pattern over mandrel 43. As the feed mechanism makes a return trip a layer of helical windings are criss-crossed over the

layer of windings underneath. Depending upon the desired quality and structure of the end product the number of traverse passes of feed carriage 68 may be varied from two to six or more. Also the spacing between the disks 71 may be varied in order to change the texture and structure of the friction material produced by the present machine.

It will be noted that mandrel 43 has tapered sections 75 and 76 which permit the windings to be easily removed from the mandrel.

As described above mandrel 43 is driven by means of a friction disk 19 and friction drum 24 which in turn is driven by motor 25 through a suitable pulley system. Although the mechanism may be started and stopped by an electric switch on motor 25, I prefer to have motor 25 running constantly while I provide a combined drive release and brake mechanism for shaft 18. This mechanism includes a brake drum 77 on the end of and rotating with shaft 18.

Connected to shaft 32 which extends through frame 13 to the left is a pivotable brake arm 78 having a recess 79 adapted frictionally to engage the outer tapered periphery 80 of the shaft portion of brake drum 77. A handle bar 81 is rigidly connected to brake arm 78 and extends to the rear of the machine where the end of said handle bar is engaged by a spring 82 whose other end is connected to table 11. Normally spring 82 pulls downward on the end of handle bar 81 and causes brake arm 78 to engage brake drum 77 to maintain shaft 18 and mandrel 43 in a motionless position.

It will be noted that shaft 18 is slightly movable longitudinally within journals 16 and 17. When the recess surface 79 of brake arm 78 engages the tapered periphery 80 of brake drum 77, shaft 18 is caused to move slightly to the right carrying along with it disk 19 as shown in dotted outline in Fig. 1. This slight displacement of disk 19 to the right disengages the flat section 21 from the continuously rotating drum 24 so that disk 19 and mandrel 43 are rendered motionless.

Of course, when shaft 18 is moved to the right, mandrel 43 moves accordingly, with its right terminus extending further through the aperture in stop plate 49 and pushing arm 46 to the right against the tension of spring 50. Although the displacement of disk 19 has been shown in dotted outline, it will be understood that mandrel 43 and arm 46 are also displaced, but the latter displacement is not illustrated since that will readily be understood from this description.

While shaft 18 and mandrel 43 are motionless the strands 72 may be adjusted through guides 71, over mandrel 43 and braided into slot 74. After this preliminary adjustment, handle bar 81 is manually pushed downwards and maintained in that position by the operator by means of grip 83. When recess surface 79 is disengaged from tapered periphery 80, the action of spring 50 causes arm 46 to move back against stop plate 49 while recess 52 causes mandrel 43 as well as shaft 18 to move toward the left. This action also moves disk 19 to the left and brings flat section 21 into frictional engagement with continuously rotating drum 24 whereby disk 19, shaft 18 and mandrel 43 are caused to rotate.

As shaft 18 and mandrel 43 begin to rotate, the feed mechanism actuated by rotating screw shaft 53, winds the strands on the rotating mandrel while grip 83 is held continuously by the operator. An L-shaped stop arm 84 connected to arm

14 of frame 13 is provided whereby the movement of brake arm 78 away from brake drum 77 is limited. When the desired number of passes of strands on the rotating mandrel is completed, handle bar 81 is released. The action of spring 82 causes brake arm 78 to move back to engage brake drum 77 whereby the rotation of shaft 18 and mandrel 43 as well as that of shaft 53 and carriage 55 is stopped.

After the strands have been suitably wound upon the mandrel, and the machine has been stopped, handle 48 is moved manually to the right releasing the terminus of mandrel 43 which can now be pulled from the socket section 42 of shaft 18. The windings are then manually removed from the mandrel, this manipulation being fairly simple since the impregnated strands have some degree of stiffness which permits them to retain their helical coiled shape.

After the helical coil 85 of strands are removed, it may be curved manually so that a narrowed end 86 where the windings covered section 76 of mandrel 43 is turned toward the slightly wider end 87 of the windings which covered the wider section 75 of mandrel 43. This is illustrated in Fig. 7. The small end is inserted into the larger end and the coil strands are then pressed into a flat disk 88 as shown in Fig. 8. This flat disk is then cured under elevated temperatures and pressures to form the finished friction facing in the form of clutch friction disk. Alternatively, as the windings come off the mandrel as a straight coil they may be pressed flat in a longitudinal strip which can then be cured and subsequently cut into shorter lengths to form friction facings for brake linings.

For differing qualities and types of friction facings where the density and distribution of the strands are to be varied, changes may be made in the gear ratio between mandrel 43 and worm gear shaft 53 so that the strands are wound upon the mandrel at different rates. Also by changing the pitch of the helical recesses on shaft 53, the speed of traverse of carriage 55 may be changed in order to distribute the strands upon the mandrel at a different angle.

It will be understood that modifications may be made in the design and arrangement of parts without departing from the spirit of the invention.

I claim:

1. A strand winding machine comprising a rotating mandrel, a shaft connected to and rotated in conjunction with said mandrel, helical screw recesses on said shaft, a carriage, means connecting said carriage to said helical recesses whereby said carriage is moved from one end of said shaft to the other when said shaft rotates, a pair of upwardly extending arms on said carriage, a recess in the top of each of said arms, a shaft nested horizontally and freely rotatable in said recesses, a series of spaced apart guides on said horizontally and freely rotatable shaft, said guides being adapted to pass a plurality of strands in a spaced apart relation towards the rotating mandrel, said horizontally and freely rotatable shaft being removable from said recesses.

2. A machine according to claim 1 and further comprising a notch in one end of said mandrel adapted to accommodate and hold a braid of the ends of said strands whereby said strands may be pulled through said guides while being wound around said mandrel.

3. A strand winding machine comprising a motor, a first shaft rotated by said motor, a mandrel connected to and rotated by said shaft, a second shaft connected to and rotated by said first shaft, helical screw recesses on said second shaft, a frame, a carriage on said frame and movable thereon longitudinally with respect to said mandrel and said second shaft, a key in said carriage, said key engaging said helical screw recesses whereby the rotation of said second shaft causes said carriage to move back and forth longitudinally on said frame and parallel to said mandrel, a pair of upwardly extending brackets connected to said carriage, a recess in the top of each of said brackets, a horizontal shaft adapted to be rotatably supported in said recesses, and a plurality of channels on said horizontal shaft between which a plurality of spaced-apart strands may be fed to the mandrel as the latter rotates.

4. A strand winding machine comprising a rotatable shaft, a mandrel connected on one end to and rotated by said shaft, a disk mounted on said shaft and rotating therewith, said disk having a flat annular portion, a normally rotating drum whose peripheral surface frictionally engages said flat portion of said disk to rotate said shaft, a motor connected to and driving said drum, said shaft being slightly movable longitudinally, a brake drum on one end of said shaft, said brake drum having a tapered peripheral surface, a pivoted brake arm, said arm adapted frictionally to engage said tapered surface, a spring connected to said arm normally holding said brake in contact with said brake drum, whereby said shaft is urged longitudinally to move said disk and accordingly said annular portion of the disk out of engagement with said drum thereby stopping the rotation of said shaft, said brake arm being movable to release said brake drum, whereby said shaft may be urged back to a position where said annular portion of said disk is frictionally engaged by said first mentioned drum.

5. A machine according to claim 4, and further comprising a stop plate, the other end of the mandrel being engaged by a recess in said stop plate, said other end being movable in and out of said recess, and the means of urging the return of said shaft to the rotating position comprising a lever arm associated with said stop plate, and a spring connected to said lever arm, said arm being caused by the tension of said spring to urge said mandrel and said shaft back to the rotating position.

6. A machine according to claim 5, and further comprising a second shaft connected to and rotated by said first shaft, a helical screw on said second shaft, a carriage mounted on said second shaft keyed into said screw for moving said carriage longitudinally and parallel to said mandrel, a guide on said carriage, and a plurality of channels in said guide adapted to feed a plurality of spaced apart strands to said mandrel as the latter rotates.

7. A machine according to claim 6 wherein said guide comprises a freely rotatable shaft and a plurality of spaced apart disks connected to said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,498,011	Belz	June 17, 1924
2,092,811	Moncrieff et al.	Sept. 14, 1937
2,519,461	Hanson	Aug. 22, 1950