A tension arbor is provided with a shaft fixedly maintained into a support. A shell arbor is rotatable mounted thereon having a flange member engaging a coil to be unwound to insure accurate alignment. A cam rod forces a gripper member through an opening to engage the spindle of sheet material to be unwound. A coiled spring urges a friction plate to engage a face plate so that repeatable tension is achieved during each unwinding. The amount of tension can be dialed for ease in operation.
CALIBRATED TENSION ARBOR

BACKGROUND

In the production of rolled electrolytic capacitors, spools of metal, usually film forming metal such as aluminum, and spools of an absorbent material such as paper are unwound and then suitably rolled up in order to form the capacitor body.

According to a previous procedure the operator was required to unscrew a knurled nut to release or reduce pressure devices or grippers from an arbor in order to reload the material on spindles. This operation required the judgement of the operator to determine the correct tension, thus some error was introduced by errors in judgment. Furthermore, when a new operator was put to work it took some time for him to learn the correct tension and considerable scrap occurred during his learning period.

Moreover, in order to obtain uniformity of product in the capacitor body, previously the operator had to adjust tension on all of the material supply spools, often totaling six in number. In the operator failed to achieve desired tension in the arbor, some of the following defects would occur. Shorted capacitors resulted often due to trapped wrinkles in the foil or paper. Also inconsistent capacitance rating sometimes occurred. This could result in shipment delays.

Furthermore, often cartridges are not wound as tightly as is required and thus when they were forced into containers, an unsatisfactory device maybe obtained which may have to be scrapped.

It is also recognized that in addition to the production of convolutely wound or rolled capacitors, similar problems regarding lack of uniformity of tension exist in the winding and unwinding of metal and/or plastic sheets in the production of a wide variety of products, such as winding a pre-formed spool, for example in automobile alternator coils.

OBJECTS

It therefore is an object of the present invention to provide a device which will insure a substantially uniform tension as strip or sheet material is wound into devices.

It is another object of the present invention to provide a readable tension scale which is not dependent upon the skill and experience of the operator.

It is another object of the present invention to provide a tension system which results in an improved quality capacitors.

It is another object of the present invention to provide a tensioning system which is reproducible.

It is another object of the present invention to provide a tensioning system which reduces scrap.

Other objects will be apparent from the following description and drawings.

DRAWINGS

FIG. 1 is a perspective view of the tension arbor of the present invention.

FIG. 2 is a sectional view along the lines 2—2 in FIG. 1.

FIG. 3 is a view along the lines 3—3 in FIG. 2.

FIG. 4 is a view along the lines 4—4 in FIG. 2.

FIG. 5 is a perspective view of the use of a plurality of tension arbors in the winding of a device according to the present invention.

DESCRIPTION

In accordance with the present invention a tension arbor 100 comprises a fixed shaft 70 which may be made for example of steel or high strength copper base alloy which is cantilever mounted into a frame F, through an opening O, by means of conventional fasteners such as threads and nuts 19.

Upon the shaft 70 is mounted the shell arbor 60. The shell arbor is mounted by means of bearings 15 and 16 so that rotation may occur about the shaft. Fasteners such as 17 engage rod members 18 to aid in the support of the shell arbor 60 and hold in place a face plate 63. Arbor 60 is provided with a flange member 64 having a shoulder thereon 65. A core 20 of a coil of material C is generally of a thickness approximately equal to the height of flange 65. Thus the coil can be located against flange 65 during loading and operation of the tension arbor 100.

In order to provide a means of gripping the material coil core, a gripper plate 80 is provided in an elongated opening 61 of shell arbor 60. The gripper plate 80 is supported by a cam rod 81. The cam rod has at its opposite end off-center bearings 81'. One of the bearings 81' extends into a groove 62 and is provided with a lever 82 for rotation of cam rod 81. In order to move the gripper plate 80 in place to fixedly hold the material coil C on shell arbor 60, lever 82 located in groove 62 is moved in the direction indicated by the arrow in FIG. 3 to move cam rod 81 into the position shown in FIG. 4 and in engagement with gripper plate 80. The material coil C, after unwinding, may be released by rotating lever 82 in the opposite direction of the arrow of FIG. 3 within groove 62. Obviously the particular directions shown could be reversed.

As indicated above, a face plate 63 is attached to shell arbor 60 by any conventional material and is designed for friction engagement. A wide variety of materials may be used for the face plate 63; for instance Asbestos with metal wires for strength and integrity is one exemplary material.

Friction plate 74 is carried by the shaft 70 and is secured against rotation with the face plate 63 by the cooperative relationship between dowel pin 72, threadedly received by the face plate, and groove 71 formed in the shaft 70.

A coil spring 73, compressively confined between nut 76 and friction plate 74, exerts pressure upon the friction plate 74 to bias the friction plate against the face plate 63. Rotation of the face plate 63 is impeded by the friction generated between the non-rotating friction plate 74 and the rotating face plate 63. This pressure may be varied in the conventional manner such as with the nut 76 rotated about thread 77. A scale 78 together with a pointer 79 may be utilized to assure a fixed tension upon reloading.

The material coil C may be any sheet or strip material such as plastic or metal. For example, it may be fiber or paper separator or a coil of electrode metal usually film forming for example aluminum. Often the separator material is subsequently impregnated with a liquid electrolyte.

The location of the side edge of material coil C of any suitable material such as, for example, the electrode and separator coils against shoulder 65 insures accurate alignment. This is important in capacitor manufacture since the separator material must extend beyond...
In operation, lever 82 is rotated in a direction opposite to the indicated direction of the arrow of FIG. 3 to the position shown in FIG. 3 to release and thereby allow removal of an empty material core which, for example, may be a tube. The empty core is slid off the arbor 60 and replaced with a new core carrying wound sheet or strip material, which may be any of the materials described above. The new core is installed to abut against flange 65. This is particularly important if accurate alignment during winding of an article of manufacture is required, as for example in staggered convolute winding of electrodes and separators.

The cam lever 82 is rotated clockwise until gripper plate 80 locks into place against the inside diameter of the new core to lock the core on the shell arbor 60. The tension on spring 73 is reset by means of nut 76 and scale 78 to the specified starting position.

Obviously, the setting may vary with different sheet or strip materials. But when for example the same electrode or separator material is used as was used previously, standard settings can be established for each material and guess work by the operator is largely eliminated.

If desired, the tension may be varied on the arbors during the winding operation. For example, the tension may be reduced during the winding operation as the material coil is unwound.

FIG. 5 is a view showing the production of a convolutely wound capacitor 110. Electrodes 111 and 112 are unwound from rolls 141 and 142 respectively, and separator material, used to separate the electrodes 111 and 112, is unwound from rolls 180 and 190. In each case a calibrated tension arbor 100 is utilized according to the present invention. Roll 222 or other suitable means is used to supply power to cause the winding of convolutely wound capacitors 110 during the winding operation. The use of the tension arbors 100 insures that uniform and repeatable tension and accurate alignment is obtained in capacitor 110.

It will be apparent that the arbor of the present invention as useful not only in the manufacture of capacitors, but wherever repeatable winding of materials is a wound article is desired.

What is claimed is:

1. Arbor means for controlling the tension of material to be unwound from coil means adapted to be carried by the arbor means, the arbor means including shaft means attached to a support means, rotatable shell means supported by the shaft means and having an elongated opening, the shell means adapted to carry the coil means, gripper means movable through the elongated opening of the shell means to engage with and retain the coil means on the shell means, means for moving the gripper means into and out of engagement with the coil means while the shell means is stationary, and tension applying means cooperatively associated with the rotatable shell means for controlling the tension applied to the material adapted to be unwound from the coil means.

2. The arbor means of claim 1, wherein the gripper means includes displaceable lever means and cam means, the lever means connected to the cam means to move the cam means into and out of engagement with the coil means.

3. The arbor means of claim 1, wherein the tension applying means includes means having a friction surface for applying a force to the rotatable shell means to regulate the tension of the material adapted to be unwound from the coil means.

4. The arbor means of claim 3, including means carried by the shell arbor for positioning the coil means with respect to ends of the shell means.

5. The arbor means of claim 4, wherein the means for positioning the coil means includes flange means at the end of the shell means which project beyond the radial extent of the shell means.

6. The arbor means of claim 5, wherein the flange means has a radial extend substantially equal to the radial extent of the core means adapted to be carried by the shell means.

7. Arbor means for controlling the tension of material to be unwound from coil means and adapted to be carried by the arbor means, the arbor means including stationary shaft means cantilevered from support means, rotatable shell means supported by the shaft means and adapted to carry the coil means, and tension applying means cooperatively associated with the rotatable shell means including friction generating means co-axial with means rotating with the shell means and means for moving the friction generating means into engagement with the means rotating with the shell means to control the tension applied to the material adapted to be unwound from the coil means.

8. The arbor means of claim 7, wherein the several means of the tension applying means and the shell means are substantially coaxial with the shaft means, and wherein the radial extent of the several means of the tension applying means are equal to or less than the radial extent of the shell means.

9. The arbor means of claim 8, wherein the tension applying means includes means to regulate the tension applied to the material adapted to be unwound from the coil means.

10. The arbor means of claim 9, including gripper means to engage with and retain the coil means on the shell means while the shell means is stationary.

* * * * *
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,738,588 Dated June 12, 1973

Inventor(s) Clifton E. Ayers

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Abstract: Line 6, delete "the" and insert ---a---.

Line 8, delete "each", line 10, delete "in" and insert ---of---.

Col. 1, line 9, after "procedure" insert ---,---.

Col. 1, line 14, delete ";" and insert ---;---.

Col. 1, line 22, delete "In" and insert ---If---.

Col. 1, line 25, after "Also" insert ---an---.

Col. 1, line 28, delete "cartridges" and insert ---capacitor bodies---.

Col. 2, line 4, delete "comprises" and insert ---includes---.

Col. 2, line 4, after "70" insert ---,--- and then delete "which may be".

Col. 2, line 6, after "alloy" insert ---,--- and delete ---which is---.

Col. 2, line 6, delete "into a" and insert ---in---.

Col. 2, line 12, after "as" insert ---at---.

Col. 2, line 20 delete "of" and insert ---for---.

Col. 2, line 37, delete "material" and insert ---means---.

Col. 2, lines 39 and 40 delete "Asbestos" and insert ---asbestos---.

Col. 2, line 58, after "example" delete the ",".

Col. 2, line 58, after "be" insert ---a---.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION
Patent No. 3,738,588    Dated June 12, 1973

Inventor(s) Clifton E. Ayers

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 59, after "metal" insert ---foil---.
Col. 2, line 65, delete "insures" and insert ---help provide---.
Col. 2, line 67, delete "must" and insert ---should---.
Col. 3, line 9, delete "slid off" and insert ---removed from---.
Col. 3, line 15, after "staggered" insert ---,---.
Col. 3, line 32, delete "production" and insert ---manufacture---.
Col. 3, lines 41 and 42, "insures that" should read -- helps provide --.

Col. 3, line 43, delete "is obtained".
Col. 3, line 45, delete "as" and insert ---is---.
Col. 3, line 46 delete "is" and insert "as".
Col. 4, line 26, delete "extend" and insert ---extent---.

Signed and sealed this 20th day of November 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMeyer
Acting Commissioner of Patents