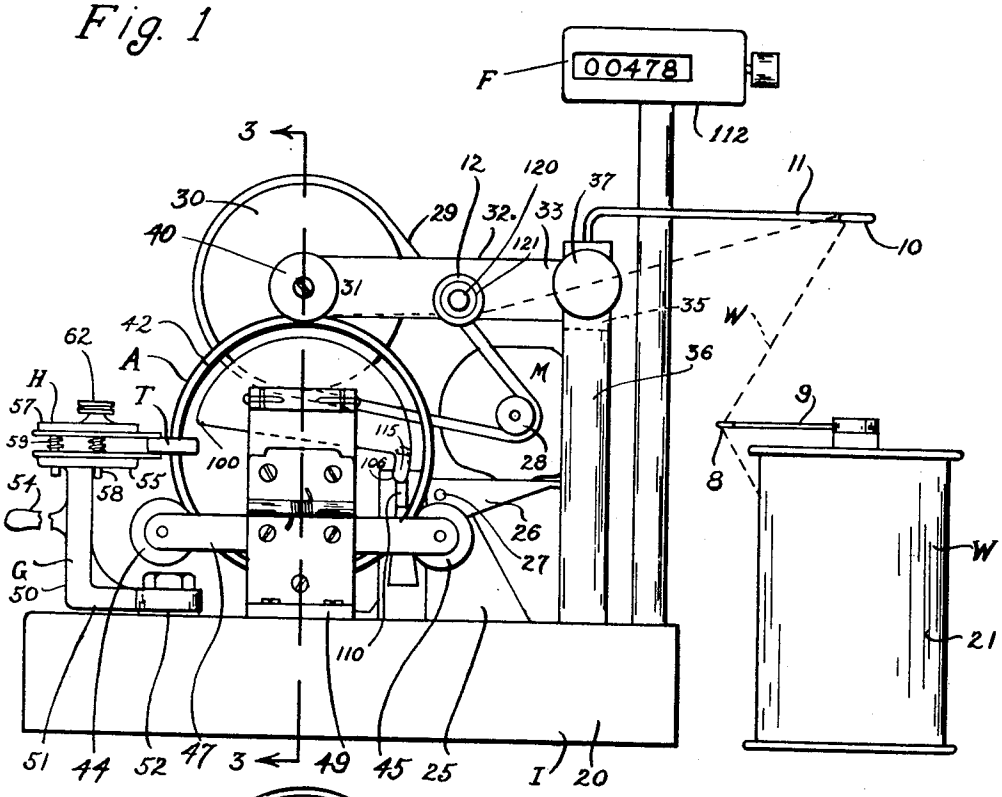
Oct. 22, 1957 E. R. MARSTERS 2,810,530

WINDING DEVICE

Filed Aug. 6, 1953

3 Sheets-Sheet 1

Fig. 1



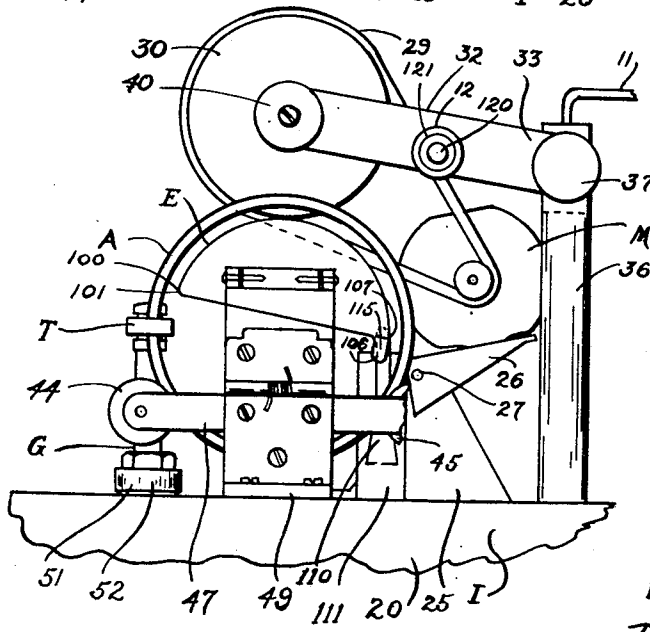


Fig. 2

INVENTOR.
ERNEST R. MARSTERS
BY
Pearson + Pearson
ATTORNEYS

Oct. 22, 1957 E. R. MARSTERS 2,810,530

WINDING DEVICE

Filed Aug. 6, 1953 3 Sheets-Sheet 2

Fig. 3

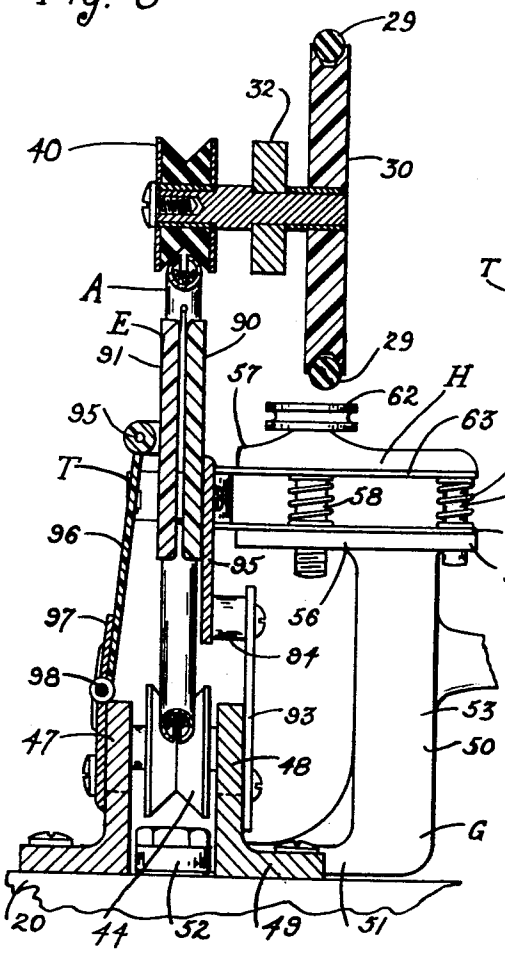


Fig. 4

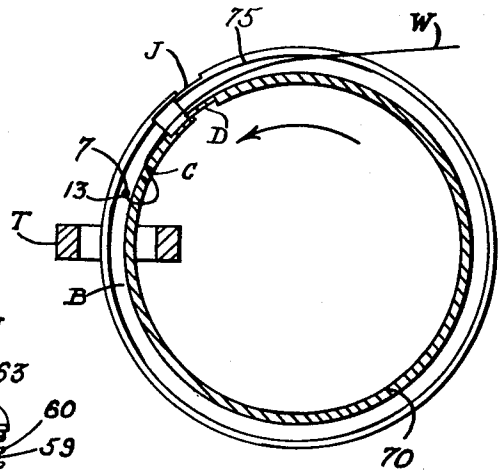


Fig. 5

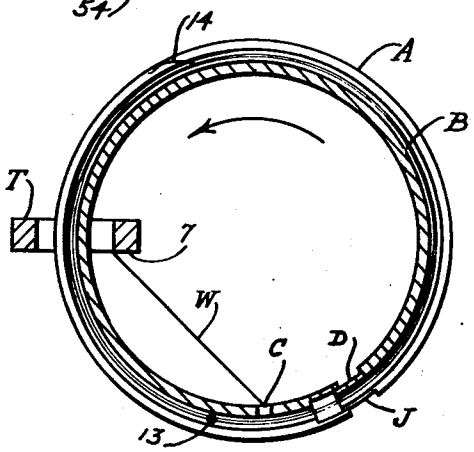
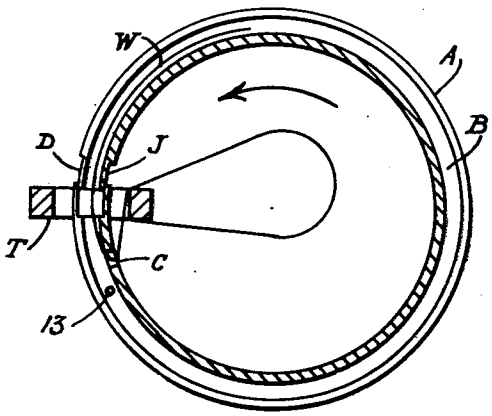


Fig. 6



INVENTOR.
ERNEST R. MARSTERS
BY
Pearson + Pearson
ATTORNEYS

Oct. 22, 1957 E. R. MARSTERS 2,810,530

WINDING DEVICE

Filed Aug. 6, 1953

3 Sheets-Sheet 3

Fig. 7

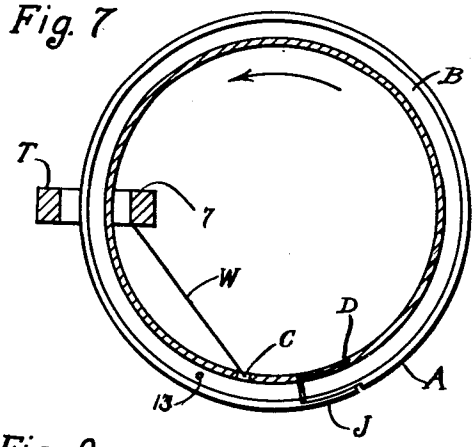


Fig. 8

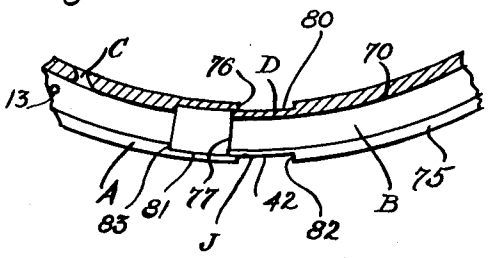


Fig. 9

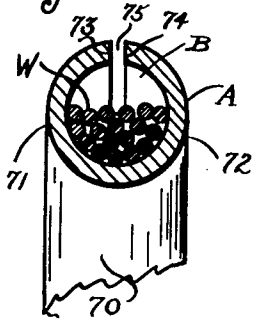
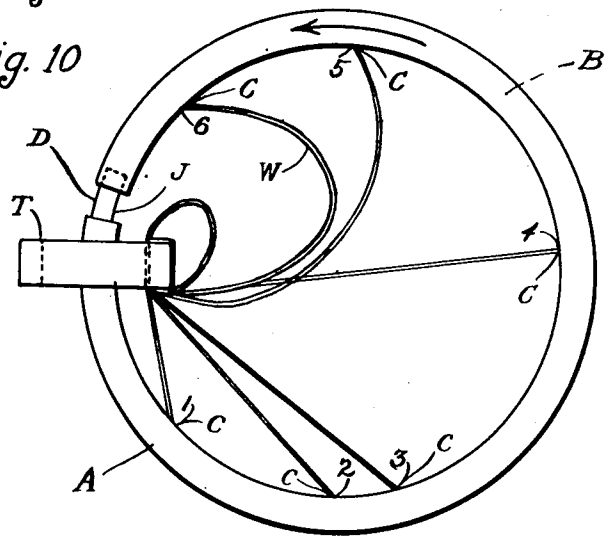


Fig. 10



INVENTOR.
ERNEST R. MARSTERS
BY
Pearson + Pearson
ATTORNEYS

United States Patent Office 2,810,53(
Patented Oct. 22, 195

2,810,530

WINDING DEVICE

Ernest R. Marsters, Bedford, Mass., assignor to Electro Devices Inc., Boston, Mass., a corporation of Massachusetts

Application August 6, 1953, Serial No. 372,730

10 Claims. (Cl. 242—4)

This invention relates to machines for winding strand material about an annular core which is closed upon itself and more particularly for winding wire upon a toroidal type core to produce electric coils of the toroidal type.

In machines of this type it is necessary that the strand material or wire to be wound on the core can be stored on a device which may pass through the space or hole enclosed by the core in order that the strand may be properly wound. It is also necessary that some means be provided to maintain tension at some or all times between the wire applied to the core and that being fed or withdrawn from the storage device.

Heretofore many machines have been proposed for accomplishing such purposes with varying degrees of success on cores of large inside diameters but have not been satisfactory for cores with an inside diameter of one eighth of an inch or less, and most such devices require a considerable number of steps in their operation. Some of these steps require taking apart the ring in which the wire is stored and from which it is delivered and their storage capacity is so limited that their store of wire must be very frequently renewed.

This invention has as its principal purpose to provide a toroidal coil winding machine which is of simple construction, inexpensive to manufacture, of large storage capacity and in which the wire can very quickly be wound directly on or in a storage ring or shuttle of very small cross section, the shuttle having a smooth outer surface and no parts to remove when winding on, or feeding out, the wire.

Another object of this invention is a coil winding machine in which the wire is wound round a core under controlled tension by novel means integral with the ring or shuttle and not decreasing the storage capacity of the shuttle.

A further object of the invention is to provide a ring, or shuttle, for winding toroidal coils, in which the storage compartment extends continuously therearound, and is almost as large in cross sectional area as the area of the hole in the core and on which the outside surface of the ring or shuttle has no attachments or projections to decrease the area available for the storage compartment.

To accomplish these objects, the device comprises a split ring or shuttle of substantially tubular cross section with an outside continuous slot through which the wire is wound and stored on the hollow inside. The ring is supported by idler supporting pulleys which engage its outer periphery and there is a drive pulley, preferably carried by a pivoted drive pulley arm. These pulleys are

preferably grooved like sheaves and confine the wire i the outer storage compartment inside of the ring.

The ring or shuttle is resilient and is split laterally, a which split there is preferably a telescopic joint, and o the inner periphery of the shuttle a wire delivery apertur is positioned, preferably near the joint. The tension o the strand between the core and the aperture, when wind ing a core, tends to draw the split ends together and tele scope the joint thereby contracting the circumferenc of the ring or shuttle. A predetermined length of th strand sufficient to form one turn around a cross sectio of the core, is thus delivered under controlled tensior

The principal feature of this device is the eliminatio of the delivering of a strand from the outside or side o the ring or the storing of a strand as an helical coil in non continuous circumferential compartment or on bobbin inside the ring. A continuous strand may be firs wound as a spiral with successive overlying circular turn passing through a slot in the unobstructed surface of th outer periphery of a ring whose cross section is substan tially tubular and the outside diameter of which can b only a little less than the inside diameter of the core. B forming the inside of the groove or storage compartmen in the ring, with a smooth surface and storing the stran as a continuous spiral, the ring can deliver or feed out th wire to the core from the inside of the ring by causin the whole spiral coiled strand to slip around in the groov or storage compartment intermittently as the wire i pulled out at each turn around the core.

In winding the wire or strand through the peripher slot and into the tubular storage compartment of th shuttle, the split, resilient shuttle is in its normal expande condition. The wire or strand is wound around th shuttle under such tension as to prevent kinks, coils an twists, thereby forming a compact continuous spiral coil but the tension is not sufficient to contract the shuttle t its minimum circumference. Thus the coiled strand i retained under control and in frictional engagement wit the inside of the storage compartment until a pull on th strand contracts the shuttle and permits the coiled portio to slip around the compartment.

A slack take-up means is provided in the form of fric tion plates which are preferably two half discs of trans parent material facing each other inside the upper hal of the hollow portion of the ring, one or both plates bein spring pressed together. The terminal tips of the plate which are near the core are a little above it so that th loop of slack wire, pressed between the plates, will b released at said tips just as the strand again becomes tau in the next cycle of rotation.

By providing a special downwardly and outwardly ex tending guide from the opposite terminal tip of one o the friction plates and a pivoted trip finger extending int it, this finger acts as the contact arm of a switch to ope and close a shunt circuit to an electric counter to coun the turns on the core.

In the drawings, Fig. 1 is a side elevation of a pre ferred embodiment of the invention.

Fig. 2 is a fragmentary similar view but with some o the parts in different positions.

Fig. 3 is a front elevation of the device shown in Figs 1 and 2, on a larger scale and in section on line 3—3 o Fig. 1.

Fig. 4 is a diagrammatic side elevation in section o the preferred form of ring or shuttle at the commence ment of winding a continuous strand in overlying turns

into the storage compartment, or peripheral groove thereof, and with the delivery aperture leading the split, telescopic joint.

Fig. 5 is a view similar to Fig. 4 showing the ring or shuttle, turned through an angle of 180°, showing the coiled strand stored within the peripheral groove, showing the strand delivery aperture trailing the split, telescopic joint and showing the inner terminus of the strand affixed to the core.

Fig. 6 is a view similar to Fig. 4 showing that instead of turning the shuttle through 180° to unwind the shuttle and wind the core it is possible, but not desirable, to unwind without such turning and with the aperture leading the split telescopic joint.

Fig. 7 is a view similar to Fig. 5 showing the preferred position of the shuttle for unwinding with the aperture trailing close behind the split telescopic joint in the path of rotation of the shuttle and showing the strand at the point in its path when it first causes the shuttle to contract, causes the stored coil to slip around in its compartment and causes a predetermined length thereof to be drawn through the aperture.

Fig. 8 is a fragmentary, enlarged, side view in section, of the shuttle illustrating the preferred configuration of the telescopic joint and the preferred substantially tangential direction of the aperture therein.

Fig. 9 is a fragmentary, enlarged, front view in section of the preferred cross sectional shape of the shuttle of the invention, and

Fig. 10 is a diagrammatic view, similar to Figs. 5 and 7 showing the various stages of winding one turn around a cross section of a core with the shuttle of this invention, including the friction plates, although the latter are not illustrated.

A typical embodiment of this invention is shown in Figs. 1 and 2 wherein the core winding apparatus I includes a base **20** above which the winding mechanism and counting mechanism is supported. Also shown is a spool **21**, carrying a supply of the wire or strand W to be wound around a core to form a toroidal coil T.

An upstanding bracket **25** is fixed to base **20** and provided with a supporting arm **26**, pivoted to bracket **25** at **27**, for supporting an electric motor M. Motor M is provided with a drive pulley **28**, around which a drive belt **29** is trained, the belt **29** being in turn trained around a larger pulley **30** journalled at the free end **31** of an arm **32**. Arm **32**, at its opposite end **33**, is carried in a slot **35** at the top of an upstanding post **36** fixed to base **20**. A knurled set screw **37**, forms a pivot for the end **33** of arm **32** and may be tightened in a well known manner to fix the arm **32** at various angles to post **36**. As indicated in Fig. 2, motor M and drive pulley **28** function as a weighted tension pulley for drive belt **29** since the weight of the motor urges the motor in a clockwise direction around the pivot **27** of supporting arm **26** and being free to so rotate, maintains the belt under tension when arm **32** is lowered as in Fig. 1, or raised as in Fig. 2. A smaller pulley **40** is also journalled at the free end **31** of arm **32**, to revolve with the larger pulley **30** and is preferably of the grooved sheave type to enable it to frictionally engage the outer periphery of the ring or shuttle A and drive the same.

The ring or shuttle A is preferably of one piece of material, such as metal and is annular in shape whereby it is unconnected to, and unsupported at, the centre of rotation thereof. It is provided with a split at **42** enabling it to be slightly distorted to permit its insertion in the hole or space encircled by the closed annular core T which core is to be wound with strand W to form a toroidal coil. In this invention, the ring or shuttle A instead of being supported around its inner periphery as in former winding devices, is supported by at least two idler pulleys, **44** and **45**, each being grooved to engage and retain the outer periphery of the ring while permitting the ring to be revolved by drive pulley **40**. Preferably idler

pulleys **44** and **45** are each journalled at an opposite end of, and between, a pair of cross bars **47** and **48**, each cross bar being supported by a centrally disposed bracket portion such as **49** at a fixed height above base **20**.

Supporting mechanism G for holding a closed annular core such as T in various positions of traverse is provided, and preferably includes a carrier member **50**, having its lower leg **51** pivotally mounted at **52** to the base **20**. An upstanding portion **53** of member **50** is provided with a handle **54** and the upper leg **55** of member **50** constitutes the lower jaw **56** of a clamp H. The upper jaw **57** of clamp H includes a threaded element **58**, threadedly engaged in the lower jaw **56** and a guide pin **59** slidably engaged in lower jaw **56** at the rear thereof. Coil springs such as **60** may encircle both pin **59** and element **58** for lifting the upper jaw when the knob **62** of element **58** is turned to unloosen clamp H. A pair of removable jaw plates **63** and **64** may also be provided, each movable with a jaw and both of the desired size to grasp cores of various sizes. As shown in Fig. 1 a core T may be clamped in the clamp H at the correct position for winding and gradually traversed on pivot **52** to another position such as that shown in Fig. 2, while ring A is progressively winding strand W around a cross section of the core.

As best shown in Figs. 4–10, the ring or shuttle A is a split, hollow, annular member, normally self-sustaining in substantially circular form but of resilient material, or otherwise inherently expandable, whereby it may be contracted to slightly less circumferential length and then expanded again to normal circumferential length. It is the essence of this invention that the strand storage means B, the strand delivery aperture C, and the strand tensioning means D are all integral with the one piece ring or shuttle A, whereby the shuttle may be of an especially small cross sectional area for winding cores of minute size such as one eighth inch inside diameter or considerably less.

The strand storage means B of the shuttle A includes an inner peripheral wall **70** spaced from the centre of rotation of the shuttle, unsupported thereon and unconnected thereto for supporting a plurality of overlying turns of the continuous strand W. Storage means B also preferably includes a pair of spaced apart, opposite side walls **71** and **72**, extending circumferentially around inner wall **70** and forming a strand receiving groove therewith for retaining the continuous turns of strand W. As best shown in Fig. 9, preferably the inner wall **70** and side walls **71** and **72** are bent into a tube of circular cross section with the free upper edges **73** and **74** of the side walls **71** and **72** spaced apart to form a winding slot **75**. A tubular strand storage compartment is thus formed, rather than merely a groove, the compartment extending continuously around shuttle A with one open end **76** thereof facing or overlapping the other open end **77** thereof at the split **42**.

The strand delivery aperture C, unlike previous winding machines having a strand wound continuously, entirely around an annular shuttle, is positioned in the inner periphery of the shuttle A, and extends through the inner wall **70** intermediate of the side walls **71** and **72**. Preferably the aperture C extends substantially tangentially through the inner peripheral wall **70** of shuttle A, rather than radially thereof and is located proximate the split **42**. As best shown in Fig. 8 a strand being delivered through aperture C from the direction of joint J, is thus guided at an obtuse angle rather than an acute angle to thereby prevent binding.

The strand tensioning means D, of the shuttle A functions because of the contractability and expandability of the material of the shuttle, together with the positioning of the aperture relative to the split **42** therein. As shown in Figs. 1 and 4, the free end **7** of the continuous strand W is led from spool **21** through the eye **8** of a rotating traveler **9**, thence through a guide eye **10** on a

guide wire **11**, thence under a tension clip **12** on arm **32**. The end **7**, as best shown in Fig. 4, is then passed through slot **75** in the outer periphery of shuttle A, then out of the storage compartment through aperture C in the inner peripheral wall **70** of shuttle A and then is anchored in a transversely extending hole **13** in the shuttle A. Shuttle A is then revolved counterclockwise by motor M until a predetermined length of the strand W has been wound around shuttle A in the tubular storage compartment of storage means B. The strand W is then cut off leaving a terminal end **14**, and the shuttle A at this time contains a plurality of overlying turns of the continuous strand W sufficient to wind the core T. The shuttle A is, of course, wound or filled in its normal expanded condition, although preferably it is wound under slight tension sufficient to contract it imperceptibly. Upon completion of the winding, the shuttle then tends to expand slightly and thereby locks the coils of strand W in place in the shuttle A. Prior to winding or filling the shuttle, as above described, the shuttle is expanded or distorted sidewise at split **42**, one end thereof such as **76** is passed through the hollow space of the closed annular core and the shuttle is returned to its normal annular shape.

As shown in Fig. 6, without moving the shuttle A after filling the same and after cutting off the end **14** from the spool **21**, the end **7** of strand W could be removed from transverse hole **13**, attached around a cross section of core T and motor M again started. However, as illustrated, the aperture C would then be leading the split **42** in the counterclockwise path of rotation of the shuttle causing the strand W to bend back upon itself as it wound around core T, thereby possibly binding at aperture C.

It is therefore preferred that after the shuttle A is filled, the arm **32** be raised to free the shuttle from its supporting and driving means, and the shuttle revolved around a vertical axis into the position shown in Figs. 5, 7 and 10. The arm **32** is then lowered and the shuttle A is so positioned that the aperture C trails the split **42**, proximate the same, in the path of rotation of the shuttle.

Returning now to the strand tensioning means D of shuttle A, the split **42** is most coil winding machines is formed by shuttle ends which abut one upon the other. Such a construction obviously would not permit contraction of the shuttle. I have discovered that the ends of the shuttle at the split, if shaped to abut must be spaced apart to form a gap whereby upon contraction the gap may close but that such a construction is not desirable since the lack of a bridge across the gap may cause the coiled strands to lack support, bend or become distorted.

It is possible to bridge the gap with a single extension of the inner peripheral wall **70** extending from one open end **76** of shuttle A to overlap the inner peripheral wall **70** of the opposite end **77** and it is possible to provide a pair of oppositely disposed extensions of wall **70**, each overlapping the other to bridge the gap. However, as best shown in Fig. 8, I prefer to provide a telescopic joint J at the split **42** in the one piece resilient shuttle A as part of the strand tensioning means D.

An integral substantially tubular extension **80** is provided at one open end of shuttle A, turned down to slidably fit within a substantially tubular recess **81** bored within the opposite end of the shuttle A, there being a shoulder at **82** and a shoulder at **83**. Thus without decreasing the area of the storage means B, the shuttle A may contract and expand at split **42** without danger of lack of support for the overlying turns of strand W and without danger of distortion of the shuttle A.

In winding a core T, as indicated in Figs. 5, 7 and 10 the end **7** of strand W is attached around a cross section of the core and the shuttle A is revolved with the aperture C trailing the telescopic joint J. The pull of strand W tangentially through aperture C as the aperture moves along points **1**, **2** and **3** in the path of rotation, causes the inner, or underlying, turns of the strand W in storage

means B to tighten, thereby contracting the circumferei of the shuttle and telescoping the joint J. The turns the strand W are thus released of their frictional enga ment with the inside walls of the storage groove, or co partment, and slip around therein to feed or delive length of strand through the aperture C.

Upon reaching the point of maximum distance fr core T, such as at **4** in Fig. 10, a predetermined len of the strand will have been drawn through the apert and the tension on the strand thereupon releases wh slack commences to appear in the delivered portion the of. Release of the strand tension permits the resili shuttle to again expand, spreading the telescopic joint and again locking the overlying turns of strand W ir frictional engagement with the inside walls of stora means B. As aperture C and joint J continue along t path of rotation of shuttle A, past points **5** and **6** there slack increases as indicated in Fig. 10. Upon passi through the core T, the delivered portion of strand completes its closed path around a cross section of t core and upon the aperture reaching points **1**, **2** or **3** the path of the shuttle, the slack is again eliminated a the turn around the core ceases to be loose. At abo point **3**, the delivered portion of strand W becomes ta and commences to exert tension on both the previo wind around the core, thereby tightening it, and up the coiled strand within storage means B, thereby ca ing the shuttle to again contract and the coiled strand slip therearound. The exact, predetermined length the strand W required to complete a new turn around cross section of core T, is then drawn or delivered fro aperture C, while joint J is telescoped and the shut then again expands at about point **4**. The cycle is r peated until all of the strand W in the storage compa ment of shuttle A has been wound around coil T, the ca rier member **50** being moved progressively, or as desire to cause the strand to be wound at the desired place core T. It should be noted that the free end **14** of stra W, and the coils thereof, cannot escape through slot of shuttle A, while winding a core since they are he in the compartment by drive pulley **40** and idler pulle **44** and **45**.

Preferably slack take-up means E is provided compri ing a semi circular plate **90** and a pivotally mount plate **91**, both preferably of transparent material. Ea plate **90** or **91** is positioned opposite to the other in t upper half of the hollow space within shuttle A. Pla **90** is immovably fixed above base **20** by any convenie means such as plate **93**, pins **94** and plate **95**, the latt being fixed to cross bar **48**. Plate **91** is hinge pivoted **95** to a supporting member **96** and member **96** is affix to a supporting member **97**, the latter being hinge pivot at **98**. A coil spring is provided at hinge **98** to contin ally urge plate **91** against plate **90** with a predetermine pressure exerted over the entire surface of the plat Preferably the terminal tips **100** and **101** of the adj cent ends of plates **90** and **91**, proximate the core T a in a slightly higher plane than the core T and than t opposite terminal tips **106**, **107**, as shown in Fig. 1. Th pressure plates **90** and **91** are thus in the two upper qua rants of the circular path of rotation of the shuttle, whe the strand W becomes slack, and tend to retard the loc formed in these quadrants as well as to press out ar coils or kinks created in the strand. The tips **100** an **101** release the gradually diminishing loop just as the loc is at its smallest extent and just as the aperture C reach points **1**, **2** or **3** on its next cycle of winding.

Counting mechanism F is preferably provided inclu ing a contact arm **110** of a micro switch **111**, the ar **110** being curved upwardly and outwardly and extendin across the path of the delivered portion of strand W b tween points **3** and **4** on the path of rotation of shutt A. Micro switch **111** is included in a circuit of we known type, which circuit includes the electric count **112** and a source of current not shown. Preferably a

utwardly curved ear **115** is provided at the terminal tip **06** of plate **91**, whereby the delivered portion of strand V upon riding up and around contact arm **110** is guided ack into the space between plates **90** and **91**.

Preferably the tension clip **12**, under which strand W ravels as it is led from spool **21** into the shuttle A upon inding or filling the shuttle, includes a knob **120** and graduated dial **121**, whereby the tension on the strand s it passes clip **12** may be set, controlled and adjusted n a well known manner.

The shuttle or ring A may be of any desired circumerential length but I have found it convenient to use a ircumferential length of twelve inches when the circumerential length of a single turn around a core is to be bout one inch. Thus each time the shuttle revolves, ne inch of strand will be withdrawn. With each revoution of the shuttle A, the electric counter will indicate uch revolution and if twenty-four turns are desired, the evice is stopped when the counter indicates the figure 4. Preferably at least two or three extra turns of strand V are wound into the storage means B of shuttle A than ill be needed to wind the core T, to assure that there ill be overlying turns thereof toward the end of the nwinding of the shuttle. Thus if it required six feet of trand to make the necessary turns around core T, at east nine feet of strand is stored in storage means B. he extra length of strand is broken off and discarded at he termination of the winding of a core T.

I claim:

1. A winding machine for winding strand material round annular closed cores including clamp means to old a core, said machine including an annular, resilient, ubstantially tubular, split shuttle normally expanded to orm a closed circle; a continuous outside slot around aid shuttle for receiving strand material spirally wound hereon; an inside strand delivery hole in said shuttle to eliver a strand through an annular core; tension means ncluding circumferential contractability and expandaility of said shuttle to control tension on the strand etween the inside strand delivery hole and a core; a pluality of pulleys supporting said shuttle only on the outide thereof; a drive pulley frictionally engaging the outide of the shuttle, and power means for revolving the rive pulley.

2. An annular, one piece shuttle, for winding toroidal oils, said shuttle comprising an inner peripheral wall f resilient material forming a closed figure capable of ircumferential contraction and expansion, said wall being paced from a center of rotation but unsupported therein, and unconnected thereto for supporting a plurality f overlying turns of a continuous strand; a pair of spaced part, opposite side walls, extending circumferentially round said inner wall and forming a strand receiving roove therewith for retaining the overlying turns of a ontinuous strand; rotatably mounted sheaves spaced round only the outside of said shuttle, at least one of hich is power driven, for engaging and supporting the uter periphery of said circular shuttle and revolving ie same about said center of rotation; a freely telecopable joint at a lateral split in said shuttle for retaing the closed and grooved configuration thereof during ircumferential expansion and contraction of said shuttle nd a strand delivery aperture extending substantially ngentially through said inner peripheral wall, between aid side walls, said aperture being positioned proximate aid telescopable joint whereby tension on a strand wound ontinuously around said shuttle and having an end proecting from said aperture tends to contract said shuttle t said joint and temporarily free the turns of said strand rom frictional retention by said shuttle.

3. In winding apparatus for winding strand material round a closed annular core, the combination of a split, ollow, annular shuttle formed of one piece of resilient aterial said shuttle having a normal circumferential ngth and integral strand storage means coextensive with the outer periphery thereof for supporting and frictionally retaining the overlying turns of an annular supply of an elongated strand continuously wound around said shuttle when said resilient shuttle is of normal circumferential length; a strand delivery aperture located in the inner periphery of said shuttle through which the inner turns of a strand wound around said shuttle may be withdrawn from under the overlying turns thereof; strand tension control means, including contractability of said resilient shuttle to less than normal circumferential length, for effecting the withdrawal of a predetermined length of said strand with each rotation of said shuttle, while simultaneously exerting controlled tension on the portion of said strand wound on a core during the previous rotation of said shuttle, and shuttle supporting and drive means, engaging only the outer periphery of said shuttle for supporting said shuttle and rotating the same around a fixed center of rotation.

4. A combination as specified in claim 3 wherein said strand tension control means includes a hollow, freely telescopable joint forming part of said strand storage means at the split in said resilient shuttle and the delivery aperture of said shuttle is positioned proximate and in rear of said joint on the path of rotation when unwinding said shuttle.

5. A shuttle for use in a toroidal core winding machine, said shuttle comprising a one piece closed ring of hollow, tubular resilient material normally expanded to a predetermined circumferential length but contractible to a lesser circumferential length and adapted to contain an annular supply of continuous strand wound therearound, a freely telescopable hollow joint at a single lateral split in said ring for maintaining the circumferential continuity thereof during expansion and contraction, a continuous slot extending completely around the outer periphery of said ring, including said joint, for receiving a strand for coiling in said hollow tubular ring and a strand aperture located in the inner peripheral wall of said tubular ring close to said joint for delivering a strand from within said ring, said ring being arranged to resiliently clamp said annular strand supply against rotation relative thereto when expanded but to permit relative rotation of said annular supply when contracted by the pull on the strand exerted through said strand aperture onto the underturns of said annular strand supply.

6. A shuttle as specified in claim 5 wherein the axis of said strand aperture is angled toward said joint to guide said strand at an obtuse angle out of said shuttle during delivery thereof.

7. An annular, split, resilient shuttle for toroidal core winding machines, said shuttle having a continuous external groove adapted to contain an annular strand supply wound therearound and being adapted to resiliently clamp said supply against relative rotation when the shuttle is in normal expanded condition and having an internal strand delivery aperture, said shuttle including a contractable joint at said split and being contractable circumferentially from its normal expanded condition to release said annular strand supply to rotation around said groove thereby permitting withdrawal of a length of strand from said aperture.

8. A shuttle as specified in claim 7 wherein said shuttle is of uniform circular, tubular cross section with an open, unobstructed peripheral winding slot extending continuously around a smooth, outer, peripheral face.

9. A shuttle as specified in claim 7 wherein at least one split end of said shuttle overlaps the other split end with a slideable, contractable fit when said shuttle is in said normal expanded condition.

10. A shuttle for toroidal coil winding machines, said shuttle comprising a ring of resilient material having a continuous annular external groove therearound for containing an annular supply of strand wound in overlapping convolutions and for resiliently clamping said annular supply against circumferential rotation within said groove

when said ring is in normally expanded condition and means for controlling withdrawal of strand from said groove while maintaining predetermined tension on said strand, said means including an internal feed aperture in said ring for permitting withdrawal of strand from beneath said annular supply and a freely telescopable joint at a split in said ring for enabling said ring to contract circumferentially under tension of strand exerted through said internal aperture, thereby unclamping said annular supply and enabling rotation thereof in said groove in the direction of feeding.

References Cited in the file of this patent

UNITED STATES PATENTS

1,555,756	Rauschenbach	Sept. 29, 19
2,171,119	Belits	Aug. 29, 19
2,185,883	Berger	Jan. 2, 19
2,366,977	Morrison	Jan. 9, 19
2,653,771	Turner	Sept. 29, 19
2,672,297	Harder	Mar. 16, 19
2,678,171	Critch	May 11, 19
2,704,637	Redlich	Mar. 22, 19