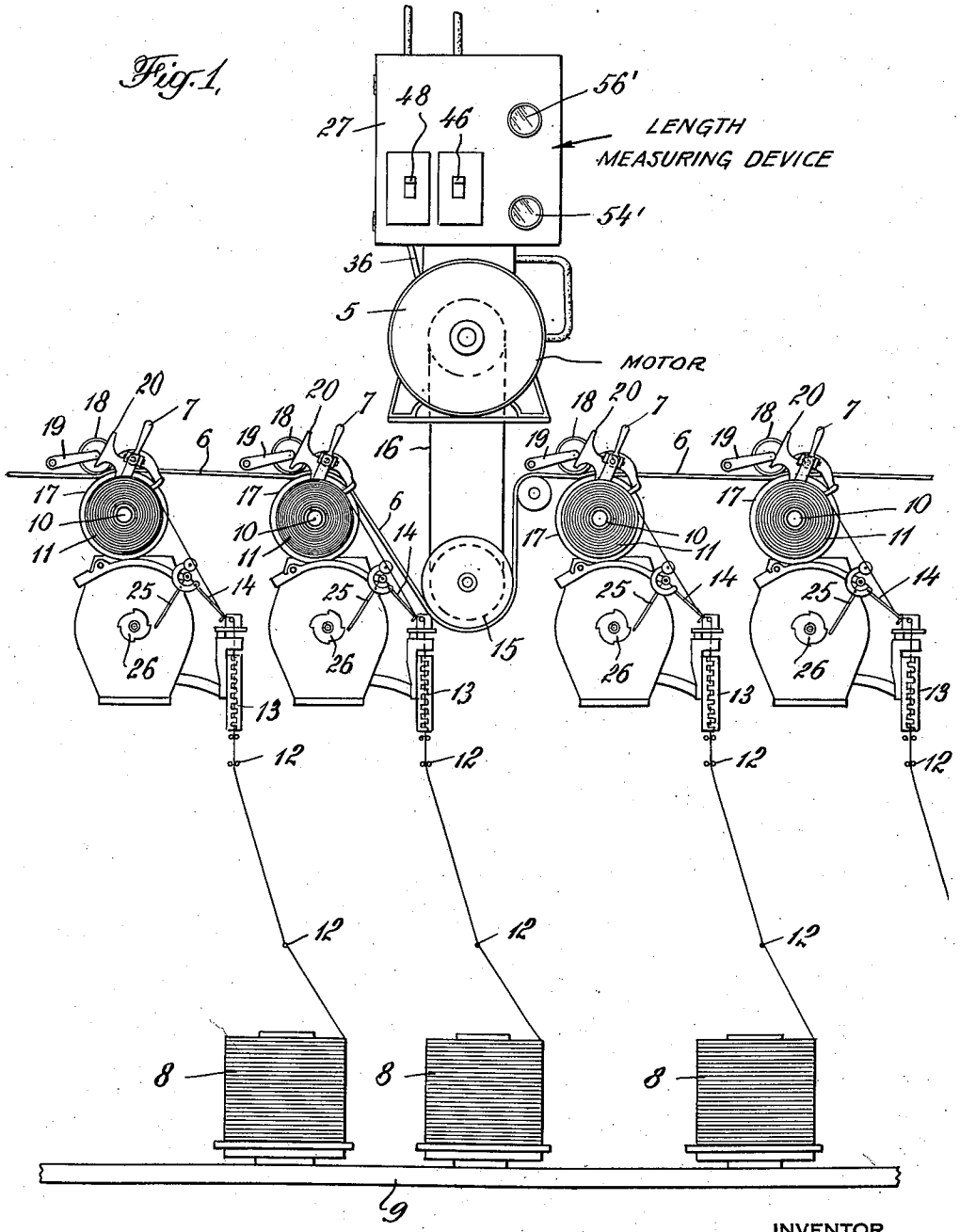
June 13, 1944. H. W. DOUGHTY, JR 2,351,411

THREAD WINDING APPARATUS

Filed Aug. 6, 1941 4 Sheets-Sheet 1

Fig. 1.



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THREAD WINDING APPARATUS

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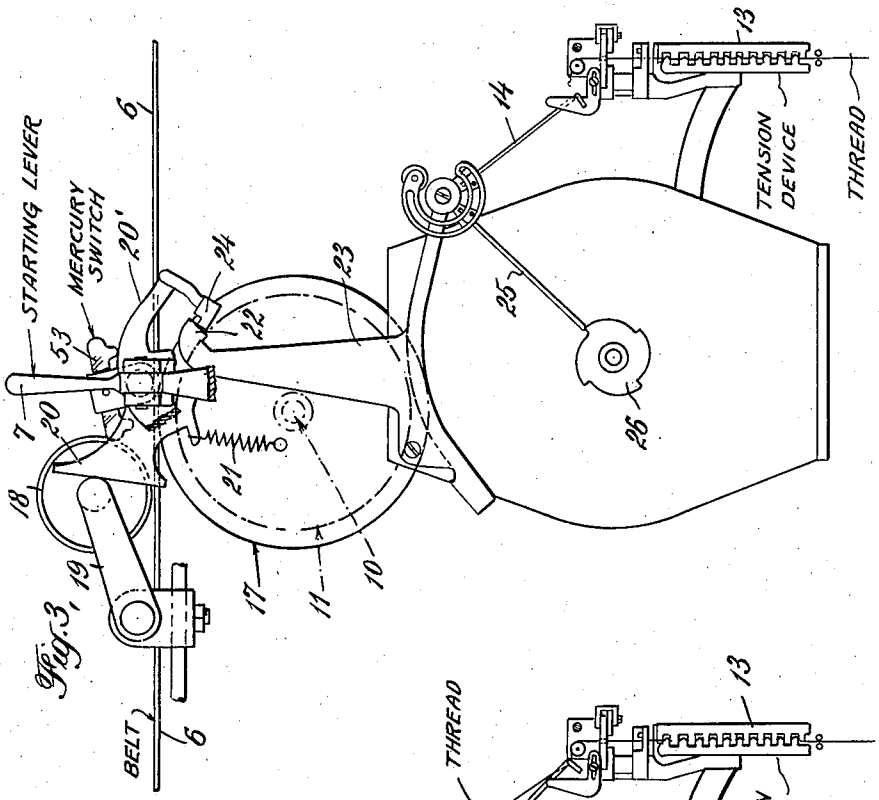


Fig. 3.

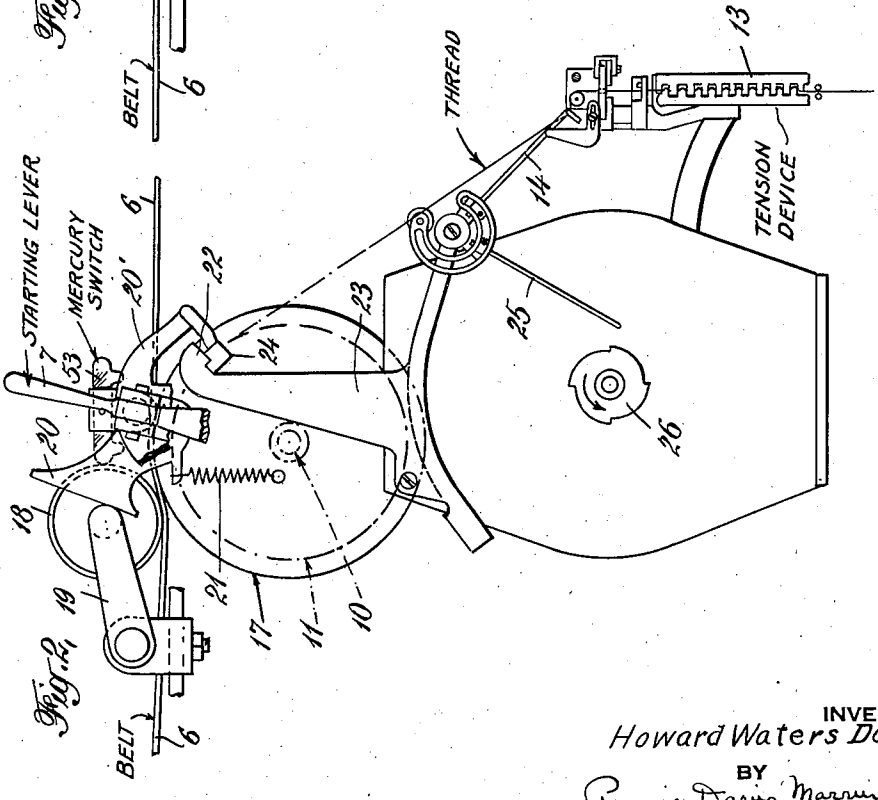


Fig. 2.

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THREAD WINDING APPARATUS

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Fig. 4,

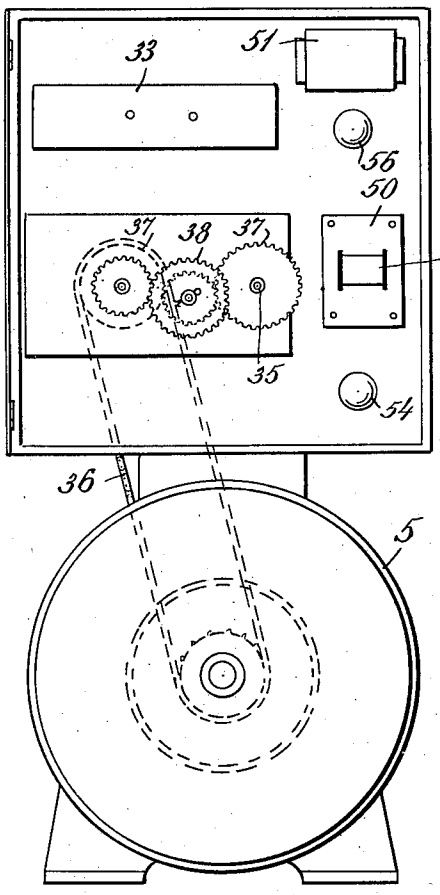


Fig. 5,

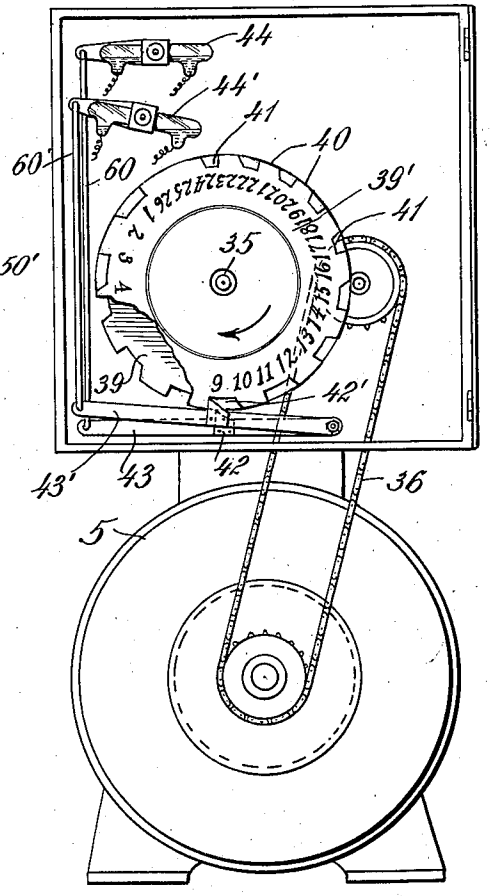
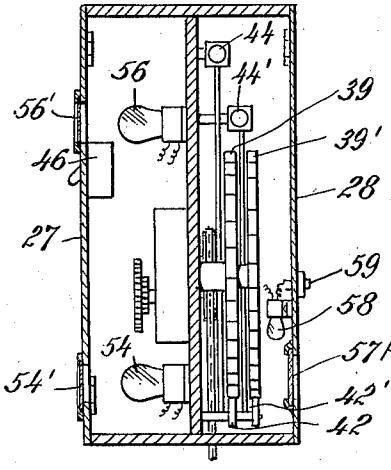


Fig. 6,



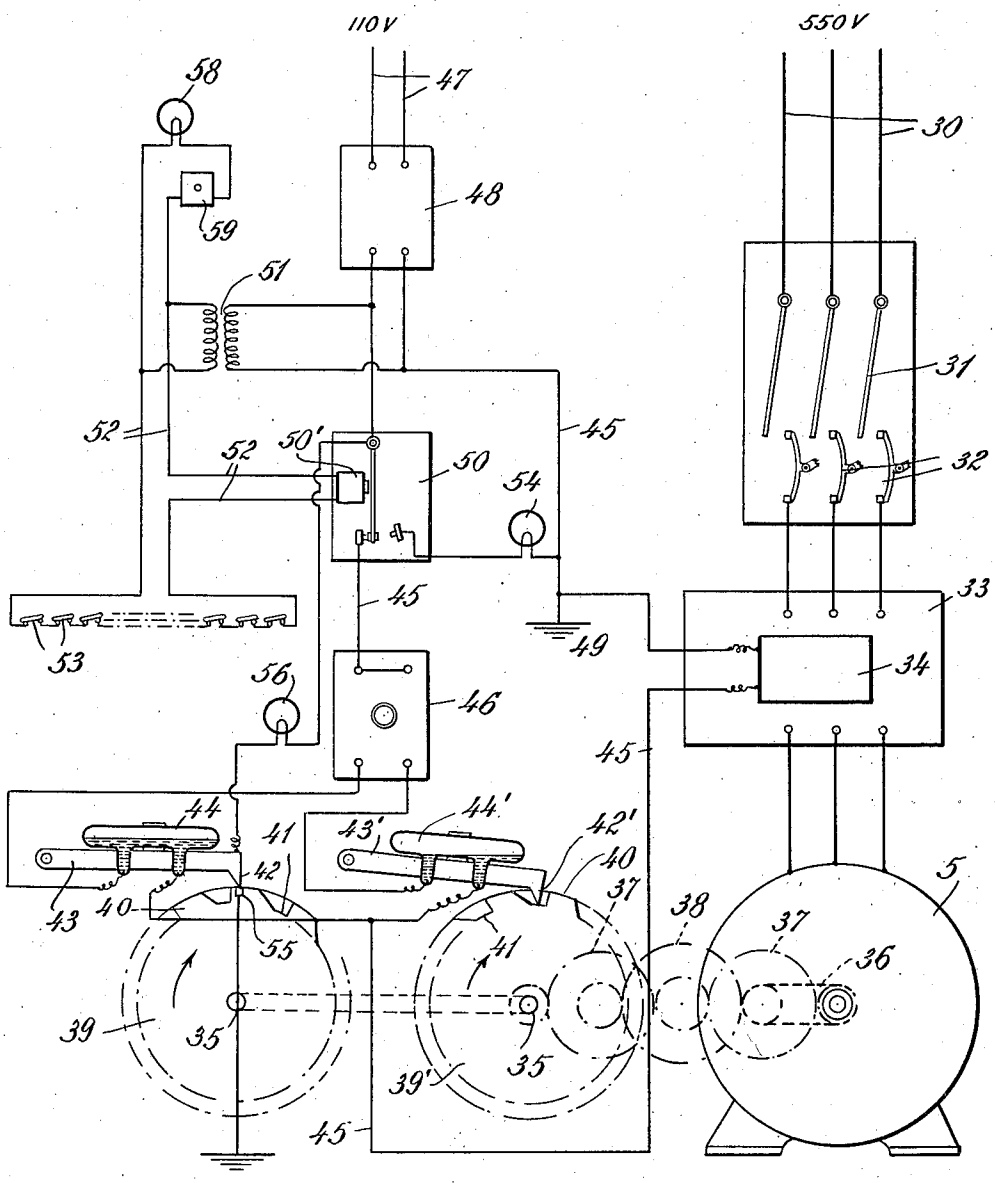
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THREAD WINDING APPARATUS

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Fig. 7.



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UNITED STATES PATENT OFFICE

2,351,411

THREAD-WINDING APPARATUS

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Application August 6, 1941, Serial No. 405,640

13 Claims. (Cl. 33—136)

This invention relates to thread winding apparatus and particularly to apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package. The invention has for its object the provision of a novel arrangement of instrumentalities, in combination with such apparatus, for assuring the removal from the primary thread package of a predetermined length of thread in an automatic manner and without dependence upon the personal judgment of the operator. More particularly, the invention aims to provide novel and improved means for winding off predetermined equal lengths of thread from a plurality of primary packages onto a corresponding plurality of secondary packages in a multiple operation.

In the textile industry generally, and more particularly in the rayon manufacturing industry, there is frequently need to wind off a definite predetermined yardage from packages of thread, yarn and the like of various forms. This operation is known by various names, such, for example, as "wasting off," "cleaning off," "splitting," etc. The operation of winding off a definite yardage is frequently of considerable importance to the rayon manufacturer, as for example in winding cones or other merchantable packages from predetermined lengths of thread wound from a plurality of thread packages. The degree of certainty and accuracy with which the operation is performed is the only guarantee that the customer will not receive thread of inferior quality or with residual shrinkage greater than commercial limits.

Various methods have heretofore been employed in winding cones and other secondary packages from predetermined lengths of thread unwound from a plurality of primary packages. Of these methods the following are the most common:

(*a*) The primary thread packages are mounted at a reeling machine and a predetermined yardage is wound off from each package to form the secondary package. This leaves the "wasted-off" thread in the form of short length skeins of little commercial value except as waste.

(*b*) The primary packages are mounted at a spooling machine and a predetermined yardage is wound-off from each package. This is a difficult operation to control accurately due to the non-positive friction drive of the take-up spools. Furthermore, due to the lack of stop motion devices on standard spooling machines, thread from one or more packages may break without interrupting the unwinding of the other packages, so that it is not practical to use a timing device for controlling the length of thread removed from each package. To overcome this difficulty it has heretofore been proposed to carefully measure some specific distance in on the sidewall of the package to be split or detailed, and at the proper point to cut the thread with scissors. This is a dangerous and slow operation and cannot be carried out with any degree of accuracy. A further objection of the spooling method is that the thread is collected on spools from which it must then be reeled-off or coned in order to put it in merchantable form. This extra operation makes the procedure expensive and slow.

(*c*) The primary packages are mounted on a standard cone winding machine, and the predetermined yardages are directly wound to cones. The yardage take-up of the cone rapidly increases as the cone builds up, so that varying periods of time are required for removing uniform yardages of thread. This complicates the use of any timing device, and places a high premium on the accuracy and care exercised by the operator in observing the proper elapsed times on each spindle and package, and allowing time-outs for breaking threads. The expedient of measuring a specific distance in on the sidewall of the package and cutting the threads at the proper points, as hereinbefore mentioned, may be resorted to, but it is inaccurate and full of potential hazards to the thread.

By the present invention uniform predetermined lengths of thread are removed from primary thread packages with precision and accuracy in an automatic manner wholly independent of the operator's personal judgment. The invention may be readily applied to standard cone winding machines, and the thread removed from the primary packages wound directly on cones ready for marketing, thus eliminating any intermediate operation with its attendant expense and delay. The invention avoids all of the inherent objections of the heretofore common procedures, and assures the accurate removal from each primary package of the desired predetermined length of thread.

In its broad aspect the invention comprises the combination with the motive means of an apparatus for winding thread from a primary package onto a secondary package of a length-measuring device for automatically interrupting the operation of the motive means when a predetermined length of thread has been unwound from the primary package, and manually operated means for then resuming the operation

of the motive means. Where the motive means is an electric motor, the length-measuring device may cause the opening of an electric switch in the electric circuit of the motor when a predetermined length of thread has been wound onto the secondary package and then permit the switch to be manually closed after it has been so automatically opened. In its preferred form, the length-measuring device comprises a pair of similar cams mounted on a common shaft connected by a reduction gear train to the electric motor or other motive means of the apparatus. Each of the cams has a circumferential series of alternate elevated and depressed cam surfaces. Adjacent pairs of elevated and depressed cam surfaces may be of progressively shorter circumferential length to compensate for the progressive increase in periphery of the secondary thread package. Each cam has a cam follower which operates to alternately close and open an electric switch as the cam follower contacts with the elevated and depressed surfaces of its associated cam. The cams, cam followers and electric switches are so arranged that the electric switches are operated in sequence and so that one switch is closed just prior to the opening of the other switch. By manual operation, the two electric switches are alternately included in an electric circuit along with means for connecting the electric motor of the apparatus to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting the motor from the source of electric energy when the electric switch included in the circuit is opened.

The foregoing and other characteristic features of novelty of the invention will be better understood from the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagrammatic front elevation of a cone-winding machine embodying the invention,

Fig. 2 is a diagrammatic front elevation of the spindle driving and control devices in their operative or running positions,

Fig. 3 is a diagrammatic front elevation of the spindle driving and control devices in their inoperative positions after the mechanical stop action has disconnected the spindle from its driving belt upon breaking of the thread.

Fig. 4 is a front elevation of the length-measuring device of the invention with the front panel removed,

Fig. 5 is a rear elevation of the length-measuring device with the rear panel removed,

Fig. 6 is a side elevation, partly in section, of the length-measuring device, and

Fig. 7 is a wiring diagram of the electrical equipment of the device.

The drawings illustrate the invention applied to a cone winding machine, in which cones are built up of a plurality of predetermined equal lengths of thread unwound from a corresponding plurality of primary thread packages. It is to be understood, however, that the invention may be equally well applied to other types of thread winding machines where it is desired to wind-off, or wind-on, a predetermined length of thread. The cone winding machine is of well-known construction and is hence only schematically illustrated in the drawings. The illustrated machine comprises two units, of six spindles each, placed end to end and driven by a single electric motor 5; only two spindles of each unit being shown in Fig. 1. The spindles are driven by a common endless belt 6, each spindle being separately controlled for slow starting by a manually-operated starting lever 7. The primary packages 8, from which thread is to be unwound, are mounted on a supporting board 9 below the spindles 10. The thread is drawn off the primary packages onto the cones 11 by the rotation of the spindles 10, the thread from each package passing through the customary guides 12, finger tensioning device 13, breakage lever 14, traverse guide etc. in its travel from the package onto the corresponding cone.

The spindle drive belt 6 passes around and is itself driven by a pulley 15 connected to the motor 5 by a belt drive 16. A drive pulley 17 is secured to the shaft of each spindle 10. An idler pulley 18, carried by a pivoted arm 19, normally presses the belt 6 into operative engagement with its cooperating spindle pulley 17, thereby causing the belt to rotate the spindle. The idler pulley 18 is adapted to be raised by a lifter arm 20, and when so raised the operative engagement between the belt and drive pulley 17 is interrupted and rotation of the spindle is stopped. The starting lever 7 is operatively connected to the lifter arm 20, and when moved to its operating or "running" position (Fig. 2) permits the idler pulley 18 to press the belt 6 into driving engagement with the spindle pulley 17, and when moved to its inoperative or "stop" position (Fig. 3) causes the lifter arm 20 to raise the idler pulley 18 and thereby disengage the spindle pulley from the belt. Each spindle 10 is thus arranged to be operatively engaged with and disengaged from the belt 6 by its manually-operated starting lever 7.

A spring 21 biases the lifting arm 20 to its position for raising the idler pulley 18 (Fig. 3). The lifting arm 20 is held in its operating position, against the tension of the spring 21, by the engagement of the notched end 22 of a pivoted segment 23 with the notched end 24 on the extension 20' of the lifting arm (Fig. 2). The segment 23 carries a pivoted tripping lever 25 which is normally biased by gravity to engage a cam 26 driven by the spindle. In normal operation, the tension of the thread on the breakage lever 14 holds the tripping lever 25 out of engagement with the cam 26.

When the machine has been threaded, the starting levers of the twelve spindles are moved to their operating positions. As each lever is so moved its associated spindle begins to rotate and the resulting tension of the thread on the breakage lever 14 holds the tripping lever 25 out of contact with the rotating cam 26, and the notches 22 and 24 interlock and hold the lifting arm 20 in its operating position (Fig. 2). Should a thread break, the resulting release of tension on the breakage lever 14, permits the tripping lever 25 to move into contact with the cam 26, and one of the several elevated surfaces around the circumference of the cam promptly moves the tripping lever to turn the segment 23 about its pivot thereby unlocking the notches 22 and 24, whereupon the spring 21 turns the lifting arm 20 and raises the idler pulley 18 to interrupt the driving connection between the spindle pulley 17 and the belt 6, and the starting lever 7 moves to its "stop" position (Fig. 3). When the thread-break has been repaired, the starting lever 7 is moved to its operating position, rotation of the spindle is resumed and the thread-break stop device is restored to the position shown in Fig. 2, as hereinbefore described.

In its application to the cone-winding machine, the invention is embodied in a self-contained length-measuring device or timing mechanism mounted above the motor 5 of the machine. The length-measuring device is driven by the motor, but controls the operation of the motor. When a predetermined length of thread has been unwound from the first twelve primary packages onto the twelve cones, the length-measuring device automatically stops the machine by interrupting the electric circuit of the motor. The first set of primary packages is replaced by a second set and the operation of the machine is resumed by a manually-operated cycle switch operatively associated with the length-measuring device. A predetermined equal length of thread is then unwound from the second set of primary packages, the machine is automatically stopped and the control mechanism set for resumption of operation by the manually-operated cycle switch. The operation is continued until the cones have been built up to the desired size. The combination of length-measuring device driven by the motor of the machine results in a stable and constant relation between the revolutions of the motor and the length-measuring device regardless of the R. P. M. of the motor as affected by variations in the electric energy supply.

The construction and operation of the length-measuring device will be best understood by reference to Figs. 4, 5, 6 and 7. The device is enclosed in a casing having a front panel or door 27 and a rear panel or door 28, permitting convenient access to the mechanism mounted therein. The motor 5 is connected to a relatively high voltage (e. g. 550 volt) source of electric energy 30, through a manually-operated single-throw switch 31, thermal-overload circuit breakers 32 and single-throw magnetic switch 33 (Fig. 7). The solenoid 34 of the magnetic switch is energized and de-energized, to respectively close and open the magnetic switch, by the length-measuring device.

The motor 5 is operatively connected to a cam-shaft 35 by a sprocket chain 36, a pair of reduction gear trains 37 and an intermediate set of cooperating idler gears 38. The idler gear set 38 may be readily removed and replaced by another idler gear set to adjust the reduction ratio between the motor and the cam-shaft 35. The interchangeable sets of idler gears permit compensation for the longer or shorter cycles required in winding-off predetermined equal lengths of different denier, thus maintaining standard cone size.

Two similar circular cams 39 and 39' are mounted on the cam-shaft 35 to rotate therewith. For convenience of explanation, the two cams are shown laterally displaced in Fig. 7, but in the actual device the two cams are mounted as a unit on the same shaft, as shown in Figs. 5 and 6. Each cam has a circumferential series of elevated and depressed cam surfaces 40 and 41, respectively. The two cams are so mounted on the shaft 35 that the depressed surfaces of one cam are substantially opposite the elevated surfaces of the other cam. Starting at the beginning of one complete series of cycles (that is one revolution of the cams), the successively adjacent pairs of elevated and depressed cam surfaces are of progressively shorter circumferential length to compensate for the corresponding progressive increase in periphery of the cone as it is built up. The progressive decrease in the circumferential length of successively adjacent pairs of elevated and depressed cam surfaces progressively shortens the cycle of operation of the successive pairs of cam surfaces to conform with the simultaneously progressive increase in the cone periphery as winding proceeds, thereby maintaining constant the predetermined length of thread wound off the primary packages during each cycle of operation of each successive pair of cam surfaces.

Cam-followers 42 and 42', carried on pivoted arms 43 and 43' respectively, are operatively associated with the cams 39 and 39', respectively. Mercury switches 44 and 44' are operatively connected to the pivoted arms 43 and 43', respectively. Referring to Fig. 5 of the drawings, it will be seen that the mercury switches are pivotally mounted near their centers and are connected by links 60 and 60' to the free ends of their respective cooperating pivoted arms 43 and 43'. The mercury switches are closed when their respective cooperating cam-followers are in contact with the elevated cam surfaces, and are open when the cam-followers are in contact with the depressed cam surfaces. The two cams 39 and 39' are assembled on their common shaft 35 in such a manner that the depressed surfaces on cam 39 are substantially opposite or correspond to the elevated surfaces on cam 39'. However, in assembling and adjusting the cams on the shaft 35, the operative end of an elevated surface on each cam overlaps by about 2° the operative beginning of the succeeding elevated surface on the other cam. As will be more particularly described hereinafter, this arrangement of the cams, cam-followers and mercury switches causes the two mercury switches to operate in sequence and so that one switch is closed just prior to the opening of the other switch. Assuming the switches in the positions indicated in Fig. 7, and the cams rotating in the direction of the arrows, the succeeding complete cycle of this sequence is as follows: (1) switch 44' closes, (2) switch 44 opens, (3) switch 44 closes, and (4) switch 44' opens.

The mercury switches are arranged to be alternately included in an electric circuit 45 by a cycle switch 46. The electric circuit 45 is connected to a relatively low voltage (e. g. 110 volts) source of electric energy 47 through a manually operated single-throw switch 48. The neutral or "cold" side of the circuit 45 is connected to one terminal of the solenoid 34 and is grounded at 49. In addition to the cycle switch 46 and one or the other mercury switches (44 or 44'), the live or "hot" side of the circuit 45 includes a double-throw relay switch 50, and is connected to the other terminal of the solenoid 34.

A 110–6 volt transformer 51 is connected across the circuit 45 approximate the switch 48. The 6-volt secondary of the transformer is connected to an electric circuit 52 in which is included the winding 50' of the relay switch 50, and twelve mercury switches 53. The mercury switches 53 are mounted approximate the twelve spindles 10 of the machine and are electrically connected in series. One mercury switch 53 is operatively associated with each spindle, and is arranged to be tilted to its open or closed position by the operation of the spindle clutch rod, that is the rod to which the starting lever 7 and the lifter arm 20 are fixed (Figs. 2 and 3). When a thread breaks, the mechanical stop action is actuated by the resultant movement of the breakage lever 14 and turns the clutch rod to stop that particular spindle. This turning of the clutch rod tilts the mercury switch 53 to its open position and there-

by de-energizes the relay switch 50, which thereupon operates to open the circuit 45 and to close the circuit of a "trouble lamp" 54, which can be seen through the window 54' in the front panel 27.

The operation of the apparatus illustrated in the drawings is similar to that of a conventional type of cone winding machine. Twelve primary packages 8, one for each spindle of the machine, are initially threaded up to empty paper cone cores on the twelve spindles 10 in the usual manner familiar to those acquainted with the art of cone-winding. The cams 39 and 39' will be in their respective initial positions for the starting of one complete series of cycles. Fig. 7 shows the cams in their respective positions during the last cycle of a complete series, so that when cam follower 42 moves into the next succeeding depression, and thereby opens mercury switch 44, the complete series of cycles will have been completed, the machine stopped and the cams will be in their respective initial positions for starting the next complete series of cycles; mercury switch 44' having been closed just prior to the opening of mercury switch 44. With the manually-operated switches 31 and 48 closed and all spindle clutches in operating position, the cycle switch 46 is manually snapped or thrown to include the already-closed mercury switch 44' in the electric circuit 45, it being understood that at the completion of the preceding complete series of cycles the cycle switch 46 was left in its other position in which mercury switch 44 was included in the electric circuit 45. The apparatus operates until the predetermined yardage has been wound from the primary packages onto the cones or secondary packages.

The predetermined length of thread to be unwound from the primary packages onto the cones during each cycle is determined by the travel of one cam-follower over the elevated surface of its associated cam. Since the motor 5 drives the cones and the thus-driven cones draw off the thread from the primary packages, it will be evident that as the cone builds up its periphery increases and consequently a progressively increasing yardage is wound on the cone per revolution of the motor. To compensate for this factor, the elevated surfaces of the cams are of progressively shorter circumferential length, as hereinbefore described; the progressive decrease in circumferential length being properly correlated to the progressive increase in the periphery of the cone. Furthermore, since the travel of one cam-follower over the elevated surface of its associated cam bears a definite relation to the revolutions of the motor, dependent upon the reduction ratio of the reduction gear train connecting the motor to the cam shaft, it will be evident that with a constant reduction ratio the length of thread wound on the cone during each cycle of operation will vary with threads of different denier, the finer the denier the longer the length of thread. Proper compensation for such differences in thread length due to denier is accomplished by the interchangeable idler gear sets 38, whereby the reduction ratio between the motor and the cam shaft may be correlated with respect to threads of different denier.

When the predetermined yardage has been wound from the first twelve primary packages, the cam-follower 42' moves into the succeeding depression, thereby opening the mercury switch 44' and stopping the machine. In consequence of the slight overlapping of the oppositely positioned elevated surfaces of the cams, hereinbefore described, mercury switch 44 is closed just prior to the opening of mercury switch 44'. The twelve primary packages are removed from the supply board and replaced by twelve full packages. These are threaded up and tied into the cones in the usual manner. Then, with all spindle clutches in operating position, the cycle switch 46 is snapped or thrown to its other position, thereby including the already-closed mercury switch 44 in the electric circuit 45 and starting the apparatus. Again, the operation continues until the predetermined yardage has been wound from the primary packages onto the cones, and the cycle is repeated until the cones have been built up to the desired size.

It will be seen from the foregoing description that the manual operation of the cycle switch 46 is the only control necessary to operate the apparatus when the two main manual switches 31 and 48 are closed. When, in the normal operation of the apparatus, the cycle switch 46 is snapped or thrown to include one of the already-closed mercury switches in the electric circuit 45, the solenoid 34 is energized and the magnetic switch 33 is closed, thereby starting the motor 5 and the winding-off operation. The winding-off continues until the mercury switch included in the circuit 45 is opened, thereby de-energizing the solenoid 34 and stopping the motor 5. Since the other mercury switch is now closed, the operator has only to snap or throw the cycle switch to its other position to again start the motor 5. The operation is as simple as turning on a conventional electric light. The operator has only the one switch to snap or throw to start the apparatus, and the length-measuring-device stops the apparatus. To restart the apparatus for the succeeding cycle, the same (cycle) switch is snapped or thrown.

The overlapping of the opposite elevated surfaces of the cams provides an automatic "make-ready" period before the end of each cycle, by closing one mercury switch (44 or 44') just prior to the opening of the other mercury switch. No other setting or adjustment for the succeeding cycle is required. There is no time limit involved in the "make-ready" period. The length-measuring device and the cone winding machine are both operated by the same motor, and the length-measuring device stops itself as well as the machine. Accordingly, there is no limit to the time spent between cycles, and the succeeding cycle may be started at will.

As the end of one complete series of cycles approaches, the cam-follower 42 engages a metal contact 55 on the ending elevated surface of the cam 39. The contact 55 is grounded to the cam shaft, and when the cam-follower engages the contact an electric lamp 56, called the "doffing light," is connected across the 110 volt source of electric energy. The lighting of the lamp 56, which can be seen through a window 56' in the front panel 27, warns the operator of the completion of the series of cycles, or one complete revolution of the cams. When the apparatus stops, after lighting of the lamp 56, the cones are full and must be removed. The "doffing light" will inform the operator that this is the case and that the full cones must be removed from the spindles before starting the next cycle. Upon the removal of the full cones and the wound-off primary packages, a new set of empty paper cones is mounted on the spindles and tied in with a set

of full primary packages, whereupon the apparatus is ready to start another complete series of cycles without any adjustment or loss of time.

Should the thread winding up on any cone break, the mercury switch **53** operatively associated with that spindle is tilted to its open position as a result of the actuation of the mechanical stop action (Figs. 3 and 7). The electric circuit **52** is thereby interrupted, the relay winding **50'** is de-energized and the relay switch **50** opens the electric circuit **45**, thereby de-energizing the solenoid **34**, opening the magnetic switch **33** and stopping the motor **5**. All of the spindles are thus stopped whenever the thread winding up on any one cone breaks. The relay switch **50** in opening the circuit **45** simultaneously connects the "trouble lamp" **54** across the 110 volt source of electric energy, the lighting of the trouble lamp indicating that the apparatus has stopped because of a broken thread and not because the end of the cycle has been reached. The apparatus will automatically restart when the broken thread is repaired and the spindle clutch is returned to its operating position, since this tilts the mercury switch **53** to its closed position and completes the circuit **52**, whereby the relay switch **50** is returned to its operative position in the circuit **45**.

As a means of taking inventory of the amount of work done by the apparatus during the shift, one of the cams carries numbers indicating the cycles. The cams illustrated in the drawings are designed for 26 cycles during each revolution, and the cycle numbering thus runs from 1 to 26 (Fig. 5). The numbers are visible through a plano-convex lens **57** in the rear panel **20** of the case enclosing the length-measuring device. A 6-volt panel lamp **58** illuminates the numbers. The panel lamp is connected across the 6-volt secondary of the transformer **51**, and is lighted by pressing a push-button switch **59**. By taking a reading of the number shown in the plano-convex lens at the beginning and end of the shift, the number of cycles run and the number of primary packages which have been run off during the shift are readily determined.

I claim:

1. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device operatively connected thereto, a pair of electric switches operatively associated with said length-measuring device, means for alternately closing and opening the switches with one switch closing just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit supplying current to operate the motor, and means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened.

2. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device including a reduction gear train operatively connected to the motor, a pair of similar cams mounted on a cam shaft driven by the gear train, a cam follower for each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened by its cam follower, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit supplying current to operate the motor, and means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened.

3. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device including a reduction gear means operatively connected to the motor, the reduction ratio of said gear means being selected to compensate for threads of different denier, a pair of similar cams mounted on a cam shaft driven by the gear means, a cam follower for each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened by its cam follower, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit supplying current to operate the motor, and means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened.

4. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device comprising a pair of similar circular cams mounted on a common shaft, a reducing gear means operatively connecting said cam shaft to said electric motor, the reduction ratio of said gear means being selected to compensate for threads of different denier, each of said cams having a circumferential series of alternate elevated and depressed cam surfaces, a cam follower operatively associated with each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened as the cam follower contacts with the elevated and depressed surfaces of its associated cam, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit, and means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor

from said source of electric energy when the electric switch included in the circuit is opened.

5. In an apparatus for simultaneously winding predetermined equal lengths of textile thread from a plurality of primary thread packages onto a corresponding plurality of secondary thread packages, the combination with motive means for simultaneously winding the secondary thread packages of a length-measuring device operatively connected to and directly driven by said motive means, said length measuring device being constructed and arranged to measure the length of all the threads by the rotation of the motive means, means actuated by said length-measuring device for automatically interrupting the operation of said motive means when predetermined equal lengths of thread have been unwound from said primary thread packages onto the corresponding secondary thread packages, a single manually operated means for resuming the operation of said motive means, after interruption of its operation as aforesaid, and additional means for automatically interrupting the operation of said motive means whenever the winding of any one of the secondary thread packages is interrupted.

6. In an apparatus for simultaneously winding predetermined equal lengths of textile thread from a plurality of primary thread packages onto a corresponding plurality of secondary thread packages, the combination with an electric motor for simultaneously winding the secondary thread packages of a length-measuring device operatively connected thereto, said length-measuring device being constructed and arranged to measure the length of all the threads by the rotation of the electric motor, means including an electric switch for connecting and disconnecting said electric motor to a source of electric energy, means operatively associated with said length-measuring device and said switch for automatically opening the switch when predetermined equal lengths of thread have been unwound from said primary thread packages onto the corresponding secondary thread packages and for permitting the switch to be manually closed after it has been automatically opened as aforesaid, and additional means for automatically opening said switch whenever the winding of any one of the secondary thread packages is interrupted, thereby stopping the winding of all the threads at the same time.

7. In an apparatus for simultaneously winding predetermined equal lengths of thread from a plurality of primary thread packages onto a corresponding plurality of secondary thread packages, the combination with an electric motor for simultaneously winding the secondary thread packages of a length-measuring device operatively connected thereto, a pair of electric switches operatively associated with said length-measuring device, means for alternately closing and opening the switches with one switch closing just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit supplying electric current to operate the motor, means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened, and additional means for automatically disconnecting said electric motor from said source of electric energy whenever the winding of any one of the secondary thread packages is interrupted.

8. In an apparatus for winding a secondary thread package of equal lengths of thread unwound from a plurality of primary thread packages, the combination with an electric motor for winding the secondary thread package of a length-measuring device operatively connected to said motor and comprising a pair of similar cams each of which has a circumferential series of alternate elevated and depressed cam surfaces, adjacent pairs of elevated and depressed cam surfaces being of progressively shorter circumferential length to compensate for the progressive increase in periphery of the secondary thread package, a respective cam follower operatively associated with each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened as the cam follower contacts with the elevated and depressed surfaces of its associated cam, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit, and means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened by the operation of its cam.

9. In an apparatus for simultaneously winding predetermined equal lengths of textile thread from a plurality of primary thread packages onto a corresponding plurality of secondary thread packages, the combination with electric motive means for simultaneously winding the secondary thread packages of a length-measuring device operatively connected thereto, said length-measuring device being driven entirely by said motive means, electric switch means actuated by said length-measuring device for automatically interrupting the operation of said motive means when predetermined equal lengths of thread have been unwound from said primary thread packages onto the corresponding secondary thread packages, a single manually operated switch means for resuming the operation of said motive means after interruption of its operation as aforesaid, additional electric switch means for automatically interrupting the operation of said motive means whenever the winding of any one of the secondary thread packages is interrupted, and means for indicating when the operation of said motive means has been interrupted by said last-mentioned additional means.

10. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device operatively connected to said motor and comprising a pair of similar circular cams, each of said cams having a circumferential series of alternate elevated and depressed cam surfaces, a cam follower operatively associated with each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened as the cam follower contacts with the elevated and depressed surfaces of its associated cam, said cams, cam followers

and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit, means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened, and means for indicating each completed revolution of said cams.

11. In an apparatus for winding a predetermined length of thread from a primary thread package onto a secondary thread package, the combination with an electric motor for winding the secondary thread package of a length-measuring device operatively connected to said motor and comprising a pair of similar circular cams, each of said cams having a circumferential series of alternate elevated and depressed cam surfaces, a cam follower operatively associated with each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened as the cam follower contacts with the elevated and depressed surfaces of its associated cam, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit, means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened, and a consecutive series of numerals circumferentially positioned on the face of one of said cams corresponding to the elevated and depressed cam surfaces thereof.

12. In an apparatus for simultaneously winding a plurality of secondary thread packages of equal lengths of thread from a corresponding plurality of primary thread packages, the combination with an electric motor for winding the secondary thread packages of a length-measuring device operatively connected to said motor and comprising a pair of similar circular cams, each of said cams having a circumferential series of alternate elevated and depressed cam surfaces, a cam follower operatively associated with each of said cams, an electric switch operatively associated with each cam follower and adapted to be alternately closed and opened as the cam follower contacts with the elevated and depressed surfaces of its associated cam, said cams, cam followers and electric switches being arranged to operate the switches in sequence and so that one switch is closed just prior to the opening of the other switch, manually operated means for alternately including first one and then the other of said switches in an electric circuit, means operatively associated with said electric circuit for connecting said motor to a source of electric energy when the electric switch included in the circuit is closed and for disconnecting said motor from said source of electric energy when the electric switch included in the circuit is opened, and means for automatically disconnecting said motor from said source of electric energy whenever the winding of any one of the secondary thread packages is interrupted and for automatically connecting said motor to said source of electric energy when the winding of that secondary thread package is resumed.

13. In apparatus for winding a predetermined length of textile thread from each of a plurality of primary thread packages onto each of a plurality of secondary thread packages, the improvement which comprises electrically driven motive means for operating the winding on the secondary packages, a length-measuring device driven by the motive means for automatically stopping the motive means when a predetermined length of thread has been unwound, independent automatic means for stopping the motive means when the winding of one thread has been interrupted, and a single manually operated switch means for resuming the operation of the motive means and the said plurality of secondary packages after the motive means has been stopped by either the length-measuring device or by the independent automatic means.

HOWARD WATERS DOUGHTY, JR.

CERTIFICATE OF CORRECTION.

Patent No. 2,351,411. June 13, 1944.

HOWARD WATERS DOUGHTY, JR.

It is hereby certified that the name of the assignee in the above numbered patent was erroneously described and specified as "TUBIZE CHATILLON CORPORATION" whereas said name should have been described and specified as --TUBIZE RAYON CORPORATION, of New York, N. Y., a corporation of Delaware--, as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of September, A. D. 1944.

Leslie Frazer

(Seal) Acting Commissioner of Patents.