Dec. 26, 1961 R. A. PIM 3,014,337

METHOD AND APPARATUS FOR REWINDING A CONTINUOUS FILAMENT

Filed Nov. 20, 1957 2 Sheets-Sheet 1

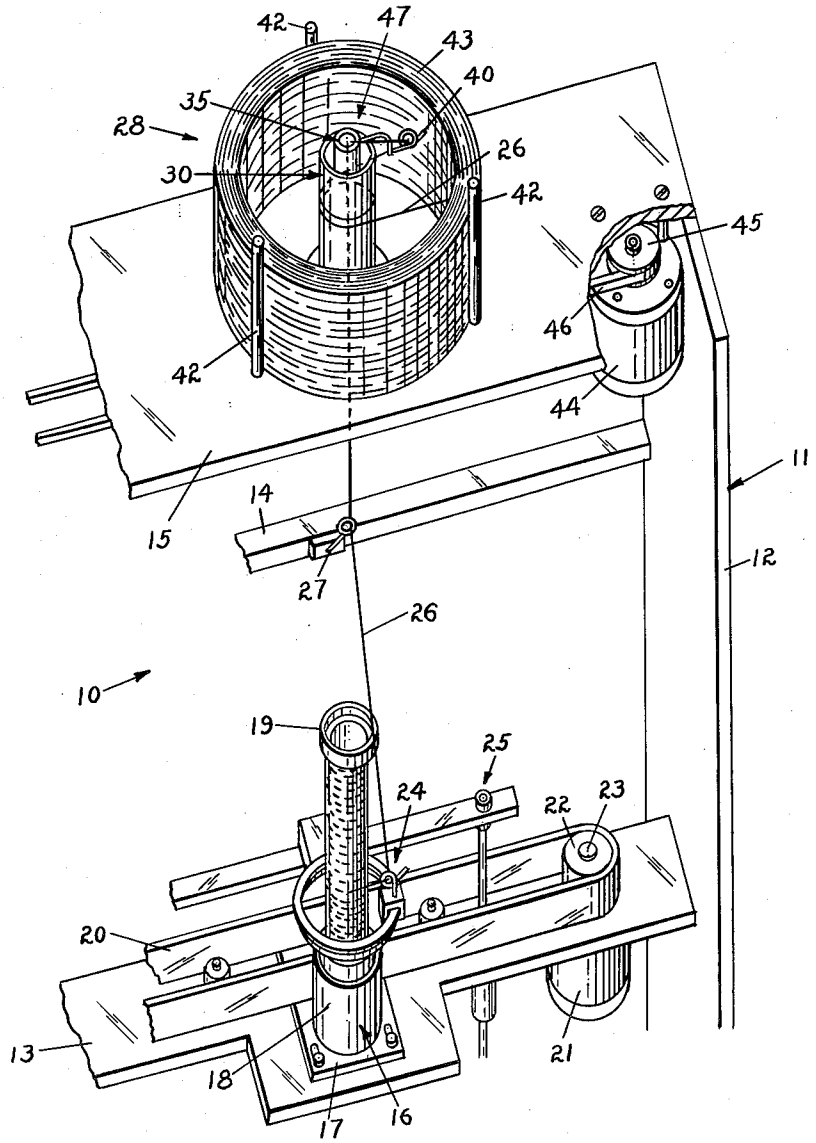


Fig. 1

INVENTOR.
Richard A. Pim
BY
Nobbe & Swope
ATTORNEYS

Dec. 26, 1961 R. A. PIM 3,014,337

METHOD AND APPARATUS FOR REWINDING A CONTINUOUS FILAMENT

Filed Nov. 20, 1957 2 Sheets-Sheet 2

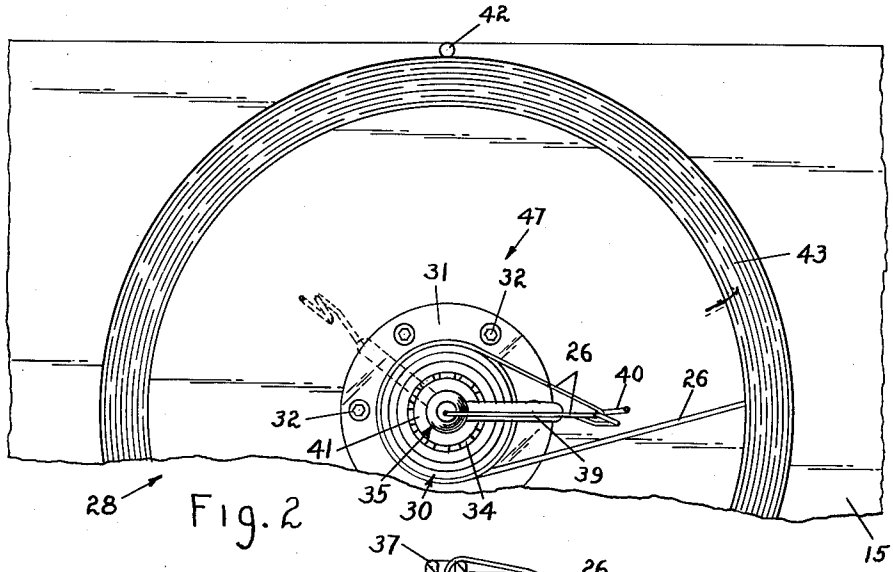


Fig. 2

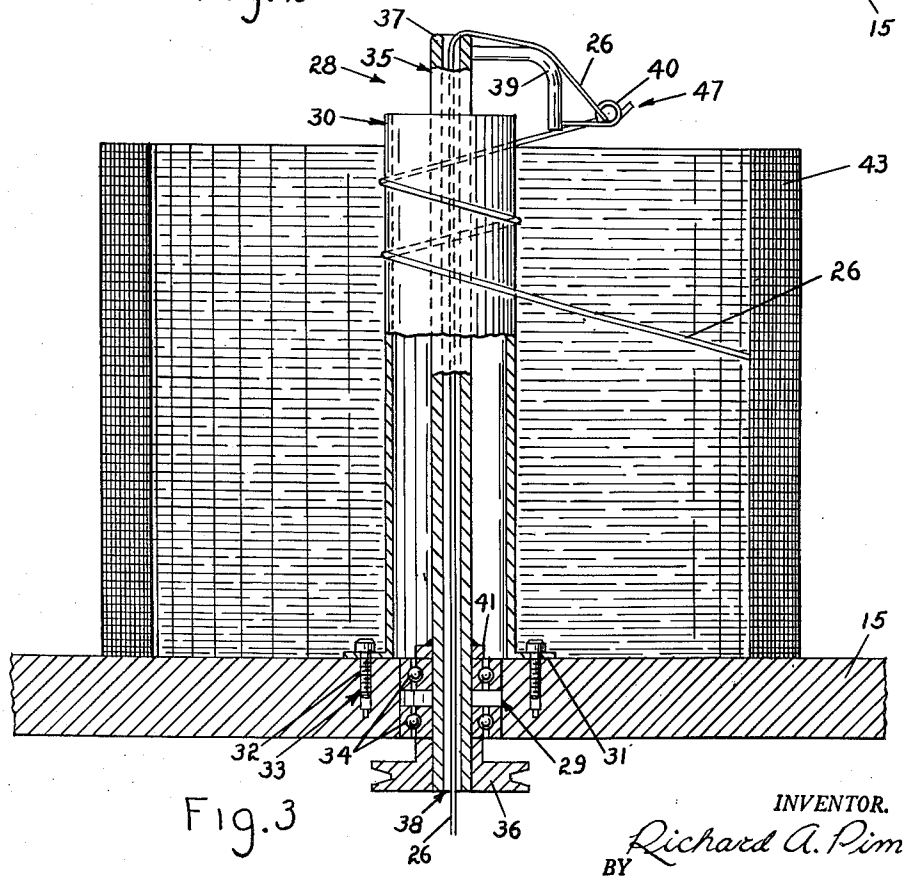


Fig. 3

INVENTOR.
Richard A. Pim
BY
Robbe & Swope
ATTORNEYS

United States Patent Office 3,014,337 Patented Dec. 26, 1961

3,014,337

METHOD AND APPARATUS FOR REWINDING A CONTINUOUS FILAMENT

Richard A. Pim, Waterville, Ohio, assignor, by mesne assignments, to Johns-Manville Fiber Glass Inc., Cleveland, Ohio, a corporation of Delaware

Filed Nov. 20, 1957, Ser. No. 697,654
16 Claims. (Cl. 57—60)

This invention relates broadly to a method and apparatus for twisting stranded filaments into a yarn. More specifically, it relates to a method and apparatus for metering the feed rate of the stranded filaments from inside a stationary package and for maintaining a constant tension at the spinning spindle.

Prior to the subject invention all metered control of first twist fiber was either drawn tangentially from outside a rotating package at a constant linear rate or over one end and from the outside of a stationary package and subsequently metered over feed rolls. The first prior method involved rotating a constantly diminishing and relatively heavy package at high speeds, which speeds can only be synchronized with that of the feed rolls and spindle at one diameter of the package. In the second method, the stranded filaments as they are drawn from the package slide over the length or a portion thereof which sliding contact abrades the filaments, increases tension on the filaments between the package and the feed rolls and also contributes to breakage of the strand.

It is therefore an object of this invention to provide a method for twisting filaments and apparatus therefor wherein the filaments are withdrawn from the inside of a stationary package.

It is another object of this invention to provide a method and apparatus for twisting filaments which automatically meters the lineal feed of the filaments to the spindle.

It is another object of this invention to provide a method and apparatus for withdrawing continuous glass strand from a package with a minimum amount of tension being imposed on the strand at the point of withdrawal.

It is still another object of this invention to provide a method and apparatus for twisting filaments which meters the filaments to the spindle at a constant, predetermined tension.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

In the drawings wherein like numerals are employed to designate like parts throughout the same:

FIG. 1 is an isometric drawing of a single spindle of a spinning frame incorporating the apparatus of the invention;

FIG. 2 is a fragmentary plan view of the supply package and the metering apparatus; and

FIG. 3 is a front elevation of FIG. 2, with parts in section.

Referring particularly to FIG. 1 of the drawings, the numeral **10** designates a spinning apparatus in general including a frame **11** comprised of two or more vertical supports **12** and a plurality of tiers or platforms, in this instance three which in ascending order are numbered **13, 14** and **15**.

Spinning apparatus in commercial use is provided with a plurality of spindles and with any one of a number of devices for stopping the filament feed to any one spindle in the event of breakage of the filaments. To simplify the explanation, only one spindle is shown and the filament break detection apparatus has been omitted.

A spindle **16** is mounted for rotation on a slide **17** which is movable on the upper surface of the lower tier **13** in a direction transverse to the tier **13**. The mechanism for moving the slide forms no part of the invention and therefore has not been shown shown in the drawings. The lower portion of the spindle **16** is in the form of a flat faced pulley **18** and the upper portion thereof is constructed in any suitable manner adapted to receive and rotate a spool or bobbin **19** upon which the yarn is traversed. A flat belt **20** is positioned to the rear of the pulley **18** and is advanced by an electric motor **21** and a pulley **22** mounted on the motor shaft **23**. A traveler ring **24** is mounted on a vertically reciprocating frame **25** to wind and traverse the filaments **26** upon the spool. The arrangement described above is commercially in use on multiple spindle spinning frames.

A guide **27** for the stranded filaments **26** is secured to the tier **14** above and in substantial vertical alignment with the axis of the spindle **16** when the latter is in engagement with the belt **20**.

A device **28** for metering the filament supply is positioned on the top tier **15** of the frame **11**, substantially in vertical alignment with the guide **27** and the spindle **16** when the latter is in engagement with the belt **20**. A circular hole **29** is cut through the top tier **15** of the frame **11** in vertical alignment with the axis of the spindle **16** and a circular tube or mandrel **30** having a flange **31** formed on the bottom end thereof is secured to the top surface of the tier **15** by screws **32** entering tapped holes **33**. As illustrated in the drawings, the axis of the tube **30** extends perpendicularly above the top surface of the tier **15**.

A pair of bearings **34** are retained in the hole **29** and support a small diameter conduit **35** for rotation on an axis corresponding to the axis of the tube **30**. The conduit **35** extends below the level of the tier **15** and receives a pulley **36** at the lower end, and also extends above the level of the tube **30**. The top face of the conduit **35** is formed in a smooth radius **37** and the hole **38** extending axially thereof is burnished to remove any projections which might snag the filaments **26**. A crank **39**, made of rod stock, is welded to the side of the conduit **35** near the top, and projects outwardly and downwardly to a level slightly below the top of tube **30**. A guide eye **40** is fastened to the crank **39** near the bottom end thereof and projects outwardly therefrom. A collar **41** is secured to the outside diameter of the conduit **35** and is supported on the inner race of the top bearing **34** to retain the associated component parts in position.

Three or more posts **42** rise from the upper tier **15** equally spaced about a diameter that is concentric with the hole **29**. The posts accurately center a package or cake **43** of stranded filaments **26** about the conduit **35** on the tier **15**. It will be noted that the guide eye **40** is positioned slightly above the top of the package or cake **43**, as clearly shown in FIG. 3.

A motor **44** or other suitable driving means is suspended from the lower side of the tier **15** and carries a pulley **45**. A belt **46** connects the pulley **45** on the motor **44** with the pulley **36** on the conduit **35** to impart a constant speed clockwise motion to the conduit **35**, the crank **39** and the guide eye **40**, as viewed from the top. The clockwise rotating elements recited above are hereinafter designated as a filament feed mechanism **47**. It is obvious, that the direction of rotation may be reversed upon reversal of the threading around the tube **30** and reversal of the direction of rotation of motors **21** and **44**.

After a cake **43** has been placed on the tier **15** within the confines of the posts **42**, the inside free end of the strand **26** may be wound around the polished exterior of the tube **30** in a clockwise direction as viewed from the top for an initial number of turns; two turns are suffi-

cient. The strand is subsequently threaded through the guide eye 40, the hole 38 in the conduit 35, the guide 27, the traveler ring 24 and started on the spool 19.

At this point it is appropriate to point out that the spool 19 and the filament feed mechanism 47 are both rotated to respectively take up yarn and feed filament at a constant, synchronized lineal rate and that friction at the traveler ring 24, the guide 27 and the guide eye 40 remains constant at each point. However, the tension required to withdraw the strand from the cake 43, though less than the tension applied by the rotating spool 19, is not constant throughout the entire cake nor does it remain constant from one cake to another. This has been a major source of faults in textile spinning operations.

The filament feed mechanism 47 is designed to compensate for the variations in tension on the strand 26 as it is withdrawn from the cake 43 and operates to supply yarn at a constant lineal rate of speed and at a constant tension to the spool 19.

The apparatus 10 as a whole is in a state of equilibrium or a normal state when the sum of the force required to withdraw the strand 26 from the cake 42 and the force required to overcome the friction of the sliding movement of the strand around the tube 30 is equal to the force exerted by the wind-up spool 19. Friction through the various guides is negligible and is omitted to simplify this description of the operation. However, since the force required to withdraw the strand from the cake varies within any one cake and between successive cakes, the number of turns of the strand 26 around the tube 30 varies inversely with the differential between the force required to withdraw the strand from the cake at any given moment and the force required when the apparatus is in equilibrium. For example, as the force required to withdraw the strand 26 from the cake 43, decreases from the normal force, the number of turns of the strand 26 around the tube 30 increases and when the withdrawal force increases above the normal force, the number of turns around the tube decreases.

In other words, the turns or bights of the strand 26 around the tube 30, regardless of the number over one, snubs the strand to provide a substantially constant tension at the spool 19. When the strand 26 freely separates from the cake 43, the actual point of withdrawal of the strand from the cake leads the rotating guide eye 40 to increase the number of turns around the tube 30. Conversely, when the strand 26 resists separation from the cake 43 at a force level above the normal, the actual point of withdrawal of the strand from the cake lags behind the rotating guide eye 40. Since the linear take up at the spool 19 remains constant and in this instance exceeds the withdrawal from the cake, the excess length of strand required to satisfy the take up demands at the spool is borrowed from the surplus represented by the accumulated turns around the tube 30.

Applicant's apparatus is particularly adapted for rewinding glass fiber strand composed of a plurality of threads. In forming a single strand, the individual fibers are pressed against a pad to pick up binding fluid. Because of the varying degree with which the fibers pick up the binding fluid some portions dry faster than others. This phenomenon causes the individual bights of the originally formed cake or package to adhere to each other in varying degrees, particularly when oils or thin solutions are employed and the coating remains substantially in a fluid or slightly viscous condition.

Another factor which contributes to the tendency of the strands to adhere in varying degrees is that in forming the bights of a package some portions intersect each other and tend to crimp one or both of the intersecting strand portions. Such crimping increases the magnitude of force required to separate one intersecting portion from another in the originally formed package.

The variations in the force required to withdraw the strand from the cake, above and below the normal force, are generally of short duration, and the magnitude of the withdrawal force successively fluctuates from a high to a low point and back to a high point. The high points of strand withdrawal force are coincident with the points of intersection of successive strand traverses of the cake. This is true of any cake comprised of strand material which is coated, lubricated or sized in any manner.

While applicant's device is particularly adapted to unwind a cake or preformed package of glass fiber strand wherein the individual turns or bights have a tendency to adhere for reasons cited, it will be understood that the device may be used to unwind any type of strand material which has a tendency to adhere for any reason.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of the same, but that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. The method of winding a continuous strand from a supply package containing the same wherein successive turns of the strand thereon have a tendency to adhere to each other in varying degrees of adherence, comprising the steps of: withdrawing the strand from said package at an aggregative constant rate wherein the instant rates vary inversely to the force required for withdrawal from the package while accumulating an excess of said strand at a point intermediately of the points of withdrawal and the point of application of the withdrawing force, and advancing said strand from the point of application of the withdrawing force to a rewind point at a rate which is in synchronous relation with said aggregative rate.

2. The method as defined in claim 1 which further comprises the step of rewinding the strand with a constant tensional force.

3. The method as defined in claim 1, wherein a substantially constant frictional force is impressed upon the filament at the intermediate point.

4. The method of rewinding a continuous strand from a tubular formed cake onto a bobbin comprising the steps of, in the recited order, removing the strand in reverse order of wind from the interior of the cake by directing the strand in a radial direction toward the axis thereof by a first force, accumulating an excess of said strand about said axis, imposing a constant tension on said strand, directing said strand to a bobbin, and winding said strand at said constant tension on said bobbin by a second force.

5. The method of winding a continuous strand onto a bobbin from a tubular supply package containing the same wherein successive turns of the strand on the supply package have a tendency to adhere to each other in varying degrees of adherence comprising, in the recited order, directing the strand from the inner surface of the tubular supply package by a first force toward the axis thereof at a lineal rate which fluctuates in direct proportion to the adherence of said successive strand turns, accumulating a varying increment of said strand, imposing a constant tension upon said increment, directing said strand to a bobbin and winding said strand by a second force at said constant tension onto said bobbin.

6. The method of winding a continuous strand as defined in claim 5, wherein said increment is accumulated at a rate which varies inversely to the adherence of said successive turns of strand to each other on the supply package.

7. The method of removing a continuous strand from a tubular supply package wherein successive turns of the strand on said package have a tendency to adhere to each other in varying degrees of adherence comprising, in the recited order, removing the strand from the interior of the package by directing it in a general radial direction toward the axis thereof through the application of a

first force, accumulating an excess of said strand about said axis, imposing a constant tension on said strand, and directing said strand away from said tubular supply package in a direction generally coaxial to said supply package through the application of a second force.

8. In apparatus for rewinding a continuous filament from a helically wound cake in the form of a hollow cylinder wherein the force of withdrawal intermittently varies above and below a normal, including a rewind bobbin and means for rotating said bobbin to rewind said filament at a first constant lineal rate, the improvement comprising a platform for supporting said cake in an upright position, a filament feed mechanism including a conduit rotatably mounted on an axis coincident with the axis of said cylinder and a guide eye carried by said conduit in circumscribing relation to said axis adapted to threadedly engage and withdraw the filament from inside the cake, means for rotating said filament feed mechanism about its axis to withdraw said filament from said cake at an aggregative constant lineal rate equal to said first constant lineal rate and wherein the instant rate varies inversely with the force of withdrawal.

9. The improvement as defined in claim 8, which further comprises a stationary tube concentrically disposed around said conduit and within the circumscribing arc of said guide eye upon which the filament is wound by said feed mechanism in a number of bights, the number thereof varying directly with the instant differential between the lineal rate of filament withdrawal and the lineal rate of filament rewind.

10. In apparatus for producing a twisted multi-filament yarn including a helically wound supply cake in the form of a hollow cylinder, a rewind bobbin and means for rotating said bobbin to rewind said yarn at a constant lineal rate, the improvement comprising, a support for supporting said cake in an upright position, cylindrical tube means in concentric relation with said cake adapted to receive a plurality of turns of said filament from inside said cake, conduit means extending through said support in concentric relation within said tube, means for rotating said conduit in synchronous relation to the rotation of said bobbin, and means including a crank and guide eye carried by said conduit adapted to wind said filament about said tube and to direct said filament through said conduit to said bobbin at said constant lineal rate and at a constant tension.

11. In apparatus for rewinding a continuous filament from a helically wound cake in the form of a hollow cylinder wherein the force of withdrawal intermittently varies above and below a normal, including a rewind bobbin and means for rotating said bobbin at a constant rate, the improvement comprising a platform for supporting said cake in an upright position, a filament feed mechanism mounted for rotation on an axis coincident with the axis of said cylinder and including a guide eye movable therewith in an orbit circumscribing said axis, means for rotating said filament feed mechanism about its axis in synchronous relation to the rotation of said rewind bobbin, a stationary tube concentrically disposed around said conduit and within the confines of said orbit, said filament feed mechanism and said tube cooperating to withdraw said filament from inside said cake at an aggregative constant rate and being adapted to accumulate the excess yarn around said tube when the instant rate of withdrawal exceeds the aggregative rate.

12. Apparatus for unwinding a package of continuous strand formed of individual turns having a tendency to adhere to each other with varying degrees of adherency and for supplying a strand at uniform tensional forces which comprises, in combination: support means for positioning and supporting said package about an axis; an apertured strand withdrawing member which receives a free end of said strand through its aperture, said aperture being radially displaced from said axis, said withdrawing member being rotatable at a constant predetermined speed about said axis to unwind and withdraw the strand from said package; and accumulating means for receiving an accumulation of the strand withdrawn from said package, said accumulating means being concentric about said axis and intermediate said package and said withdrawing means.

13. An automatic strand tension regulator for rewinding machines having bobbins comprising, in combination: means for positioning and supporting a preformed strand package in a vertical position; a mandrel concentric to the axis of the strand package for receiving a portion of said strand; and a rotating member for threadably receiving said strand, said mandrel and said rotating member being cooperatively arranged to unwind said strand from said package, to wind and position said strand about said mandrel, and to unwind portions from said mandrel and pass said portions through the threadable portion of said rotating member.

14. A constant tension unwinding device for preformed strand packages comprising, in combination: means for supporting a preformed strand package about an axis; a mandrel concentric with said axis for receiving an accumulation of strand from said package; a rotating member also concentric with said axis and defining an aperture in spaced relation with said axis through which the strand from said mandrel is threaded, said rotating member being rotated at a predetermined constant rate to remove the strand from said mandrel with uniform tension; and means for receiving the strand from the apertured rotating member.

15. The method of providing a strand with a substantially constant tensional force which comprises, in combination: withdrawing the strand from a preformed package supply source at random tension; accumulating the withdrawn strand about a mandrel; withdrawing the strand from said mandrel in a manner whereby the amount of accumulated strand is decreased when the tension forces at the supply source are above normal and is increased when said tension forces are below normal; and advancing the strand from the point of withdrawal to a rewind point at a rate which is in synchronous relation with the aggregative rate at which the accumulated strand is withdrawn from said mandrel.

16. The method of rewinding a tubular shaped package of continuous strand having a tendency to adhere which comprises, in combination: directing the strand from the inner surface of the tubular supply package toward the axis thereof at a random rate corresponding to the adherency of the successive strand turns; winding a varying increment of said strand about a mandrel positioned at said axis; and removing portions of said increment at a constant aggregative rate which imposes a constant tension upon said increment for advancement at a constant aggregative rate to a rewind point.

References Cited in the file of this patent

UNITED STATES PATENTS

1,803,124	Nau-Touron	Apr. 28, 1931
1,813,611	Dickie et al.	July 7, 1931
2,481,538	Rowedder	Sept. 13, 1949
2,699,032	Landolt	Jan. 11, 1955
2,718,363	Roberts	Sept. 20, 1955
2,739,766	Rayburn	Mar. 27, 1956

FOREIGN PATENTS

164,207	Germany	Nov. 7, 1905