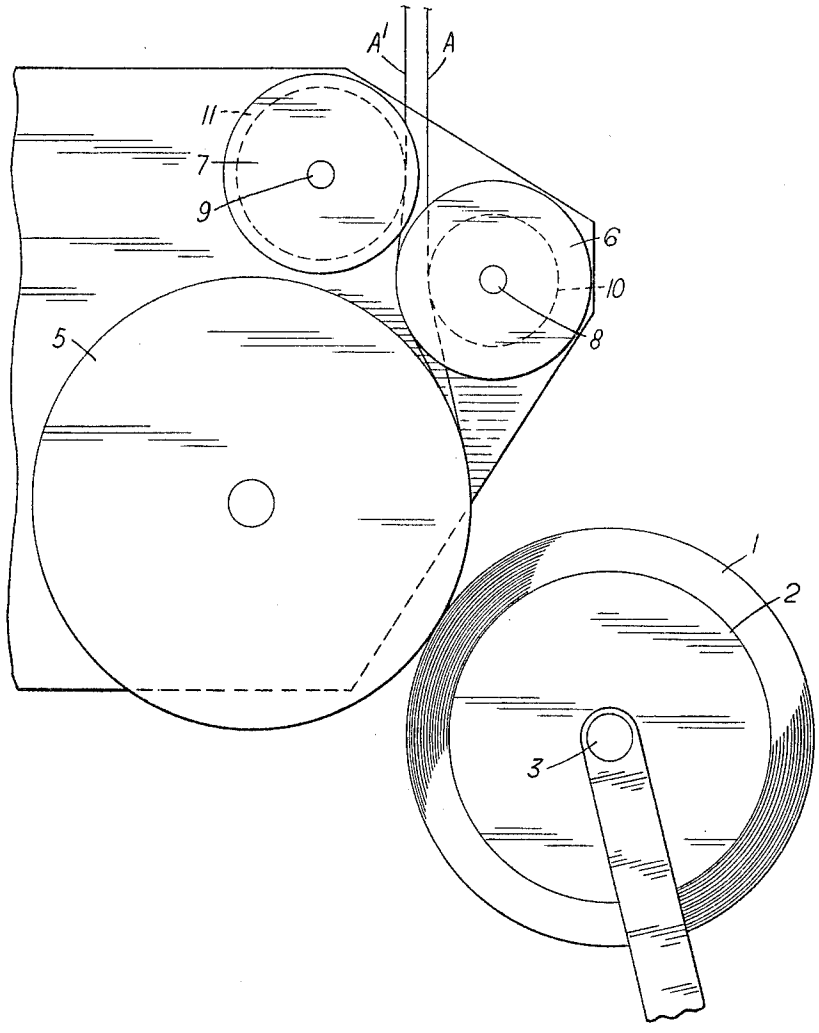
Aug. 16, 1966 D. C. FERRIER 3,266,741

METHOD AND APPARATUS FOR WINDING YARN

Filed April 16, 1964 3 Sheets-Sheet 1

Fig. 1.



Inventor
DUNCAN CAMERON FERRIER

By
Cushman, Darby & Cushman
Attorneys

Aug. 16, 1966 D. C. FERRIER 3,266,741

METHOD AND APPARATUS FOR WINDING YARN

Filed April 16, 1964 3 Sheets-Sheet 2

Fig. 2.

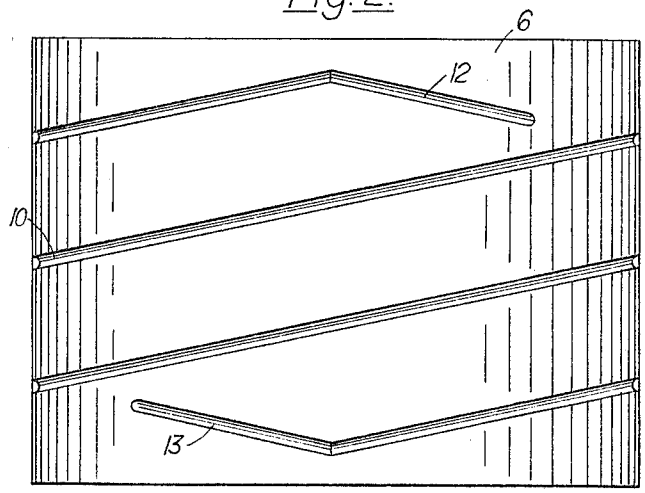
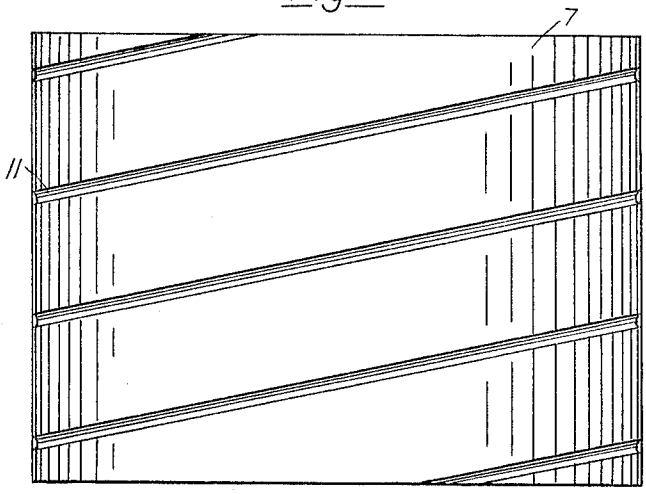


Fig. 3.



Inventor
DUNCAN CAMERON FERRIER

By
Cushman, Darby & Cushman
Attorneys

Aug. 16, 1966 D. C. FERRIER 3,266,741

METHOD AND APPARATUS FOR WINDING YARN

Filed April 16, 1964 3 Sheets-Sheet 3

Fig. 4.

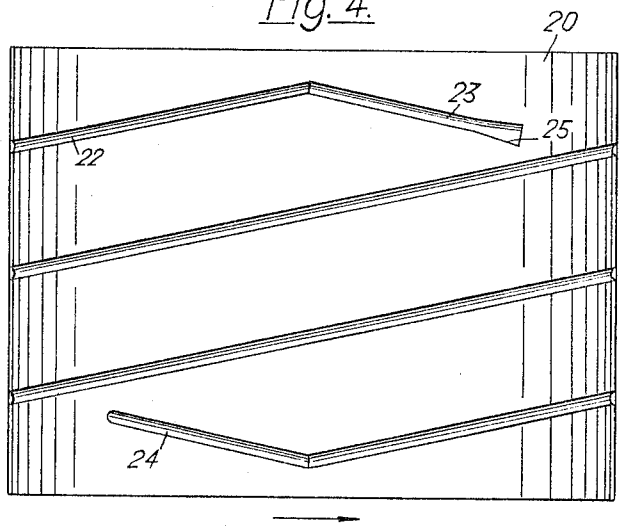
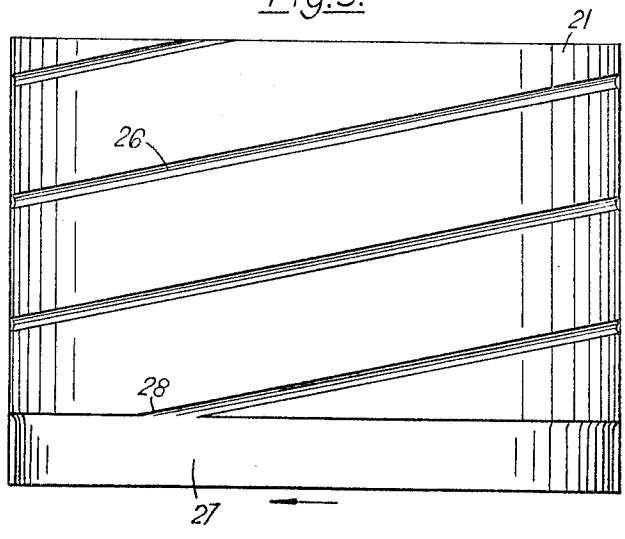


Fig. 5.



Inventor
DUNCAN CAMERON FERRIER

By
Cushman, Darby & Cushman
Attorneys

United States Patent Office 3,266,741 Patented August 16, 1966

3,266,741
METHOD AND APPARATUS FOR WINDING YARN

Duncan Cameron Ferrier, Llan-yr-Avon, Cwmbran, England, assignor to British Nylon Spinners Limited, Pontypool, England

Filed Apr. 16, 1964, Ser. No. 360,303
Claims priority, application Great Britain, Apr. 20, 1963, 15,684/63
4 Claims. (Cl. 242—43.2)

The present invention relates to improvements in winding yarn onto a package and is particularly directed to yarn winding in which the yarn during winding onto a package is traversed across the package by means of grooved traverse rolls, and to apparatus therefor.

In the winding of yarn on revolving yarn packages, which are normally peripherally driven to maintain uniform yarn speed, the yarn is rapidly traversed across the package first in one direction and then reversed and traversed at the same speed in the opposite direction.

Such traversing is frequently effected by reciprocatory guides mounted on a traverse bar. At high winding speeds the traverse bar is, however, subjected to very high strains during the reversals of direction of traverse which often result in the bar fracturing. Thus the speed at which a yarn can be wound onto a package is limited by the strains imposed on the traverse bar.

Yarns may also be traversed by means of rotary guides which do not suffer from the disadvantage of the aforementioned reciprocatory guides.

The rotary guides normally comprise a single rotatable cylindrical roll having an endless groove or grooves in the longitudinal surface thereof. There are two main types of such rolls; a single groove roll in which the groove extends from one end of the roll to the other and back again without intersecting with itself, and a multigroove roll in which the return portion of the groove is superimposed on the forward portion so that there are one or more intersections of the two portions between their ends. In both of these types of rolls the yarn is engaged in the groove and is traversed to and fro longitudinally of the package as the roll rotates.

Each of the aforementioned rolls has certain disadvantages however. In order to wind a package of substantial length (e.g. more than three inches) using a single groove roll the roll has to have a very large diameter and is excessively bulky. An equivalent multigroove roll is much smaller, being virtually a compressed form of the single groove roll, and is therefore much more desirable as a piece of equipment. Difficulties experienced with this type are related to the high tension which has to be applied to the yarn in order to ensure that it remains in the correct groove during traversing. The higher the speed the greater is the applied tension required, thus speed of winding is limited by the tension since excessively high tensions are likely to cause permanent damage to the yarn. The need for this tension is brought about by the fact that in a yarn being traversed across a yarn package the portion of the yarn on either side of the groove, i.e. those portions of the yarn approaching and leaving the groove, lag behind the yarn lying in the groove. When the yarn being traversed encounters an intersection of the two grooves there is a tendency due to this lag, if the yarn tension is not sufficiently high, for the yarn to leave the outwardly traversing branch of the groove and to return in the direction whence it came rather than to complete the traversing movement. Much effort and inventive skill has been applied, over many years, to try and eliminate this tendency and thus allow increased winding speeds to be employed.

An apparatus which is free from disadvantages of the

single and multigroove rolls has been suggested for winding yarn on conical packages. This apparatus comprises, in combination, two intergeared parallel rollers spaced a short distance apart the yarn package being driven by one roller which has in the periphery thereof a single helical groove which extends sufficiently to give the yarn the full length of traverse desired and turns back for a short distance at both reversals and also in one direction of traverse between such reversals. The other roller has a spiral groove in the surface thereof which serves only to traverse the yarn between the reversals in the opposite direction of traverse.

For winding yarn on conical packages the grooves have a constantly increasing pitch from end to end of the rollers, both in the same direction, to give the necessary accelerated traverse towards one end of the package.

In order to be traversed across the yarn package by these rollers the yarn is laid across both rollers and therefore is continuously in physical contact with both rollers. When running in the groove of one roller it passes over the peripheral surface, at an angle to the grooves, of the other roller and vice-versa.

This particular apparatus as aforementioned, and in common with other grooved rotary traverse rollers, requires that one of the rollers provides the drive for the yarn package by being in close physical contact with the package. Whatever advantages this may have with regard to the laying of the yarn on the package it does have one particular disadvantage. In the uniform winding of yarn on a package there is a tendency for a defect known as pattern winding to occur, this is due to the repeated laying of yarn on the same points on the package. In order to prevent this pattern winding it is necessary to ensure that the harmony of motion of the yarn package and the driving roller is broken at intervals. In practice yarn winding machines are frequently fitted with devices for this purpose. Thus the yarn winding machine may be provided with a retarding means capable of being brought into intermittent contact with the yarn package to cause variations in the speed of the yarn package. Such methods for the prevention of pattern winding are undesirable since the effect on the speed of the yarn package is likely to be large and jerky and this then leads to marked variations of tension in the yarn being wound onto the package, which tension variations are likely to produce other undesirable defects at a later stage in the history of the yarn.

We have now found that in an improved method for winding yarn on a package, particularly a cylindrical package to form what is known as a cheese, the yarn is passed between two driven intergeared parallel, grooved rollers spaced apart from the yarn package which is separately driven. The two rollers are spaced a small distance apart and the yarn passing therebetween is traversed across the package in one direction by the groove in one roller and in the opposite direction by the groove in the second roller. The yarn is in continuous contact with one roller only, being either in the groove contained in the surface of that roller or running on the peripheral surface thereof.

Since the traversing rolls and the yarn package are separately driven, pattern winding can be readily avoided by making small smooth variations in the speed of traversing keeping the winding speed constant.

The fact that in this method the yarn is passed between the rollers means that only a relatively small angle of wrap is required to maintain the yarn in contact with one or both rollers and hence the tension induced in the yarn by frictional contact with the rollers is reduced and higher winding speeds can be obtained.

Accordingly therefore, the present invention provides a method for winding a yarn onto a driven yarn package

wherein the yarn during winding is traversed across the yarn package by grooves contained in the peripheral surfaces of two driven contra-rotating axially parallel rolls spaced apart from each other and from the yarn package, the groove in the roll laying the yarn on the package at both reversals and in one direction of traverse and the groove in the other roll laying the yarn on the package in the opposite direction of traverse only, the yarn passing between the rolls in its path to yarn package and in contact with the peripheral surface of the first mentioned roll whilst being traversed across the yarn by the groove in the second mentioned roll.

Preferably the yarn is laid initially on a roller driving the yarn package by frictional contact therewith and then offset directly onto the said yarn package.

In general, the effectiveness of a yarn traverse mechanism is optimised when the displacement of the point of lay of the yarn at the package is equal to the displacement of the yarn path at the traverse. This is, however, an ideal situation and in practice the closest approximation to it occurs when the effective length of yarn free path between the traverse and the point of lay at the package is minimal. In the method of traversing a yarn across a package described hereinbefore, advantage is taken of the high resistance of the drive roll to relative motion between the drive roll and the yarn in contact with it to reach a state as near the ideal as possible. Thus for practical purposes in this method the effective length of yarn free path is the distance between the traversing rolls and the point to which the yarn is laid onto the drive roll, since from the drive roll the yarn is offset directly onto the yarn package with negligible movement relative to the drive roll.

The invention also provides an apparatus for carrying out the winding of a yarn onto a driven yarn package. The apparatus comprises two driven traverse rolls which are rotated in opposed directions and which are spaced apart from each other and from a separately driven yarn package. One of the traversing rolls contains a single main helical groove of constant pitch in its peripheral surface and the groove is turned back a short distance at each end to form the beginning and the end portions of the helical groove. The turned back portions of the groove are of insufficient length to intersect the main groove and the second of the traversing rolls contains in its periphery a single helical groove in the same sense and pitch as the main groove in the first mentioned roll.

Preferably the yarn package is peripherally driven by a fixed driven roller, rotating in the direction of yarn travel, making frictional contact with the said yarn package, said roller being mounted in close relationship to the traversing rolls and extending across the yarn path to cause a yarn being traversed by the traversing rolls to make contact with a portion of the surface thereof and to be laid thereupon before being wound on to the yarn package.

The position of the yarn package driving roller in relation to the traversing rolls and the yarn package is such that it constrains a yarn being traversed by the roll which reverses the direction of traverse to move out of contact with the other traversing roll.

The helical groove in the traversing roll which reverses the direction of yarn traverse is preferably deeper than the groove in other traversing roll.

In the most preferred form the helical groove in the traversing roll which reverses the direction of yarn traverse has a width of 0.020" to 0.030" and has an expanded lead-in end portion. The other traversing roll has a portion around the circumference of the roll at the lead-in side machined to the depth of the groove, and the groove at the point where it joins said machined portion is expanded to provide a lead-in tip portion.

The width of the groove in the last mentioned roll is not critical and it may, for example, be as much as 0.375".

There will now be described with reference to the accompanying drawings two embodiments of the apparatus and the method by which they are to be employed according to this invention. This description is given merely by way of illustration of the invention and is in no way intended to be limitative thereof.

In the drawings:

FIGURE 1 is a cross-sectional view of the apparatus of this invention showing the yarn path through the apparatus for each direction of traverse;

FIGURE 2 is a development of the front and lower traversing roller of FIGURE 1 which serves to lay the yarn on the package in one direction of traverse and at both reversals; and

FIGURE 3 is a development of the rearmost and upper traversing roller of FIGURE 1, the groove in which serves to lay the yarn on the package between reversals in the opposite direction of traverse.

FIGURES 4 and 5 are developments of preferred forms of the front and rearmost traversing rollers respectively.

In FIGURE 1, yarn package **1** is mounted on a cylindrical container **1** of 4½ inches in diameter secured to a freely rotatable shaft **3** mounted on a swinging arm **4**. It is spring urged against a drive roll **5** so as to be in driving contact therewith, the swinging arm **4** permitting the outward movement of the yarn package **1** as its diameter increases owing to yarn being wound on. Grooved front and rear traversing rollers **6** and **7** each being 2½ inches in diameter having peripheral grooves **10** and **11** are mounted on parallel shafts **8** and **9** which are geared together such that the rollers revolve in opposite directions. A and A' show the paths the yarn takes as it is being traversed by rolls **6** and **7** respectively, in each instance the yarn being laid on the drive roll **5** before being wound onto the yarn package **1**.

In FIGURE 2 there is shown a development of the front traversing roller **6** containing a deep groove **10**, 5/16" deep and 0.125" wide which extends almost across the full length of the roller in the form of a right hand helix having a pitch of 1.25 inches. The end portions **12** and **13** of the groove **10** turn back for a short distance to start a left hand helix having the same pitch as the right hand helix. The length of the said end portions **12** and **13** are such that they each subtend an angle of 120° at the centre of the roll.

In FIGURE 3 there is shown a development of the rear traversing roller **7** containing a shallow groove **11**, 0.125" deep and 0.125" wide which extends across the full length of the roller in the form of a right hand helix having the same pitch as groove **10** in the roller **6**.

Referring again to FIGURE 1, the rollers **6** and **7** are spaced a small distance apart and near to the yarn package driving roll as possible, their position relative to each other being so arranged that when the yarn is traversed by the deep groove in roller **6**, path A, it is in contact with that roller only but when it is traversed by the shallow groove in roller **7**, path A', it is also in contact with the peripheral surface of roll **6**, around which it describes an arc before being laid initially on the drive roll **5** and thence offset or printed directly onto the package **1**.

Thus in operation therefore, yarn to be wound onto cylindrical container **2**, which is driven by the drive roll **5**, is passed between the contra-rotating rollers **6** and **7** and is taken up by groove **10** of roller **6** and thus follows path A. Groove **10** then causes the yarn to be traversed across the package via the drive roll **5**. When reaching the turned back portion **12** of groove **10** the direction of traverse of the yarn is reversed and after a short distance it runs out of the groove onto the peripheral surface of roll **6**. The yarn is immediately deflected by the peripheral surface of roll **6** into the groove **11** of roll **7** to follow path A' which continues to traverse the yarn in the reversed direction. On approaching the end of the traverse caused by roll **7** the yarn slips into the turned back portion **13** of groove **10** to take up the preferred path A again. The portion **13** of groove **10** completes

the traverse of the yarn across the package in the reversed direction and then reverses the direction of traverse back to the original direction. The above process is then repeated until the yarn package is full.

Thus the yarn is traversed in one direction across the package by the groove **10** of roll **6**, which also reverses the direction of traverse at both ends and is traversed in the other direction between reversals by the groove in roll **7**.

In the most preferred embodiment of the apparatus, the traversing rollers **6** and **7** are replaced by rollers **20** and **21**, developments of which are shown in FIGURES 4 and 5 respectively.

In FIGURE 4 the front traversing roller **20** contains a groove **22** which is 0.3125" deep and 0.020" wide extending across the roller in the form of a right hand helix having a pitch of 1.25". The end portions **23** and **24** of the groove **22** turn back for a short distance in the manner of roll **6** described in FIGURE 2. The tip **25** of the end portion **23** of groove **22** with which the yarn first makes contact on being transferred from the rear roller, is expanded to provide a lead into the groove for the yarn.

In FIGURE 5 the rear traversing roller **21** contains a groove **26** which is 0.125" deep and 0.125" wide extending across all but an end portion **27** of the roller in the form of a right hand helix. The end portion **27** is machined down to a depth of 0.125", i.e. the depth of the groove **26** and the end portion **25** of the groove where it joins the end portion **27** of the roller is expanded slightly to form a lead for the yarn.

The width of the end portion **27** is controlled by the length of the turned back portion **24** of groove **22** in roll **20**, it should be wide enough to just catch the yarn as it is released from the said turned-back portion of the roll **20**.

The rolls are employed in the same manner as described with reference to FIGURE 1. The narrower groove **22** in roll **20** improves the reversal of the yarn traverse and allows the yarn to move readily to pass over it when being traversed by the other roller, reducing still further the tendency of the yarn to "drop in" to groove **20** when being so traversed. The provision of the "lead in" portions to the grooves and of the machined portion of roll **21** gives an improved transfer of yarn from one roll to the other. As a result of these improvements faster yarn winding speeds may be obtained with this preferred embodiment.

It is clear that in the foregoing embodiments of this invention, the relative speeds of the traversing rolls should be adjusted to give an even density of yarn across the package.

What I claim is:

1. A method for winding yarn onto a driven yarn package comprising the steps of: taking a yarn from a supply and passing the yarn between first and second traversing rolls which are spaced from one another and from the yarn package, each of said rolls having a groove in its peripheral surface for guiding the yarn for winding along said yarn package, laying the yarn on the yarn package in a first traversing direction and at both reversals of traversing directions by a contact of the yarn in a guiding groove of only the first traversing roll while maintaining the yarn completely out of contact with the second traversing roll, shifting the yarn to a groove in the second traversing roll when said first direction of traverse is completed, and laying the yarn on the yarn package in an opposite traversing direction by a contact of the yarn in the guiding groove of the second traversing roll and with a peripheral surface of the first traversing roll, whereby

frictional contact of the yarn with said traversing rolls is substantially reduced for a more rapid winding of the yarn on a package.

2. The method of claim **1** and including the step of laying said yarn onto a surface of a driving roll for the yarn package prior to winding said yarn onto the yarn package and placing said yarn onto the yarn package by a direct contact of the driving roll surface with the yarn package.

3. Apparatus for winding a yarn onto a yarn package comprising:

first and second traversing rolls spaced from one another and driven to rotate in opposite directions to one another for traversing a yarn which extends from a supply in a path passing between said traversing rolls for delivery to a yarn package, said first traversing roll having a single main helical groove of a constant pitch in its peripheral surface with the ends of said main helical groove being turned back to form beginning and end portions of a helical groove having a pitch in the opposite sense of the main helical groove but with said end portions not intersecting said main helical groove, said main helical groove of said first traversing roll functioning to traverse said yarn in a first direction relative to a yarn package while maintaining said yarn out of contact with the second traversing roll, and said second traversing roll having in its peripheral surface a single helical groove in the same sense and pitch as the main helical groove of the first traversing roll, said helical groove of said second traversing roll functioning to traverse said yarn in a direction opposite to the traversing direction of said first traversing roll, and

a yarn package spaced from said first and second traversing rolls for receiving the yarn being moved between said traversing rolls, said yarn package being driven by a driving roll which is spaced from the first and second traversing rolls and interposed between said traversing rolls and said yarn package for driving the yarn package by frictional contact therewith, said driving roll further being positioned to present a yarn engaging surface which biases the yarn being moved between said first and second traversing rolls and which maintains the yarn in a path which is out of contact with said second traversing roll during said first traversing direction and which maintains said yarn within the helical groove of the second roll and in contact with the surface only of said first traversing roll during said second traversing direction, whereby frictional contact of the yarn with the traversing rolls is substantially reduced for a more rapid winding of the yarn onto the yarn package.

4. The apparatus of claim **3** wherein the helical groove in said first traversing roll is deeper than the helical groove in the second traversing roll, said helical groove of the first traversing roll thereby defining a path of movement for said yarn which maintains the yarn out of contact with the second traversing roll while it is being traversed in said first direction by said helical groove of the first traversing roll.

References Cited by the Examiner

UNITED STATES PATENTS

2,419,003	4/1947	Bateman	242—43
3,092,339	6/1963	Hill et al.	242—18

FOREIGN PATENTS

891,517	9/1953	Germany.

STANLEY N. GILREATH, *Primary Examiner.*