FIG. - 6 -

FIG. - 7 -

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PNEUMATIC DOFFING ARRANGEMENT

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This invention relates to dosing and dosing of textile bobbins, cones and the like, and more particularly to a dosing and pneumatically dosing arrangement employed in a yarn winding apparatus which adapts itself to automatic or semiautomatic operation.

It is a principal feature of this invention to provide a simple yet effective system wherein all bobbins may be faultlessly removed or dosed from a winding frame substantially simultaneously through the medium of an ejecting air jet exerted through the center of the spindles.

A further feature is the provision of a unique, simple, yet effective, spindle arrangement incorporating therein a pneumatic dosing means for the dosing of bobbins and the like from the spindle under pneumatic pressure.

Still another feature is the provision of a spindle having a pneumatic dosing arrangement in which the bearings of the spindle are substantially protected from gas pressure utilized for dosing.

A further feature is the provision of a novel bobbin dosing and dosing arrangement for spinning frames, roving frames and the like, requiring less operator action than with manual dosing and dosing.

Another feature is the provision of a dosing and dosing arrangement in which dosing is accomplished through the medium of compressed air passing through the spindle, and dosing is accomplished through the use of a movable carrier.

A further feature is the provision of a pneumatically dosing rotary-spindle arrangement which permits free rotation of the spindle about a supporting shaft, while functioning during dosing to seal in substantially air tight relation the normally free connection between the spindle and the shaft.

Still further features and many attendant advantages of the invention will become apparent from the following detailed description of a preferred physical embodiment of the invention, in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a schematic illustration of a portion of a dosing frame incorporating my invention.

FIGURE 2 is a side elevation view in partial section of a single spindle arrangement according to my invention.

FIGURE 3 is a view similar to that of FIGURE 2 illustrating schematically the action of the apparatus at the beginning of the dosing operation.

FIGURE 4 is a further view in partial section illustrating schematically the action of the bobbin while being dosed.

FIGURES 5—10 illustrate sequential stages in a complete dosing and dosing cycle of the apparatus of FIGURE 1.

FIGURES 11 and 12 are fragmentary detail views in partial section of a dosing receiving cup and a dosing bobbin holder, respectively.

FIGURE 11a is a section view taken on the line 11a of FIGURE 11.

FIGURE 14 is a section view of a modified form of bobbin holder.

FIGURE 14 is a fragmentary section view of a spindle modification.

The illustrated embodiment of the invention relates particularly to those bobbins known as warp bobbins, the frames for such bobbins often being equipped with spindles which may be readily adapted to incorporate the instant invention, although it will be apparent that the invention is not limited to such bobbins and might also be employed for handling filling or other types of bobbins or yarn carriers. Also, it will be apparent that the invention may be used in any winding or unwinding arrangement whereby a rotatably mounted bobbin or other yarn carrier is to be dosed and/or dosed in the operation thereof.

Briefly, according to the broad aspect of the invention, closed-ended bobbins are dosed from the spindles of spinning, twisting or in other apparatus wherein the dosing medium of air under pressure transmitting an axially ejecting force to the interior of each bobbin, preferably simultaneously for any desired group or plurality of bobbins, as for instance the bobbins on one side of a warp spinning frame. The bobbins are then collected as by a movable overhead carrier and replacement bobbins are next placed onto the empty spindles, preferably through the medium of the same overhead carrier.

Referring to FIGURE 1 wherein my invention is illustrated as embodied in a dosing frame of generally conventional construction in respect to the dosing aspect thereof, a dosing frame 10 is provided having a plurality of spindle positions 12, each including a spindle 14 rotatably mounted on a spindle rail 16 and driven by drive belts 18 in accordance with conventional practice. A traversing ring rail 20 provides the desired twisting and building motion for the apparatus, and yarn drafting, guiding, and supply means (not shown) may be provided all in accordance with conventional practice as may be desired. The various parts of the apparatus for winding the yarn onto the spindle or spindles do not in themselves constitute a part of this invention and will therefore not be further illustrated or described in detail, as their construction and operation will be readily apparent to one skilled in the art, and may obviously take any conventional or desired form consistent with the practice of this invention which resides in the various dosing and dosing aspects next to be described.

As seen in FIGURE 2 each spindle 14 includes a shaft 22 having a main body 22a suitably mounted in fixed upright position on rail 16 (FIGURE 1) in any suitable conventional or desired manner. A pair of ball bearings 24, 26 or other suitable anti-friction bearings are disposed in axially spaced apart relation on shaft 22 as by light press fitting, and serve to rotatably support a hollow spindle tube 40 fitted over the outer race thereof as by a press fit, snap ring, or other suitable connection as may be desired. The upper end of the shaft body 22a is tapped to accommodate and seat the threaded connecting end of a shaft extension 22b of reduced diameter. Obviously, the shaft body 22a and extension 22b might be made integral if desired. Upper bearing 26 is fitted onto shaft extension 22b and is securely held in snug relation against an end shoulder 28 formed in the main shaft body 22a, as by a lock nut 29 screwed onto an upper threaded portion 27 of extension 22b adjacent the bearing seat thereon. There is connected to spindle 42 at its lower end, as by forming integral therewith or suitably securing thereto, a whorl 42 which receives belt 18 for rotation of the spindle in accordance with conventional practice.

An axial hole 44 is formed, as by drilling, through the center of the main body of shaft 22 as well as shaft extension 22b to provide an air passageway from the lower end of shaft 22 to the upper end of its extension 22b for bobbin dosing, as later described. The surrounding wall of the axial hole 44 effectively forms an axially extending pneumatic pressure transmitting guide for dosing of bobbins from the spindle 14. The upper portion 44a of the axial hole through shaft extension 22b is of reduced diameter, and a diametral port, or...
ports, 46 is formed in the wall of the extension 22b slightly below this reduced diameter portion of the axial hole. The upper end of extension 22b extends through a central sleeve 48 in the upper portion of spindle tube 40 to a point slightly below the top of the extension 22b. Fitted close surrounding relation over the upper end portion of extension 22b is an elastic tube 50, of plastic, rubber or other suitable material. For snug and secure fit theron the elastic tube 50 may be screwed down over a portion of the upper screw-threaded portion 27 of extension 22b. In any event tube 50 is so disposed on extension 22a as to extend both above and below ports 46. An air tight enclosure is formed around the ports 46 by the tube 50, as by the use of two ring clamps 52 and 54, clamped over tube 50 respectively above and below the ports 46 and the axially inner and outer surfaces of the end of spindle tube 40.

The bottom end of the stationary spindle shaft 22 at each position is suitably coupled in air tight relation to a pneumatic pressure branch line 54 which connects to a suitable pneumatic pressure source 58 through a trunk line 56 and a control valve 57, as illustrated schematically in FIGURE 1.

Referring again to FIGURE 1, there is provided an overhead conveyor system for replenishing the spindles with empty bobbins and for receiving and carrying away full bobbins from the spindles. This conveyor system includes a trolley 60 which may be suitably mounted for travel on an overhead rail 62 and may have a self-propelling arrangement in the form of a reversible motor 64, traction wheel 66 and interconnecting drive belt 68. A horizontally mounted shaft 70 or cable drum is rotatably supported in a pair of bearings 72 secured to trolley 60 in a position depending on relation. Shaft 70 is coupled through a gear reduction box 74 to a reversible motor 76 also mounted on and carried by trolley 60 to provide for selective rotation of the shaft 70. Gear box 74 may suitably include a worm gear connection in order to prevent undesired rotation of shaft 70 by torsional stress exerted directly thereon.

Supported by and in depending relation from shaft 70, as by a pair of flexible cables 78, each retained by a reel or drum 79 fixed on shaft 70, is a carrier 80 which extends over the entire length of the frame positions. Securely on the carrier 80 at intervals corresponding to the gauge of the spindles on frame 10 are a plurality of dop receiving holders in the form of inverted flared-mouth cups 82 corresponding to the number of spindle positions, and alternately between cups 82 are secured a corresponding plurality of empty-bobbin holders 92.

In order to assist the proper alignment of carrier 80 with the spindle positions 12 a pair of upstanding guide posts 110 are mounted on frame 10, one at each end thereof. Correspondingly spaced guide slots 112 are formed near the ends of carrier 80 and adapted to fit over the guide posts 110 when the carrier is adjacent the frame 10 at a height beneath the upper end of the posts. The guide slots 112 are each of such a length that positioning of the carrier 80 with the posts 110 in contact with one end of the slots will result in positioning the dop receiving cups 82 in alignment with the various spindles 14, whereas positioning of the carrier such that the posts 110 are in contact with any two adjacent ends of the slots will result in positioning the empty bobbin holders 92 in alignment with the spindles 14.

As seen most clearly in FIGURE 11, the dop cups 82 may be and are preferably formed of rubber, resilient plastic or other resilient material in the shape of an open-bottomed bell and are each secured to the carrier 80 as by screws 83 extending through a metal washers 85 and the top of the cup 82. The lower end of each cup 82 has an outwardly flared skirt 84 forming a flared opening terminating in an upper cylindrical portion 86 at the top interior of the dop receiving chamber. The flared lower end of each cup 82 is wider at the bottom than the closed upper end of the bobbins or other yarn carriers 30 and thus serves to guide the bobbin into the upper end 86 of the receiving chamber in the cups 82. This upper portion 86 of the bobbin-receiving chamber has a diameter slightly smaller than the upper end portion of the bobbin 30, and thus when a bobbin 30 is pushed into this undersized resilient upper chamber portion 86 the bobbin will be firmly held therein by the clamping force thereof. In addition to serving a guiding function the flared lower end 84 also serves to fit closely about the upper tapered portion 80 of the full yarn packages and thus tends to hold the yarn against unwinding or disengagement thereof. Preferably, a one way valve is formed in the upper end of the cup 82, and in the illustrated example this valve takes the form of a tapered slit 87 having resilient coniguous lips 87a at the top thereof and a flared lower portion. This permits the air to be easily pushed out of the cup interior during entry of the bobbin into the cup, while withdrawal of the bobbin from the cup is opposed by partial vacuum formation in the cup during withdrawal and the resistance of the lips 87a to entry of air into the cup interior.

The empty bobbin holders 92 in the illustrated example, as seen in detail in FIGURE 12, each take the form of a permanent magnet 94 which is vertically resiliently movably supported on the carrier 80 by a relatively heavy compression spring 96 and a sleeve 98 slidably fitted over a connecting bolt 99 secured to the carrier 80.

For use with this embodiment the bobbins 30 are each either formed entirely of ferromagnetic material, or may be formed with a portion at their upper end of ferromagnetic material, as shown. The latter is the preferred construction of the bobbin material as standard open-end bobbins of paper, wood, etc., may readily be adapted to use with a bobbin holder of this type by the addition of a metal cup or disc insert 31 as shown.

One function of spring 96 is to permit the firm seating of empty bobbins 30 onto the spindle tubes 40, irrespective of small variations in the seated height of the bobbins on their spindles, and to absorb shock during this seating action by the lowering of carrier 80. A flared guide 97 of suitable material such as plastic, metal, rubber, etc., is suitably secured to the magnet, as by a press fit, and serves to guide the bobbins into proper position on the magnets 94.

It will readily be apparent that while there has been shown one preferred embodiment of the full bobbin dop receiving means and empty bobbin holding means, in the form of a resilient cup and resiliently mounted magnet, respectively, these are illustrative and preferred constructions for the holders which may take other forms as may be desired. For instance, the dop receiving cup 82 might also take the form of a split collet (not shown) held together under the action of a resilient surrounding member such as a spring clip or elastic band. Or, as shown in FIGURE 13, the bobbin end holders 182 (for either empty or full bobbins) might have internal annular tapered rings or ridges 188 formed of resilient friction-gripping material, such as rubber, on their annular inner gripping surface for ease of entry of the bobbins with comparatively greater force required for ejection or removal of the bobbins therefrom. Also, the empty bobbin holder might in some instances employ a means of gripping (such as by friction, or positive gripping) rather than a magnetic mode of holding the bobbins, thus permitting the use of completely non-metallic bobbins.

In operation the frame 10 may, as stated previously, function in the conventional manner for spinning, twisting, or winding yarn or the like onto the bobbins or other carriers 30, and such operation will therefore not be described herein. Prior to, or at, the conclusion of the operation resulting in the deposit of textile or other material onto the bobbins or other carriers 30, the trolley 60 and associated carrier 80 is loaded with empty bobbins 30.
at a suitable supply station (not shown) and is brought on the overhead rail 62 into the position shown in FIGURE 1. Motor 76 is then actuated to lower the carrier 80 to the position illustrated schematically in FIGURE 5, wherein the empty bobbins 30 are disposed alternately between the full bobbins, and the deft receiving cups 82 are aligned with and a small distance (e.g. one or two inches) above the tops of the full bobbins at the various spindle positions 12. In order to assure proper alignment it may be desired in some instances to position trolley 60 so as to exert through the medium of cables 78 a small lateral bias or corrective force on the carriage 80 in a direction tending to hold the carrier at its extreme left position as defined by the lateral abutment of slots 112 with posts 110.

The normally closed valve 57 is then opened and air under pressure passes from source 58 through valve 57, trunk line 56, and the various branch line 55, to the individual spindle positions 12. At each spindle position 12 the air passes up through axial bore 44 in shaft 22 and out into the substantially airtight chamber 34 formed between the top of spindle tube 40 and the closed upper end of yarn carrier 30.

In order to provide a more airtight chamber 34 and to provide control of pressurized air down through tube end opening 48 and bearings 24 and 26 the expandable tube 59, ports 46, and restricted end bore or orifice 44a are provided, as described supra. Upon the application of the air pressure at the upper end of bore 44 the air will not only pass into chamber 34 through the restricted end orifice 44a, but due to differential pressure between the interior of bore 44 and the exterior of tube 50 the air will also pass through port, or ports 46, and cause the inflation or expansion of tube 50, thereby closing the normally existing gap between the tube 50 and the surface forming end opening 48. The pressurized air thus effectively seals the chamber 34 through the action of tube 50, and substantially all of the air is utilized to eject or deft the bobbin 30, this sealing and deft action being clearly shown in FIGURES 3 and 4.

The deft or ejected bobbins 30 are driven upward by the air pressure and into the deft receiving cups 82 which have been, as stated above, positioned in alignment with the full bobbins prior to deft. A yarn tail of a few revolutions which has been formed in a conventional manner either on the bobbin 30 or on the tube 40 slightly beneath the lower end of bobbin 30 at the completion of the spin out operation, may be utilized to maintain continuity of thread-up for the next bobbin to be wound on each spindle. As seen in FIGURES 3 and 4 this tail 32 of yarn may be caused to spiral up to some degree about the tube 40 and will break at an intermediate point as the bobbin 30 is deft. This leaves a tail 33 wrapped on the spindle tube 40 which may be employed to maintain supply-to-spindle yarn continuity for a new empty bobbin 30 which will be wound onto the tube 40, as will next be described.

After the substantially simultaneously deft of the full bobbins, the carrier 80 is raised to a point where the full and empty bobbins just clear the tops of the spindles (FIGURE 7). The carrier 80 is then moved to the right, as by the brief actuation of motor 64, to bring the empty bobbins 30 into alignment with the spindle positions 12, as shown in FIGURE 8. Next, motor 76 is actuated to lower carrier 80 to place the empty bobbins 30 down onto the tubes 40 (FIGURE 9). By permitting the carrier 80 to ride down at a moderate or moderately fast rate, and/or until a slight slack appears in cable 78, the empty bobbins may be seated onto the tubes 40 by the weight and/or momentum of the carrier 80, or if desired by adding extra thrust to the carrier as by an operator on the carrier or through the use of a positiveacting mechanical thrust mechanism as may be desired. Thus, upon reaccumulating motor 76 and raising the carrier, as shown in FIGURE 10, the bobbins will be retained on the tubes 40 due to the frictional retention force between the tube 40 and bobbin 30 being greater than the magnetic attractive force of holder 92. The trolley motor 64 is then actuated and the trolley 60 with its carrier 80 and load of full bobbin packages is moved on overhead rail 62 to a suitable position away from the frame 10 where the full bobbins 30a may be removed therefrom. The frame 10 may then be started to wind yarn onto the empty bobbins 30, and the entire operation may then be repeated for this or a separate frame 10 which may be serviced by the same trolley-carrier 60, 80.

An alternative embodiment of a spindle having provision for closing the upper chamber 234 between the upper free end of the spindle tube 240 and the closed end of the bobbin 30 is shown in FIGURE 14. In the embodiment a centrally apertured disc gasket or diaphragm 250 of rubber, plastic or other suitable resilient material is suitably secured to by a wing clamp 252, to the outer end of the shaft 222 and is formed so as to normally hold itself out of contact with tube 240, thus permitting unimpeded rotation of the spindle tube during normal winding operation of yarn onto the bobbin 30. During winding, the air pressure applied through the bore 244 of spindle shaft 222 forces the diaphragm 250 down, tending to close the gap between the diaphragm and the spindle tube 240, with the bobbin 30 being pushed off the spindle by the air as in the preceding example.

While the pneumatic deft apparatus for the spindles has been illustrated in combination with a trolley-type carrier for donning and deftting the bobbins, and this is the most advantageous and preferred arrangement, it will be apparent that the pneumatic deft apparatus may be used separate from the trolley-type deft-carrier and in other systems. For instance the bobbins might be deft onto the conveyor belt mid-stream alongside the spindles, the movement of the bobbins onto the conveyor occurring as through the use of overhead deflectors above the spindles which deflect the upwardly ejected bobbin laterally onto the conveyor belt.

Also it will be apparent that the deft-bobbin carrier might be utilized with other bobbin ejecting apparatus, although the presently combined arrangement lends itself to the most advantageous use and mode of operation.

Many further modifications of the invention will become apparent to those skilled in the art, without departing from the spirit or scope of the invention, and it is therefore understood that the invention is not to be limited by the illustrative examples given herein but only by the scope of the appended claims.

I claim:

1. The method of deftting a closed-ended yarn carrier from a spindle having a stationary blade and a rotatable bobbin mounting member rotatably disposed on said blade, comprising subjecting said carrier to an axially directed pneumatically transmitted ejecting force by passage of a stream of air through a longitudinally extending bore in said spindle blade and into effective force transmission to the closed end of said yarn carrier, releasing said carrier upon ejection from said spindle and then moving said carrier to a point spaced from the point of reception thereof.

2. The method according to claim 1, further including the step of reloading said deft spindle with an empty carrier.

3. A bobbin ejecting support arrangement comprising a bobbin support having a stationary central member and a rotatable bobbin engaging and holding member, an axially directed pneumatic pressure transmitting guide formed in said stationary member and adapted to be in operative pressure transmitting connection to a bobbin when held by said rotatable member, and a conduit operatively connected to said pressure transmitting guide and adapted to be connected to a source of pneumatic pressure to selectively eject an effectively closed ended bobbin from said support.
A bobbin ejecting support arrangement comprising a bobbin support having a stationary central member and a rotatable bobbin engaging and holding member, an air passage pressure transmitting guide formed in said stationary member and adapted to be in operative pressure transmitting connection to a bobbin when held by said rotatable member, and a conduit operatively connected to said pressure transmitting guide and adapted to be connected to a source of pneumatic pressure to effectually eject an effectively closed bobbin from said support, a plurality of said supports and associated conduits, and a common conduit line operatively connecting each of said first mentioned associated conduits together for substantially simultaneous doffing from said supports.

A rotatable yarn package supporting and doffing apparatus comprising a stationary supporting shaft having a longitudinally extending air passage formed therein, and a yarn-carrier-supporting tube rotatably mounted on said shaft, said air passage extending effectively through said shaft and the upper end portion of said tube for effective air pressure transmission to an effectively closed ended yarn carrier when held on said tube, and means for selectively sealing the upper end of said tube during doffing.

Apparatus according to claim 5 wherein said sealing means comprises a resilient diaphragm operatively connected to one of said shaft and tube.

A rotatable yarn package supporting and doffing apparatus comprising a stationary supporting shaft having a longitudinally extending air passage formed therein, and a yarn-carrier-supporting tube rotatably mounted on said shaft, said air passage extending effectively through said shaft and the upper end portion of said tube for effective air pressure transmission to an effectively closed ended yarn carrier when held on said tube, and means for selectively sealing the upper end of said tube during doffing, said sealing means comprising an elastic tube mounted on said shaft and operatively connected to said air passage.

A rotatable yarn package supporting and doffing apparatus comprising a stationary supporting shaft having a longitudinally extending air passage formed therein, and a yarn-carrier-supporting tube rotatably mounted on said shaft, said air passage extending effectively through said shaft and the upper end portion of said tube for effective air pressure transmission to an effectively closed ended yarn carrier when held on said tube, a low friction bearing between and connecting said tube and said shaft, and means adapted to selectively prevent air flow from the upper end of said tube and shaft and into said bearing.

Apparatus according to claim 9 wherein said air flow prevention means is pneumatically operable.

Apparatus according to claim 10 wherein said air flow prevention means is pneumatically operable in response to pressure differential between said air passage and the exterior of said shaft.

Apparatus according to claim 11 wherein said air flow prevention means comprises a resilient tube closely surrounding said shaft near said end thereof, and a transverse air passage formed in said shaft and connecting the interior of said resilient tube with said longitudinally extending air passage.

A rotatable yarn package supporting and doffing apparatus comprising a stationary supporting shaft having a longitudinally extending air passage formed there-
like, comprising a longitudinal member having a plurality of yarn holders mounted thereon, said holders being alternately doff receiving holders and donning holders, at least one of said holders comprising an article supporting magnet movably mounted in a depending relation on said longitudinal member, and a spring cushion disposed between said magnet and said longitudinal member.

22. A support according to claim 21 wherein said magnet has a flared guide skirt depending therefrom for centering a yarn carrier on said magnet.

23. A support for yarn carriers such as bobbins and the like, comprising a common supporting member and a plurality of downwardly extending inverted cups mounted thereon and having flared open mouths, the internal surface of at least one of said cups having substantially annular resilient bobbin-gripping-and-supporting rings formed therein, said rings being spaced apart and having upwardly tapered internally facing surfaces to permit ease of insertion of a bobbin with comparatively greater force being required for removal of a bobbin therefrom, said cups having an effective internal gripping surface substantially complementary to the head end of a bobbin.

24. A support according to claim 23 wherein said one cup has an air orifice formed at its upper end.

25. A support according to claim 24 wherein said air orifice is a valve offering greater resistance to air flow into said cup than out of said cup.

26. A support for yarn carriers such as bobbins and the like, comprising a common supporting member and a plurality of downwardly extending inverted cups mounted thereon and having flared open mouths, said cups having an effectively generally cylindrically shaped internal gripping surface axially displaced from said flared open mouth and forming an effectively generally cylindrically shaped bobbin gripping cavity substantially complementary to the head end of a bobbin, at least one of said cups having an air orifice formed at its upper end, said air orifice being in air transmitting connection between the exterior of said cup and said internal bobbin gripping cavity formed by said cup.

27. A support for yarn carriers such as bobbins and the like, comprising a common supporting member and a plurality of downwardly extending inverted cups mounted thereon and having flared open mouths, said cups having an effectively generally cylindrically shaped internal gripping surface axially displaced from said flared open mouth and forming an effectively generally cylindrically shaped bobbin gripping cavity substantially complementary to the head end of a bobbin, at least one of said cups having an air orifice formed at its upper end, said air orifice being a valve offering greater resistance to air flow into said cup than out of said cup.

28. A rotatable yarn package supporting and doffing apparatus comprising a stationary supporting shaft having a longitudinally extending yarn-carrier-doffing air passage formed therein, said air passage being adapted for receiving and conveying air therethrough from an air pressure source, and a yarn-carrier-supporting tube rotatably mounted on said shaft, said air passage extending effectively through said shaft and the upper end portion of said tube for effective air pressure transmission to a yarn carrier when held on said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,090,757 Shackleton Mar. 17, 1914
1,399,690 Clayton Dec. 6, 1921
1,667,552 Igou Apr. 24, 1928
1,769,479 Smith Jan. 20, 1931
1,842,383 Bell Jan. 26, 1932
2,240,047 Marzoli Apr. 29, 1941
2,293,290 Gammeter Aug. 18, 1942
2,308,209 Schmutzer et al. Jan. 12, 1943
2,353,189 Rundell July 11, 1944
2,463,484 Gelpke Mar. 1, 1949
2,666,562 Birch Jan. 14, 1954
2,766,879 Draper Oct. 16, 1956
2,903,290 Morris et al. Sept. 8, 1959

FOREIGN PATENTS

339,874 Great Britain Dec. 18, 1930
638,353 Germany June 18, 1937
57,626 Denmark May 6, 1940
822,958 Germany Nov. 29, 1951
1,063,409 France Dec. 16, 1953
427,119 Canada July 3, 1956