May 11, 1937. H. R. BLAIR 2,079,730

GAINER MECHANISM FOR WINDING MACHINES

Filed April 18, 1935 4 Sheets-Sheet 1

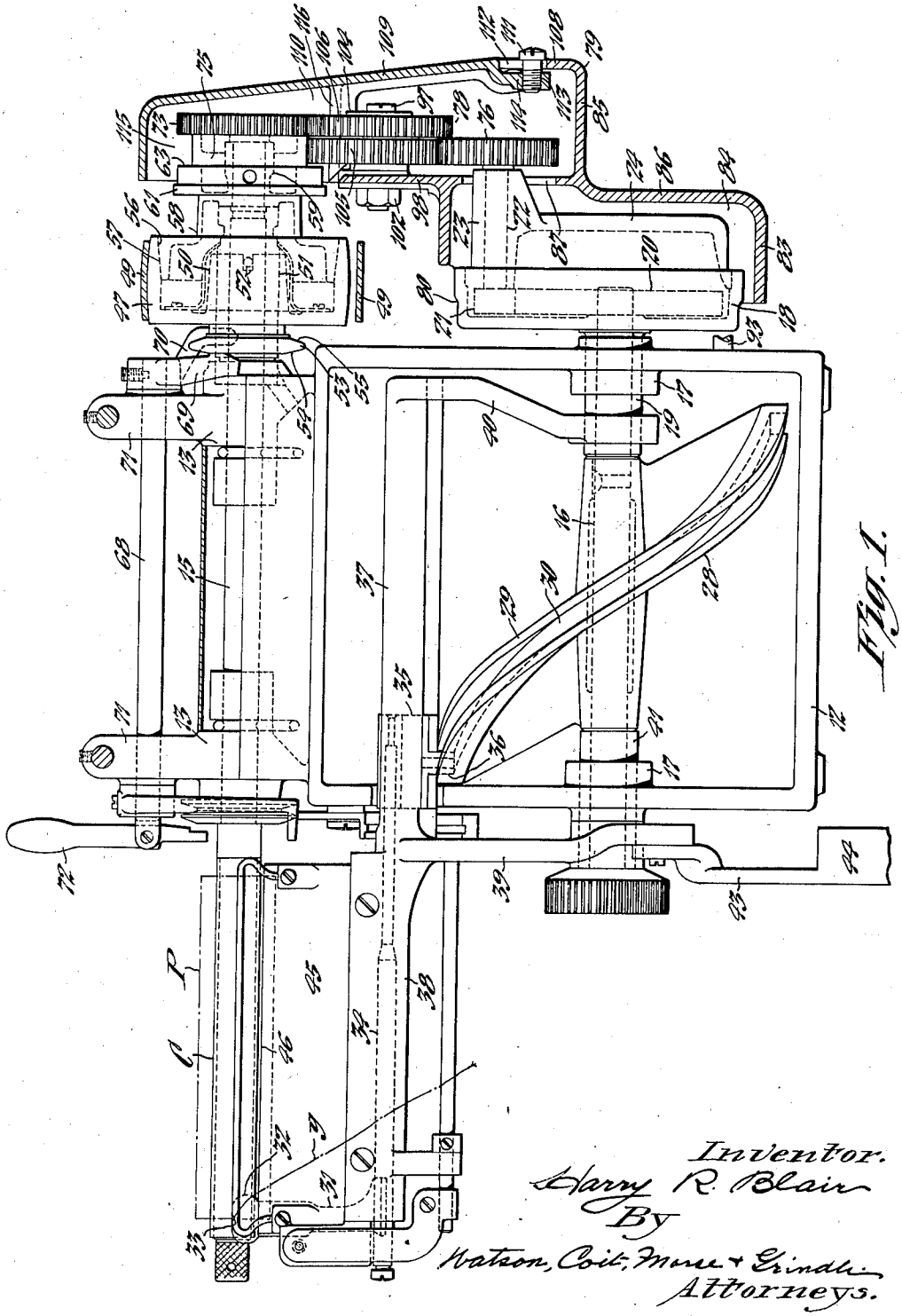

Fig. 1.

Inventor.
Harry R. Blair
By
Watson, Coit, Morse & Grindle
Attorneys.

May 11, 1937. H. R. BLAIR 2,079,730

GAINER MECHANISM FOR WINDING MACHINES

Filed April 18, 1935 4 Sheets-Sheet 2

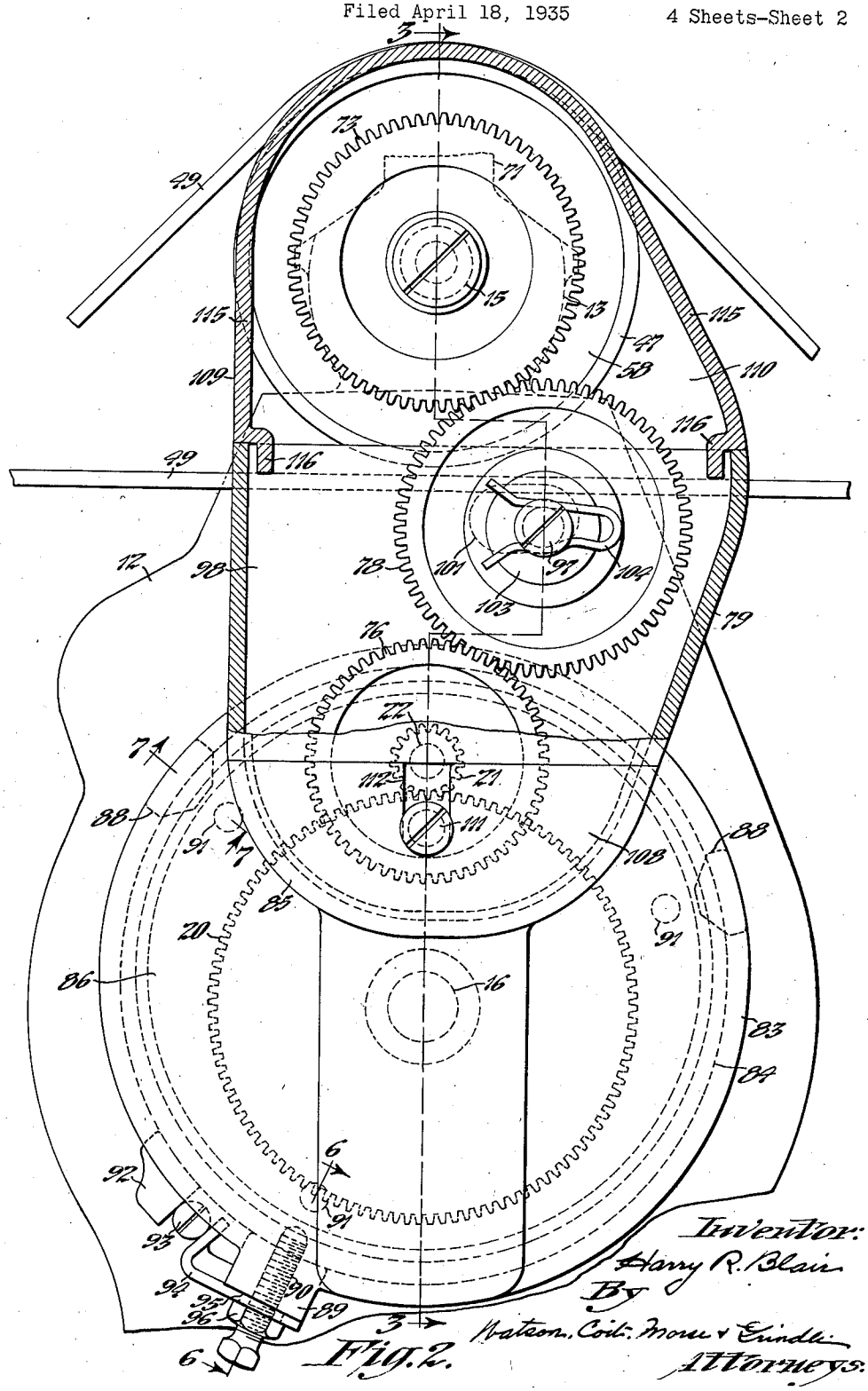

Fig. 2.

Inventor:
Harry R. Blair
By
Watson, Cole, Grosvenor & Dindle
Attorneys.

May 11, 1937. H. R. BLAIR 2,079,730

GAINER MECHANISM FOR WINDING MACHINES

Filed April 18, 1935 4 Sheets-Sheet 3

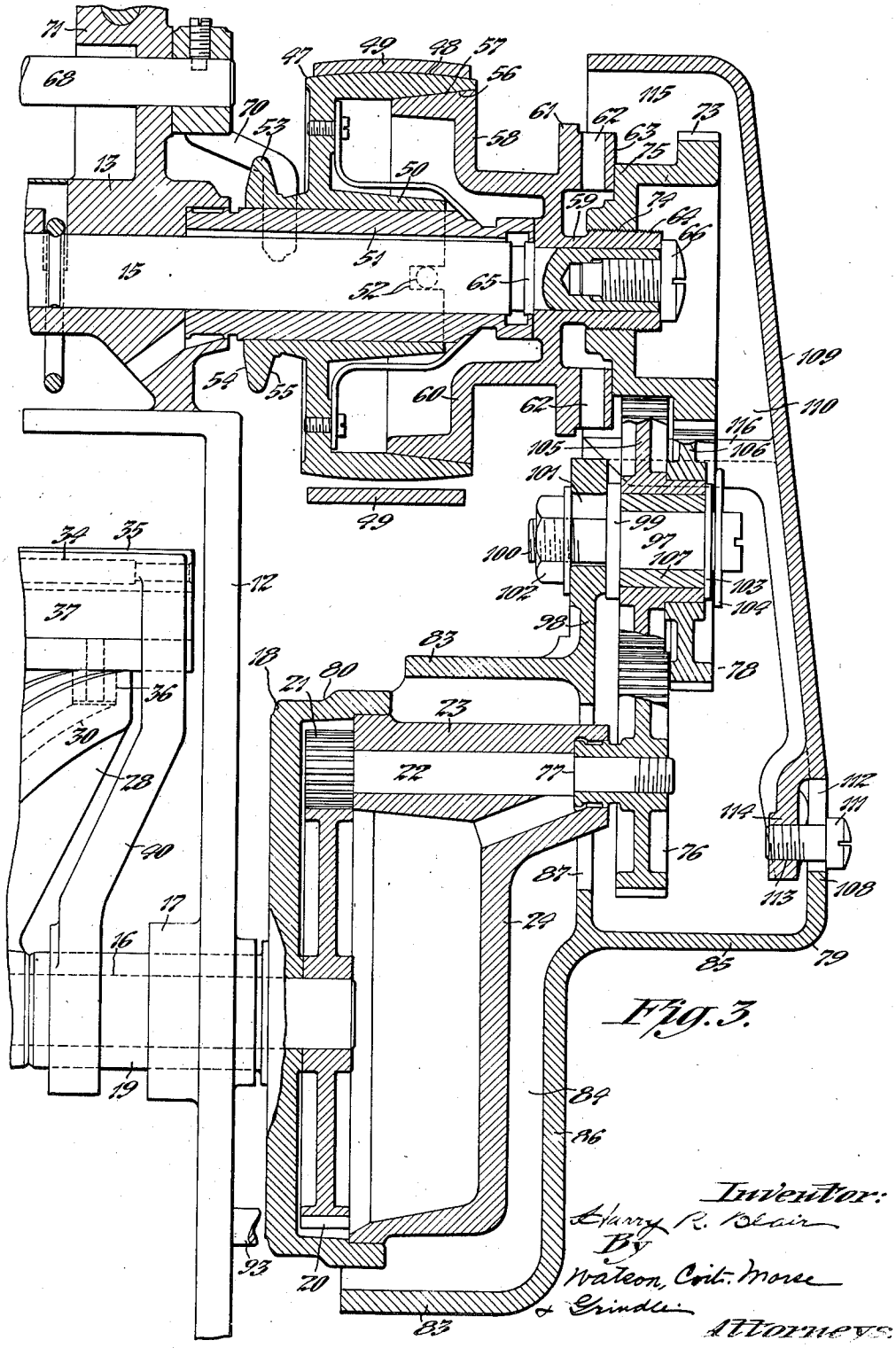

Fig. 3.

Inventor:
Harry R. Blair
By
Watson, Coit, Morse & Grindle
Attorneys

May 11, 1937. H. R. BLAIR 2,079,730

GAINER MECHANISM FOR WINDING MACHINES

Filed April 18, 1935 4 Sheets-Sheet 4

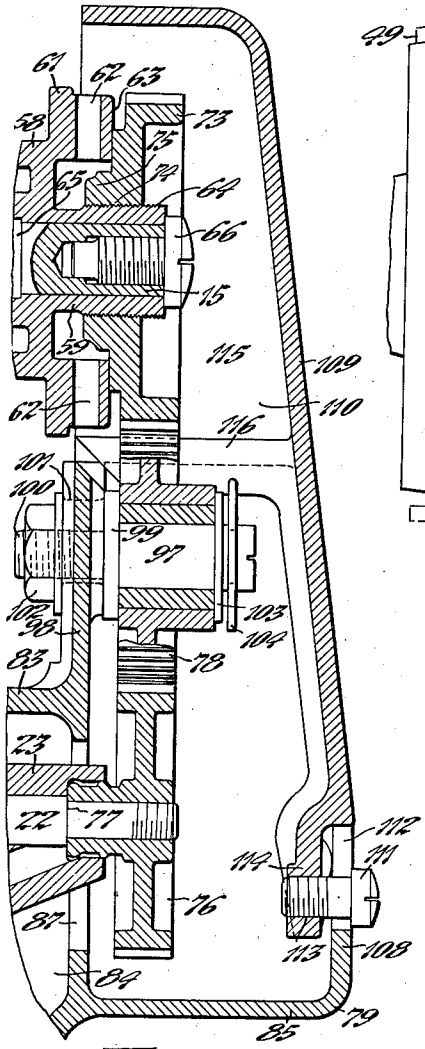

Fig. 4.

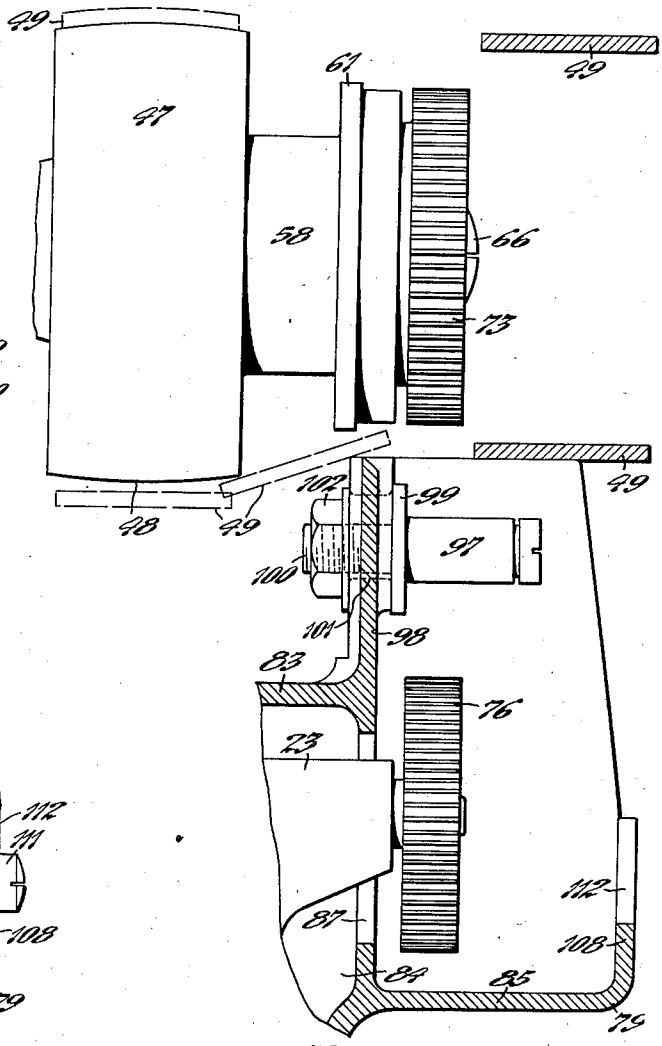

Fig. 5.

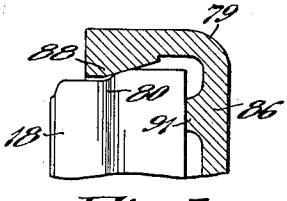

Fig. 7.

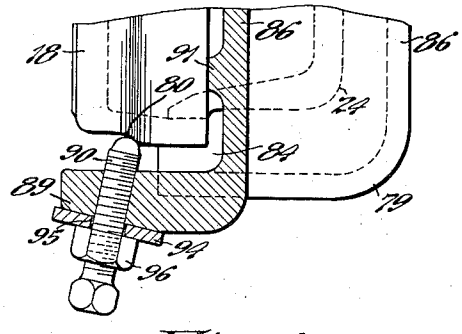

Fig. 6.

Inventor:
Harry R. Blair
By
Watson, Coit, Morse & Grindle
Attorneys.

Patented May 11, 1937 2,079,730

UNITED STATES PATENT OFFICE

2,079,730

GAINER MECHANISM FOR WINDING MACHINES

Harry R. Blair, Cranston, R. I., assignor to Universal Winding Company, Boston, Mass., a corporation of Massachusetts

Application April 18, 1935, Serial No. 17,122

4 Claims. (Cl. 74—421)

This invention relates to winding machines for winding thread, yarn, wire and other strand materials into cops, cones, coils or other types of packages, and more particularly to a gainer mechanism for regulating the speed ratio between the winding-spindle and strand-traversing means to properly dispose the turns of strand material on the package during the winding.

Various types of winding machines in common use include gainer mechanisms embodying an expansible pulley on the winding-spindle connected by a belt to a pulley for driving the reduction-gearing which actuates the strand-traversing means. One example of such commonly used gainer mechanism is shown and described in United States Letters Patent No. 1,966,159, granted July 10, 1934, to G. S. Beckman. Although such gainer mechanisms are quite satisfactory for most uses it is sometimes desired to convert them from a belt-drive to a positive or fixed gear-drive. Heretofore such conversion has necessitated a reconstruction of the winding machine to accommodate such a drive, requiring considerable time and expense to accomplish the result.

One of the objects of the present invention is to provide an attachment for a winding machine of the type indicated for converting a belt-driven gainer mechanism to a gear-driven mechanism.

Another object of the present invention is to provide a winding machine with a detachable gainer mechanism of the type indicated which may be quickly disassembled for adjustment to change the ratio of winding speed to traverse speed.

Another object of the present invention is to provide a detachable gainer mechanism of the type indicated including a casing having means for attaching it to the winding machine and embodying gearing for drivably connecting the spindle to driving shaft with the driven camshaft.

Another object of the present invention is to provide a fixed gainer mechanism for winding machines of the type indicated which may be quickly detached to facilitate the application of the driving belt to and its removal from the spindle pulley.

Another object of the present invention is to provide a detachable gainer mechanism of the type indicated which is of simple construction, economical to manufacture, easy to assemble and efficient for performing its intended function over a long period of time without repair or adjustment.

Further objects of the improvement are set forth in the following specification which describes a preferred form of construction of the invention, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a side elevational view of a conventional type of winding machine incorporating the novel gainer mechanism of the present invention which is shown partly in section and illustrated as including a compound intermediate gear;

Fig. 2 is an enlarged end elevational view of the winding machine illustrated in Fig. 1 with the gainer mechanism casing shown as partly broken away to illustrate the relationship of the driving gears;

Fig. 3 is an enlarged view of the end of the winding machine showing the gainer mechanism in section on line 3—3 of Fig. 2;

Fig. 4 is a longitudinal sectional view of the gainer mechanism similar to Fig. 3 showing a single intermediate connecting gear journaled in the gainer casing between the spindle and camshaft;

Fig. 5 is a view similar to Fig. 4 showing the gainer casing with its cover removed and illustrating the manner in which the driving belt may be either applied to or removed from the spindle pulley;

Fig. 6 is a detailed part-sectional view taken on line 6—6 of Fig. 2 and showing the adjustable abutment for clamping the gainer mechanism casing to the reduction-gear box or housing; and

Fig. 7 is a detailed part-sectional view taken on line 7—7 of Fig. 2 and showing the pads or lugs for engaging the exterior of the reduction-gear box or housing to hold the gainer casing in position.

The gainer mechanism of the present invention includes a detachable casing having a chamber surrounding the reduction-gear box or housing, which is of standard construction, and a second chamber embracing the gainer gears. Means are provided for clamping the gainer casing onto the reduction-gear box which is supported on the winding machine frame whereby to form a quick-detachable mounting. The gainer casing is adapted to carry an intermediate gear for drivably connecting a gear on the spindle or driving shaft with an intermediate driven shaft extending outwardly from the reduction-gear box. The casing also includes a removable cover for rendering the gears of the gainer mechanism accessible for removal or substitution. Further,

the gainer mechanism of the present invention includes means for rotatably supporting the intermediate gear and means for adjusting said support in the casing to adapt it to receive interchangeable gears of different sizes.

The present drawings illustrate a well known type of winding machine in which the cop, cone, coil or package of strand material is wound on a positively driven winding-spindle, constituted as the driving shaft of the machine, and the strand traversed longitudinally thereof by means of a reciprocating thread-guide. For convenience of description the material to be wound will be hereinafter referred to as "yarn" and the wound mass or body produced on the machine as a "package"; it being understood that these terms are to be construed broadly as designating any kind of strand material, whether textile or otherwise, and any form of cop, cone, coil or package wound therefrom.

Fig. 1 of the drawings illustrates one of a plurality of winding units as usually arranged in gang form and comprising a box-like frame 12 carrying bearings for the rotating shafts of the machine. The frame 12 has upper spaced bearings 13 in which the winding-spindle or driving shaft 15 is journaled, and arranged therebelow in parallel relation thereto is a cam-shaft 16 extending through bearing members held in hubs 17 on the frame 12. The winding-spindle 15 overhangs the forward side of the frame 12 for receiving the paper cop-tube C on which the package is wound. At its opposite end the spindle or driving shaft 15 projects outwardly beyond its bearing 13 and overhangs the rearward side of the frame.

The cam-shaft 16 projects beyond the rearward bearing hub 17 into a reduction-gear housing 18, being journaled in a bearing sleeve 19 formed as a part of the housing and extending inwardly through the side of the frame. The housing 18 is thus supported in the bearing hub 17 of the frame 12 and is rotatable with respect thereto. A gear 20 is fixed to the end of the shaft 16 within the housing 18 in driving engagement with a pinion 21 on a shaft 22 journaled in a bearing 23 in the opposite cover portion 24 of the housing. The opposite end of the shaft 22 projects outwardly from the bearing 23 and is reduced at its end to receive an intermediate gear to be later described. It will be understood that the housing 18 and the gearing so far described constitute a part of the standard machine as usually constructed.

Fast on the cam-shaft 16 is a cam 28 formed with a cylindrical rim 29 in which is a helical groove 30. The cam 28 is connected to reciprocate a thread-guide 31 which is of usual construction having a head 32 formed with a groove or notch 33 through which the yarn *y* feeds to direct it onto the package being wound. The thread-guide 31 is carried at the end of a horizontal rod or traverse-bar 34 which is connected to a slide or cross-head 35 having a bowl or roller 36 engaging in the helical groove 30 of the cam 28.

The thread-guide 31 with its reciprocable traverse-bar 34 and connected crosshead 35 are mounted to slide in a traverse-frame 37 pivotally supported on the axis of the cam-shaft 16. As herein illustrated, the traverse-frame 37 comprises a horizontally-extending member 38 formed with suitable grooves or guideways for the crosshead 35 and traverse-bar 34 and provided with opposite legs 39 and 40 straddling the cam 28 and pivotally mounted on the bearing sleeves for the cam-shaft 16. The legs 39 and 40 of the traverse-frame 37 have hubs at their ends surrounding a sleeve or bushing 41 in the forward bearing hub 17 and the sleeve 19 of the reduction-gear housing positioned in the rearward hub 17. The outer leg 39 of the traverse-frame 37 is extended below its bearing hub, preferably in a separate arm 43 attached thereto and terminating in a counterweight 44 which tends to maintain the frame in substantially erect position. Attached to the overhanging part of the traverse-frame 37 is a plate or back 45 against which the thread-guide 31 bears to direct it in a course parallel to the surface on which the winding is performed. In the present illustration of the machine the traverse-frame back 45 has its bearing face 46 extending parallel to the axis of the winding-spindle 15 on which the cylindrical package is wound, while in other instances the back may be inclined at an angle to the axis of the winding-spindle when a conical package is to be wound on the machine.

The winding machine may be driven from a motor or any other source of power and a belt-drive is usually employed with the power transmitted through a suitable pulley on the spindle or driving shaft 15 of the machine. As most clearly shown in Fig. 3, the pulley 47 is of a well known type having a crown-faced rim 48 adapted to receive a belt 49 and provided with an integrally formed hub 50 slidable on a bearing sleeve 51 with a pin-and-slot connection therebetween as indicated at 52. The pulley 47 also includes an annular flange 53 on its hub 50 having beveled faces 54 and 55 on opposite sides thereof. At the side opposite from the flange 53 the pulley has a conical friction clutch-face 56 on the inner periphery of its rim 48. The bearing sleeve 51 is adapted to freely rotate on the shaft 15 and the pin-and-slot connection at 52 provides a driving engagement with the pulley but allows lateral sliding movement of the pulley to engage its friction face 56 with a co-operating conically faced rim 57 on a clutch-member 58.

The cooperating clutch-member 58 comprises a hub 59 embracing the reduced end of the shaft 15 and a web 60 adjacent the forward end of its hub extending outwardly to support the conical clutch-rim 57. An annular flange 61 extends rearwardly from the web 60 and is apertured at 62 to receive the spokes of an expansion pulley (not herein shown) when a belt-driven gainer is used. The outer end of the flange 61 provides an annular flat face 63 for a purpose as will later appear. The hub 59 is screw-threaded on its exterior as shown at 64 to receive an adjusting member for actuating the expansion pulley when the belt-driven gainer is used. This threaded portion of the hub 59 provides means for mounting a gear on the shaft 15 when a fixed gainer mechanism is used. The clutch-element 58 is secured fast on the shaft 15 with the inner end of its hub 59 abutting a collar 65 by means of a screw 66 in the end of the shaft having its head set up against the outer end of the hub.

The movement of the pulley 47 with respect to the fixed clutch-element 58 is controlled by manually-operable mechanism including a rock-shaft 68 carrying depending lever-arms 69 and 70, see Fig. 1, for engaging the opposite beveled faces of the flange 53 on the pulley. The rock-shaft 68 is mounted in lugs 71 which project

from the top of the frame 12 and is adapted to be rocked manually by a handle 72 fixed to its forward end.

It is the usual practice with machines of the present type to drive a plurality of the heads or units of the gang machine from a single transmission belt 49 passing over the pulleys 47 on the several driving shafts 15. An endless belt may be used for this purpose extending continuously from the pulley on the motor or line shaft to pass over all the pulleys 47 on the driving shafts 15 of the several heads, with suitable idlers, not herein shown, pressing against the belt to maintain a contact. As shown in Fig. 2, the driving belt 49 passes across the top of the pulley 47 and downwardly for engagement with idler pulleys on either side, its slack length leading back in the opposite direction on the underneath side of the pulley.

With this type of machine it is a common practice to provide an adjustable expansible pulley on the end of the driving shaft 15 connected by a belt to a pulley on the shaft 22 extending outwardly from the reduction-gear box 18. The ratio between the diameters of the respective pulleys is such as to cause the thread-guide 31 to be actuated with a continual advance or gain to lay the thread on the package in crossing helices with the coils of yarn closely adjacent to form regular layers. This form of drive constitutes what is known as a belt-driven gainer mechanism, the speed ratio between the spindle 15 and cam-shaft 16 being regulated by adjusting the diameter of the expansible pulley hereinbefore referred to. To prevent slippage of the belt on the pulleys the housing 18, which is pivotally mounted on the frame 12 and carries the shaft 22, is held by a cord and weight (not herein shown) to tension the belt connecting the pulleys. The present invention provides for conversion of the usual belt-driven gainer to a positive or gear-driven gainer mechanism as next explained.

To this end a gear 73 having a threaded bore 74 is substituted for the expansion pulley, initially incorporated in the clutch-element 58, by screwing its hub onto the threaded end 64 of the hub 59 of the clutch-element 58 to engage its flange 75 with the flat face 63 at the rearward end of the flange 61. A gear 76 is also substituted for the pulley ordinarily carried on the end of the shaft 22 which projects outwardly from the reduction-gear housing 18 and, as illustrated in Fig. 3, its hub is screwed onto the shaft in binding engagement with a shoulder 77 formed thereon. The gears 73 and 76 are arranged to mesh with an intermediate gear 78 carried by a detachable casing 79 clamped to the reduction-gear housing 18.

As shown in Figs. 2 and 3, the detachable casing 79 comprises, in an integral structure, an annular wall 83 forming a lower chamber 84 for enclosing the annular outer wall of the reduction-gear housing 18 and an upwardly-extending curved wall 85 overlapping and offset with respect to the annular wall 83. An end wall 86 having a contour corresponding to that of the end of the reduction-gear housing 18 is joined to the curved wall 85 for closing the chamber 84. In the web between the overlapping and offset walls 83 and 85 an opening 87 is provided through which the bearing 23 on the housing 18 projects.

As shown in Figs. 2, 6 and 7, the casing 79 is attached to the reduction-gear housing 18 by means of a pair of spaced lugs or pads 88 and an abutment 89 carrying an adjustable set-screw 90 for engaging an annular shoulder 80 formed on the exterior of the housing. The lugs 88 and abutment 89 are formed as a part of the annular wall 83. Spaced bosses 91, see Fig. 6, are also provided on the inner face of the end wall 86 for engaging the outer rim of the main portion of the reduction-gear housing 18 to properly position the casing thereon. The housing 18 and casing 79 clamped thereto are held against rotation about the cam-shaft 16 by an abutment in the form of a lug 92 projecting from the wall 83 of the casing and engaged by a pin 93 fast in the rearward wall of the main frame 12. An adjustable stop 94 is also provided for engaging the opposite side of the pin 93, the stop having a slot 95 for receiving the set-screw 90. The stop 94 and set-screw 90 are locked in adjusted position by a check-nut 96.

The intermediate gear 78 for cooperation with the driving gear 73 and driven gear 76 is journaled on a stud 97 fixed in the rearward wall 98 of the casing 79 which extends upwardly above the annular wall 83 to a point below the clutch-member 58. The threaded shank 100 of the stud 97 projects through a slot 101 in the wall 98 and is provided with an annular flange 99 which abuts the side of a boss on the wall. The stud 97 is locked in place by a nut 102 screwed onto its threaded shank 100 and engaging the opposite side of the wall. The position of the stud 97 may be varied within the limits of the slot 101 by loosening the nut 102, whereby to provide for the substitution of interchangeable gears 78 of different sizes for changing the ratio of winding speed to yarn traverse. To provide for the convenient substitution of different gears, the means for retaining the gear 78 in place consists of a washer 103 with a hairpin-shaped spring-pin 104 having its legs yieldingly engaging a circumferential slot at the end of the stud 97, see Fig. 2.

The intermediate gear 78 may be either a compound gear as shown in Figs. 1 to 3 or a single gear as shown in Figs. 4 and 5. The compound gear may be used with its two composite gears having teeth varying in number so that the mechanism may be adjusted with great accuracy to effect changes in the gain to cause the thread-guide 31 to lay the coils of yarn on the package with the required spacing in proportion to different thicknesses of yarn. The compound gear 78 comprises a gear 105 having a laterally extending hub on which the hub of another gear 106 is shrunk or otherwise fixedly secured. A bushing 107 is preferably provided within the hub of the gear 105 for free rotation on the stud 97. The driving gear 73 for use with the compound gear 78, shown in Figs. 1 to 3, has its toothed portion offset with respect to its hub to adapt it to mesh with the teeth of the gear 106, while the teeth of the gear 105 mesh with those of the driven gear 76. When a single intermediate gear such as shown in Fig. 4 is used, the driving gear 73, intermediate gear 78 and driven gear 76 are disposed in alinement and the ratio of the number of teeth on the respective gears provides the necessary gain between the winding-spindle and yarn-traversing means.

The casing 79 has a relatively short wall 108 extending upwardly from the edge of the curved wall 85 with a removable cover 109 attached thereto to form a chamber 110 for enclosing the change-gears. The cover 109 extends upwardly from the wall 108 and is provided with curved top and straight side walls 115 which form extensions of the curved wall 85 of the casing 79 whereby to

provide a hood enclosing the driving gear 73. The cover 109 is detachably connected to the wall 108 by a single screw 111 extending through a slot 112 therein and engaging a threaded hole 113 in an offset flange 114 on the cover. The bottom edges of the side walls 115 of the cover 109 are provided with offset flanges 116 which overlap the inner sides of the wall 85 of the casing 79 see Fig. 2.

The gainer mechanism of the present invention is applied to use in the manner as next explained. To convert the gainer mechanism from a belt-drive to a fixed gain gear-drive the proper driving and driven gears 73 and 76 are applied to the clutch-element 58 and shaft 22, respectively. A selective intermediate gear 78 is then mounted on the stud 97 and secured thereto by the washer 103 and spring-pin 104 before the casing 79 is attached to the machine; the nut 102 being left loose to allow the stud 97 to be adjusted in the slot 101 in the wall 98. The casing 79 is then attached by placing its annular wall 83 over the reduction-gear housing 18 with the bosses 91 engaging the outer rim of the housing proper and the lugs 88 and set-screw 90 overlying the annular shoulder 80. The casing 79 is then rotated until the lug 92 on its wall 85 engages the pin 93, after which the set-screw 90 is tightened to clamp the casing in place with the lugs 88 snugly abutting the annular shoulder 80 on the rim of the housing 18. The adjustable stop 94 is then slid into engagement with the opposite side of the pin 93 and the nut 96 tightened on the set-screw 90 to lock the several parts in place. The stud 97 is then adjusted in the slot 101 to properly mesh the intermediate gear 78 with the driving and driven gears 73 and 76, after which the nut 102 is tightened to fixedly hold the stud and gear in position. The cover 109 may then be applied to the casing 79 to enclose the gearing and the machine is ready for operation.

To commence the winding operation the yarn *y* is taken from a source of supply through a tension-device (not herein shown) passed through the thread-guide 31 on the traverse-frame 37 and its end attached to a cop-tube C mounted on the spindle 15. The driving pulley 47 is then engaged with the clutch-element 58 fixed to the shaft 15 by swinging the handle 72 to cause the depending arm 69 on the rock-shaft 68 to act upon the beveled face 54 of the flange 53. The pulley 47 is continuously driven by the belt 49 and when engaged with the clutch-element 58 it rotates the spindle 15 to wind the yarn *y* onto the cop-tube C. The cam-shaft 16 is driven from the spindle or shaft 15 through the gears of the gainer mechanism and thereby the cam 28 is rotated to traverse the thread-guide 31 by the engagement of the roller 36 on the traverse-bar 34 with the groove 30 in the cam. The ratio of the gainer gearing between the spindle or shaft 15 and cam-shaft 16 is selected to cause the coils of yarn to be laid on the periphery of the package P in regular order and in relatively close association to form uniform layers. The winding operation is continued until a full package is produced, at which time the winding operation is arrested by moving the handle 72 rearwardly as viewed in Fig. 1. This operation causes the arm 70 on the rock-shaft 68 to engage the beveled face 55 of the annular flange 53 to shift the pulley 47 away from the clutch-element 58. The completed package P may then be doffed, another cop-tube C applied to the spindle, and the winding operation started again by the same sequence of operations as previously described.

To change the speed ratio between the spindle 15 and cam-shaft 16 or to remove the belt 49 from the gang of pulleys 47 over which it passes the following operation only is necessary. The cover 109 is removed from the casing 79 to expose the gearing by releasing the screw 111. The intermediate gear 78 is released by withdrawing the spring-pin 104 from the groove in the end of the stud 97 and the gear may be then removed from the stud. To remove the belt 49 in the manner indicated in Fig. 5 it is only necessary to slide its slack side across the upper edges of the side and front walls of the casing 79 and outwardly away therefrom. After the belt has been removed and replaced the same intermediate gear 78 can again be mounted on the stud 97 or another gear substituted and the cover 109 replaced on the casing and fastened thereto by the screw 111. When a different size of intermediate gear 78 is substituted the stud 97 is released by loosening the nut 102 and adjusted in the slot 101 until the intermediate gear meshes with the driving and driven gears 73 and 76, after which the nut 102 is tightened to lock the stud in position. The machine is then in condition to continue the winding operation.

From the foregoing description it will be apparent that the present invention provides a novel and ingenious form of attachment for converting a belt-driven gainer mechanism to a positive or gear-driven mechanism by the substitution of selective gearing in place of pulleys and a belt. It will further be observed that the present invention provides an attachment which may be applied to a standard type of machine already in use without the substitution of any parts other than the gears and casing and without reconstruction of the other elements of the machine. Still further, it will be observed that the convertible fixed gainer mechanism is quickly detachable and capable of receiving interchangeable gears to vary the ratio of winding speed to traverse speed.

Various modifications may be made in the structure and arrangement of the parts of the device to adapt it for use on machines other than that herein shown without departing from the spirit or scope of the invention. Therefore, without limiting myself to the exact construction and arrangement herein shown and described, I claim:

1. In a winding machine of the type having a winding-spindle and a cam-shaft with a gear-housing at one end of the latter in which a driven shaft is journaled, a gainer mechanism for driving the driven shaft from the spindle comprising gears on the spindle and driven shaft, a casing detachably mounted on the gear-housing, gearing mounted in said casing for intermeshing engagement with the gears on the spindle and driven shaft whereby the winding machine may be quickly altered to change from a belt-driven gainer mechanism to a positive gear-driven gainer mechanism, and means for mounting said gearing in the casing whereby to permit the gears thereof to be changed to alter the speed ratio between the spindle and driven shaft.

2. In a winding machine of the type having a winding-spindle and a cam-shaft with a gear-housing supported by the end of the latter in which a driven shaft is journaled, a gainer mechanism for driving the driven shaft from the spindle comprising detachable gears on the spindle and driven shaft, a casing detachably mounted on the gear-housing and having a stud adjustable

therein, and a change gear journaled on the stud for intermeshing engagement with the gears on the spindle and driven shaft whereby the winding machine may be quickly altered to change from a belt-driven gainer mechanism to an adjustable gear-driven gainer mechanism.

3. In a winding machine of the type having a winding-spindle and a cam-shaft with a gear-housing rotatably mounted at one end of the latter and in which a driven shaft is journaled, a gainer mechanism for driving the driven shaft from the spindle comprising gears on the spindle and driven shaft, a casing detachably mounted on the gear-housing, means for holding the casing and housing against rotation on the cam-shaft, a stud mounted in the casing for adjustment thereon, and a change gear journaled on the stud and intermeshing with the gears on the spindle and driven shaft whereby the winding machine may be quickly altered to change from a belt-driven gainer mechanism to an adjustable gear-driven gainer mechanism.

4. In a winding machine of the type having a winding-spindle and a cam-shaft with a gear housing at one end of the latter in which a driven shaft is journaled, a gainer mechanism comprising gears detachably mounted on the spindle and driven shaft, a casing having an annular wall enclosing the gear-housing, means including an adjustable abutment on the annular wall of the casing for detachably clamping the casing on the housing, a stud mounted in the casing and adjustable relative thereto, and a gear on the stud intermeshing with the gears on the spindle and driven shaft whereby the winding machine may be quickly altered to change from a belt-driven gainer mechanism to a positive gear-driven gainer mechanism.

HARRY R. BLAIR.