March 14, 1967 M. F. IVANKO ETAL 3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

Filed May 6, 1964

6 Sheets-Sheet 1

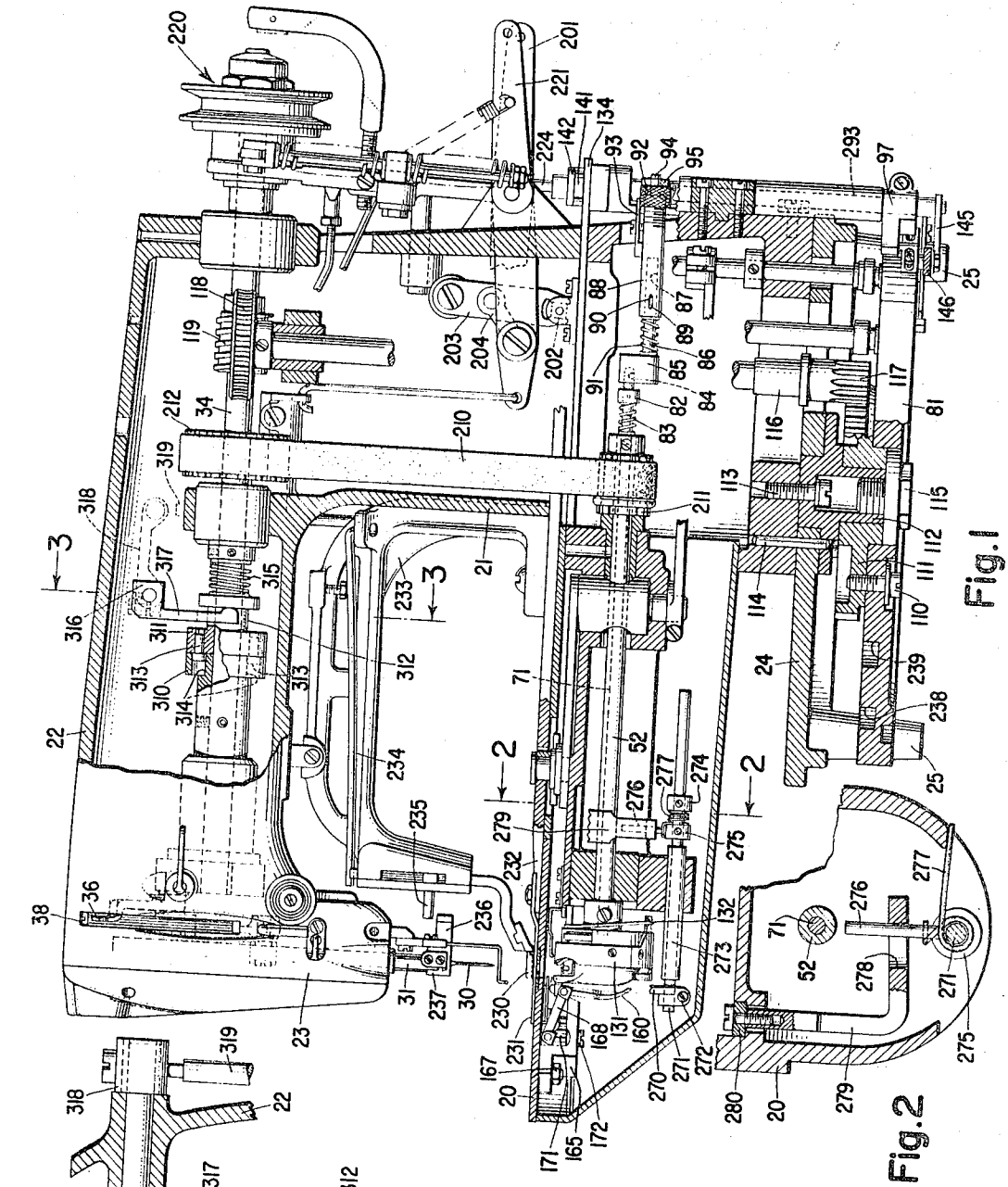


Fig. 1

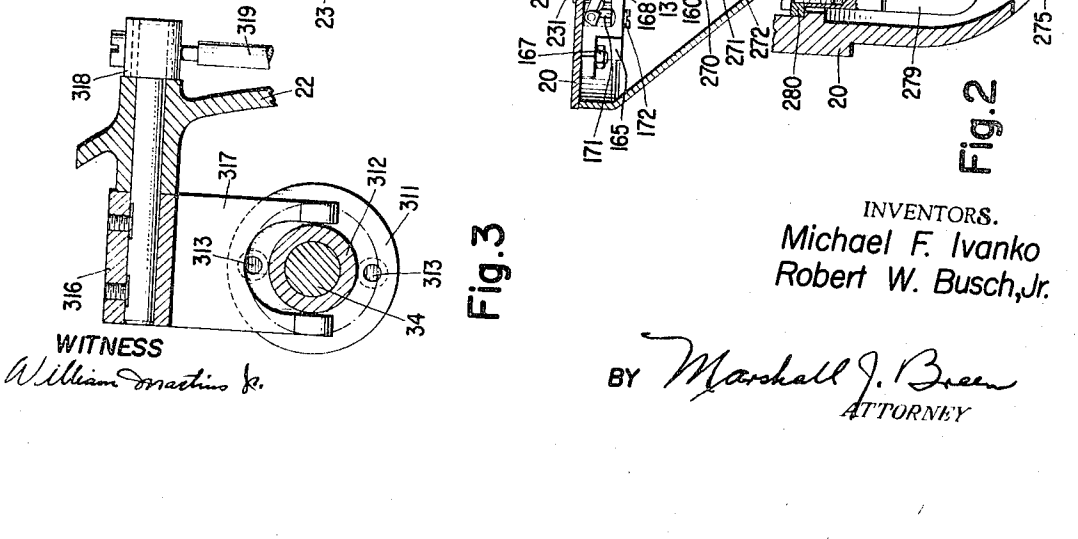


Fig. 2

Fig. 3

INVENTORS.
Michael F. Ivanko
Robert W. Busch, Jr.

WITNESS
William Martin Jr.

BY Marshall J. Breen
ATTORNEY

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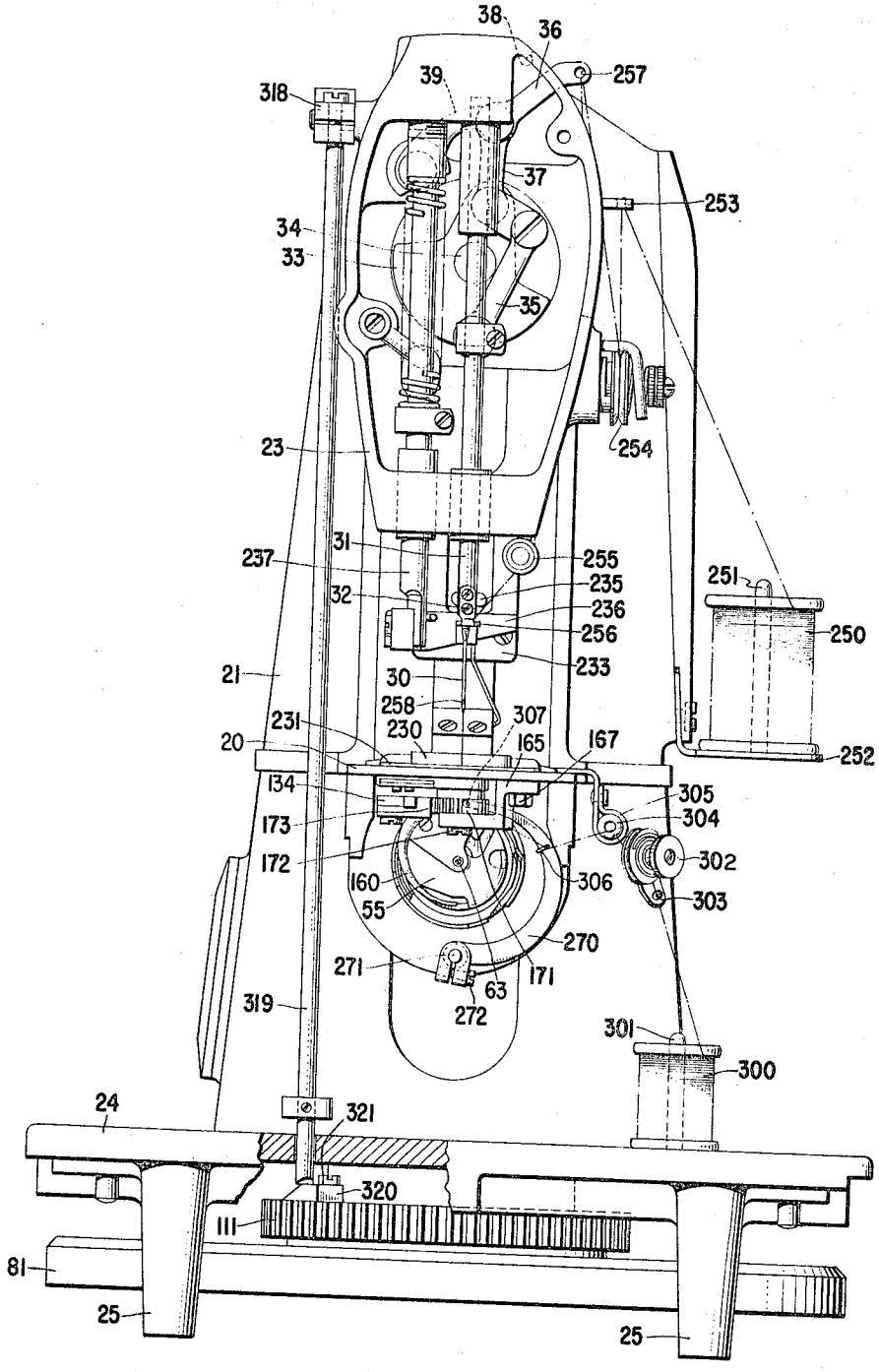


Fig. 4

WITNESS

William Martin Jr.

INVENTORS

Michael F. Ivanko

Robert W. Busch, Jr.

BY Marshall J. Breen

ATTORNEY

March 14, 1967 M. F. IVANKO ETAL 3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

Filed May 6, 1964 6 Sheets-Sheet 3

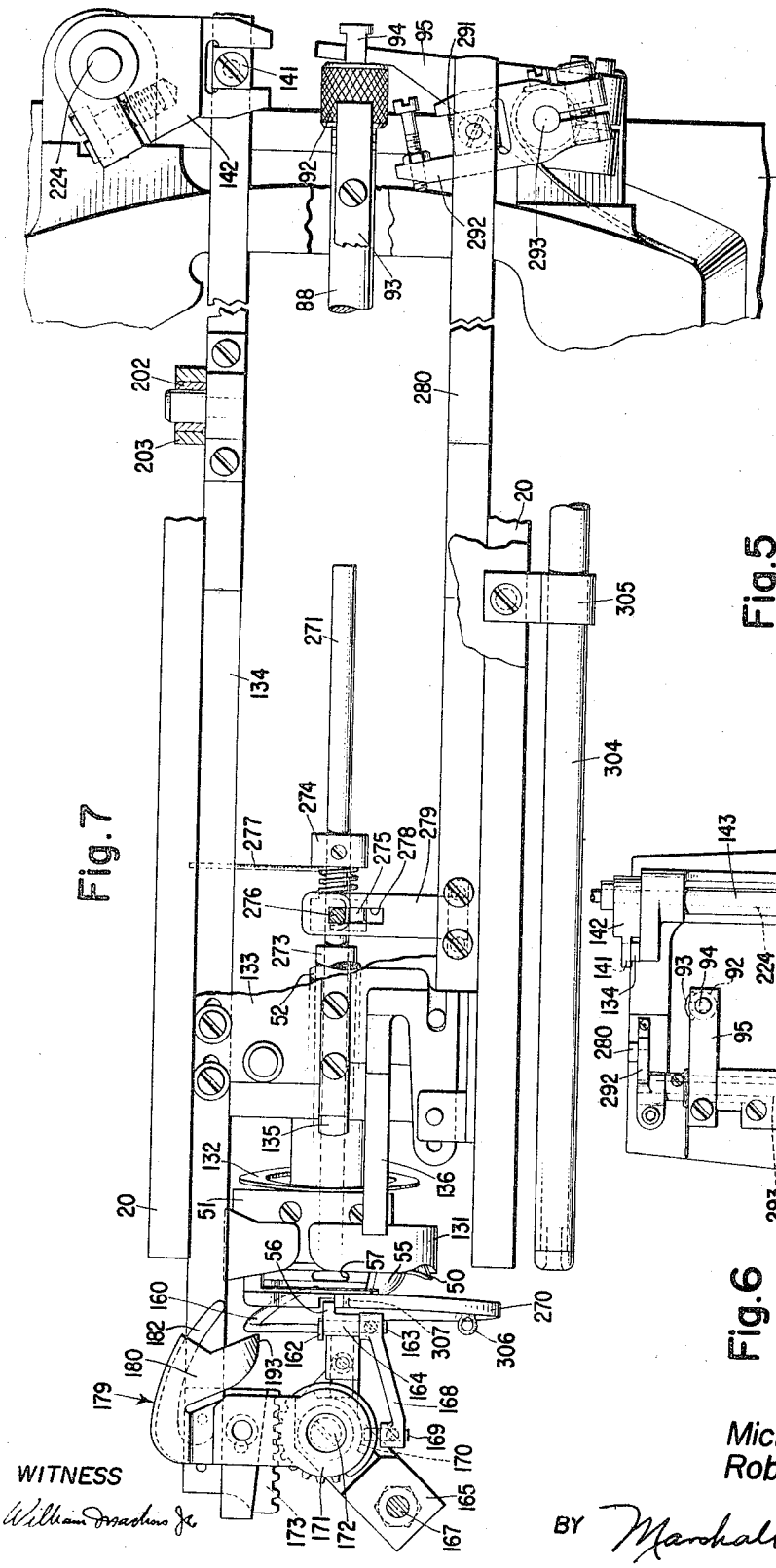


Fig. 7

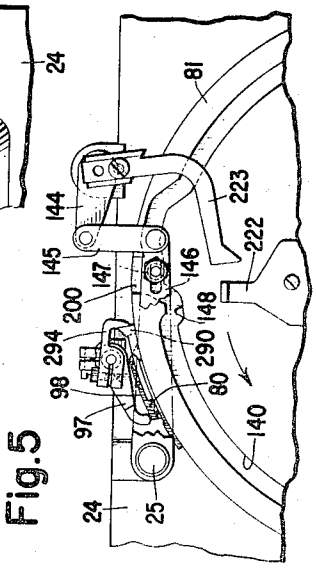


Fig. 5

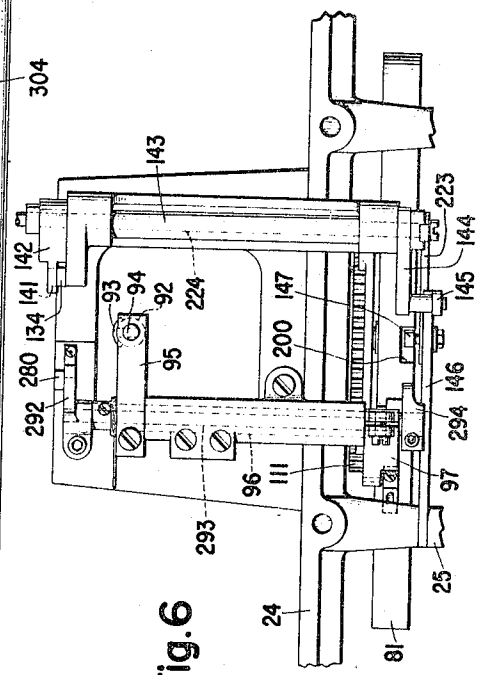


Fig. 6

INVENTORS
Michael F. Ivanko
Robert W. Busch, Jr.

WITNESS
William Masters Jr.

BY Marshall J. Breen
ATTORNEY

March 14, 1967 M. F. IVANKO ET AL 3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

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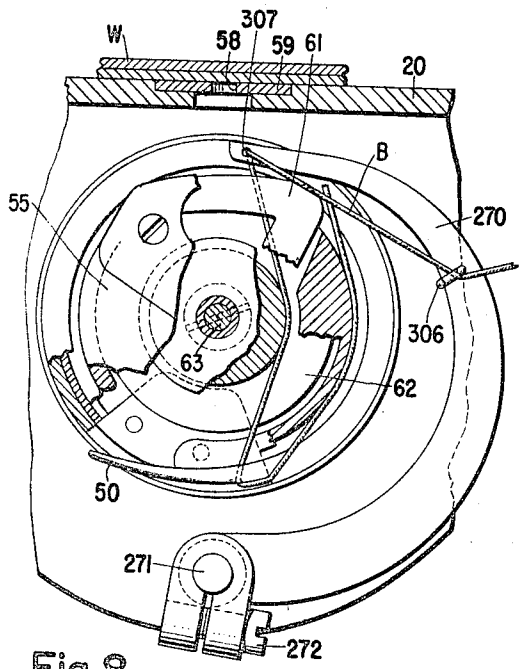


Fig.8

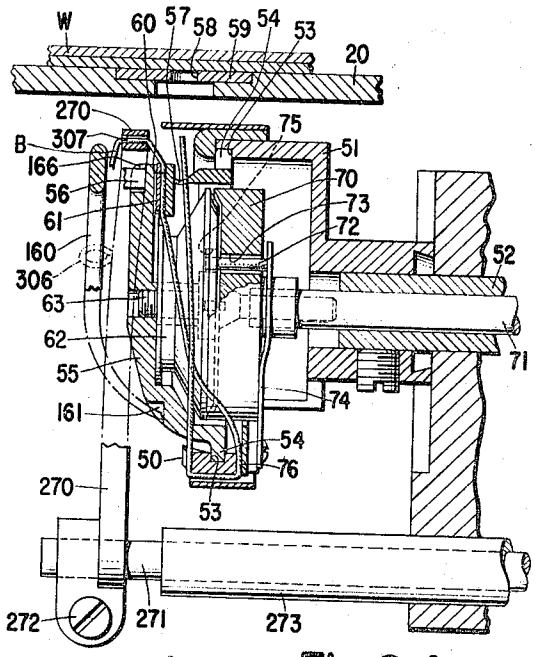


Fig.8-A

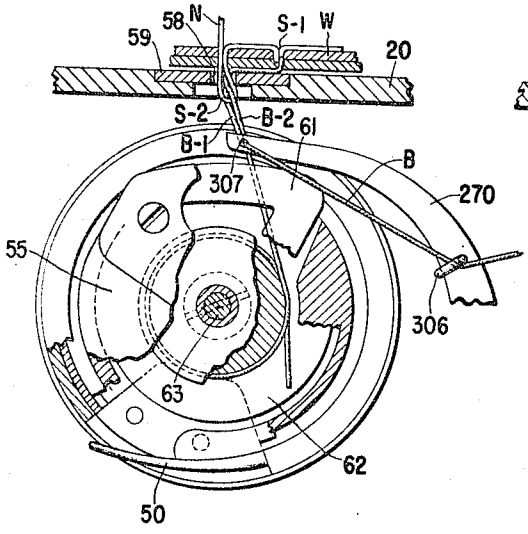


Fig.9

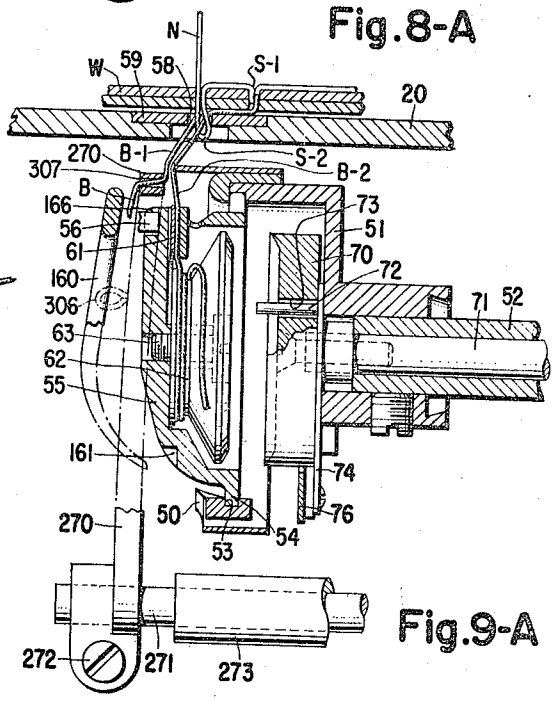


Fig.9-A

WITNESS

William Martino Jr.

INVENTORS

Michael F. Ivanko

Robert W. Busch, Jr.

BY Marshall J. Breen

ATTORNEY

March 14, 1967 M. F. IVANKO ETAL 3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

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6 Sheets-Sheet 5

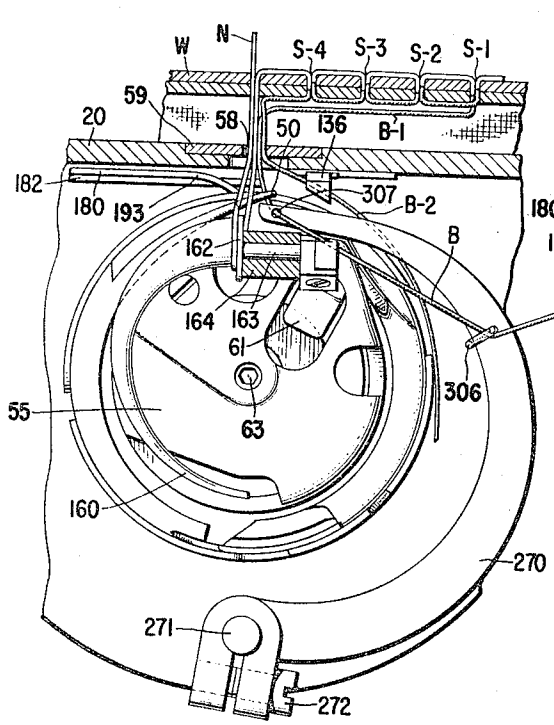


Fig.10

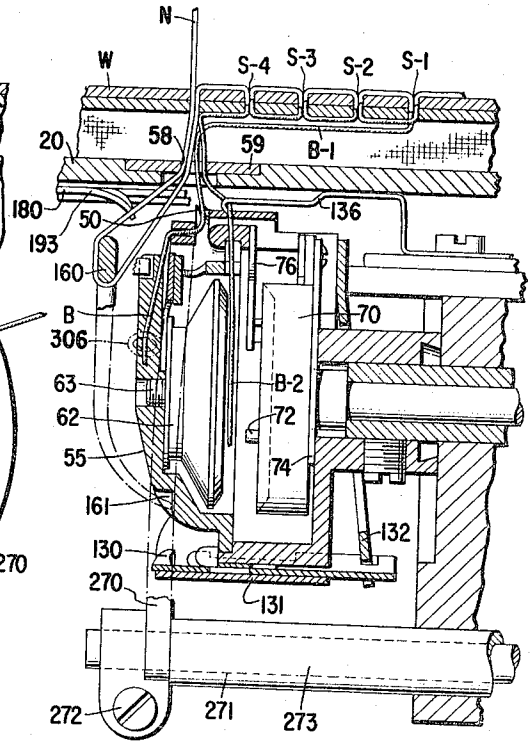


Fig.10-A

WITNESS

William Martins Jr

INVENTORS

Michael F. Ivanko

Robert W. Busch, Jr.

BY Marshall J. Breen

ATTORNEY

March 14, 1967 M. F. IVANKO ETAL 3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

Filed May 6, 1964

6 Sheets-Sheet 6

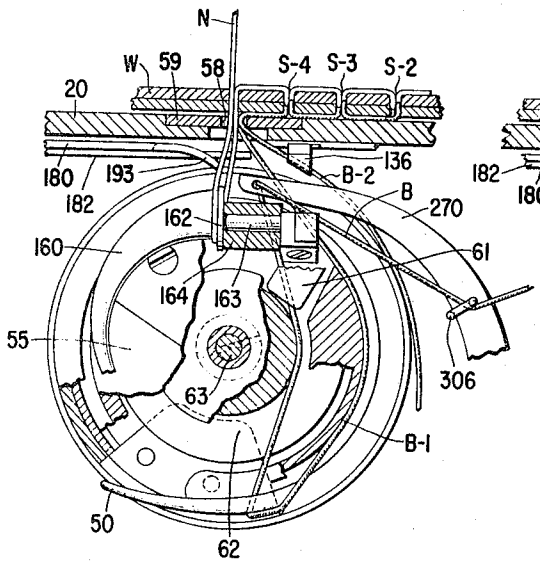


Fig. 11

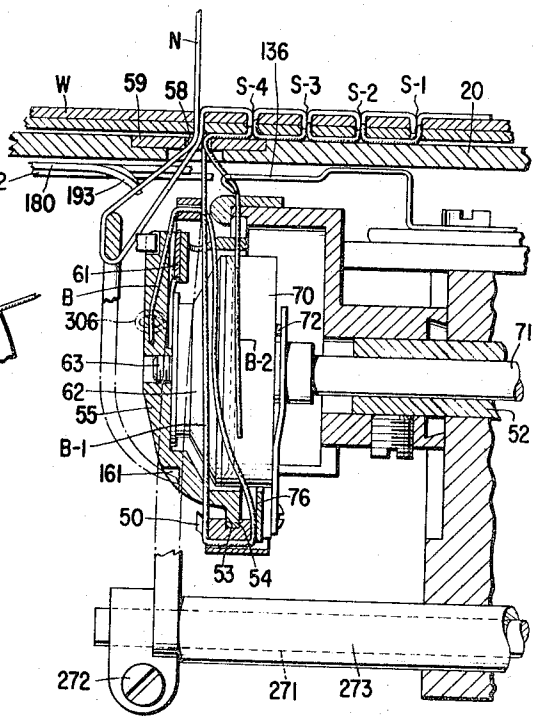


Fig. 11-A

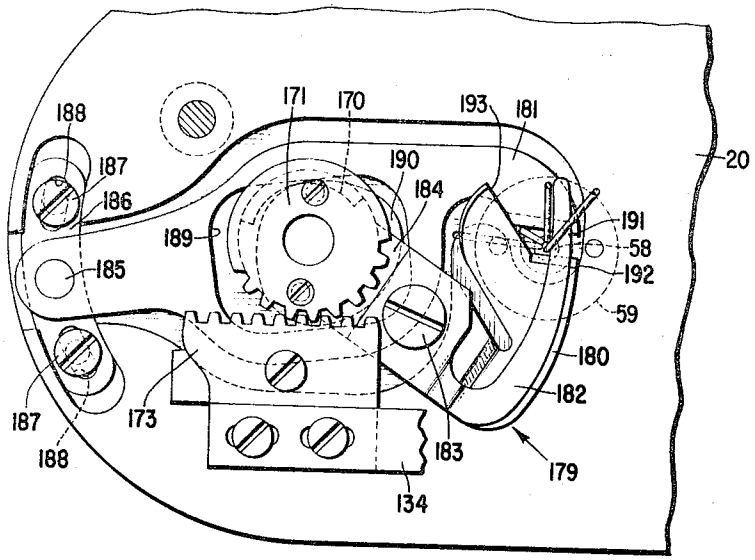


Fig. 12

WITNESS

William Martin Jr.

INVENTORS

Michael F. Ivanko

Robert W. Busch, Jr.

BY Marshall J. Breen

ATTORNEY

United States Patent Office 3,308,776
Patented Mar. 14, 1967

3,308,776

SEWING MACHINES HAVING BOBBIN THREAD REPLENISHING MEANS

Michael F. Ivanko, Rockaway, and Robert W. Busch, Jr., Boonton, N.J., assignors to The Singer Company, New York, N.Y., a corporation of New Jersey

Filed May 6, 1964, Ser. No. 365,333
5 Claims. (Cl. 112—181)

This invention relates to a sewing machine having bobbin thread replenishing means, and more particularly to a lockstitch sewing machine having means by which the stitch forming mechanism may wind thread on a bobbin from a source separate from the thread source for the needle and without interrupting the threading of the needle thread.

In a conventional lockstitch sewing machine, a needle carrying an upper thread in an eye near its free end is projected through goods to be sewn to cast a loop which by means of a loop taker mechanism is passed around a bobbin carrying an under thread to form a lockstitch in the goods.

Heretofore, various means have been devised to replenish thread on the bobbin from the needle thread source. Some of the foregoing means have involved in general seizing thread from the needle, directing and anchoring the thread so seized on the bobbin and rotating the bobbin. However, in some applications, it is highly desirable to be able to provide a different type of under thread from the upper thread as, for example, in sewing goods which are one color on one side and another color on the other side.

To provide a bicolored stitch with those conventional sewing machines which are capable of replenishing thread on a bobbin in place in the loop taker mechanism, it is necessary to go through the painstaking task of unthreading thread from a first source; and threading thread from a second source around the tensioning device, through the take-up lever, through all the guides, and finally through the eye of the needle. After replenishing the bobbin with thread, it is necessary to unthread the thread from the second source and rethread the thread from the first source.

It is, therefore, an object of this invention to provide a sewing machine having means for replenishing thread on a bobbin in place in the sewing machine loop taker mechanism with thread from a source separate from the source of thread for the needle and without interrupting the threading of the needle thread.

Another object of the invention is to provide a sewing machine with the foregoing object in mind for automatically performing bobbin thread replenishing and sewing operations in succession.

Another object of the invention is to provide a sewing machine for automatically performing the foregoing object repetitiously.

Another object of the invention is to provide a sewing machine in accordance with the foregoing objects having means for preventing the needle thread from interfering with the bobbin thread replenishing operation.

A still further object of the invention is to provide a sewing machine in accordance with the foregoing objects having means for immobilizing the needle while replenishing the bobbin with thread from a source separate from the source of thread for the needle.

The objects of the invention are accomplished by providing a source of thread supply separate from the source of the thread directed to the needle, and a means for introducing thread from the separate source of supply to the bobbin in a replenishing operation without interrupting the threading of the needle thread. The needle reciprocating mechanism may be rendered inoperative during the bobbin thread replenishing operation to prevent interference by the thread carried by the needle. The loop taker mechanism is used in the bobbin thread replenishing operation, as well as for the sewing operation, thus obviating the need for separate mechanisms for these diverse functions.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front side elevational view, mostly in vertical cross section, of a sewing machine embodying the present invention,

FIG. 2 is a cross sectional view taken substantially along the line 2—2 in FIG. 1,

FIG. 3 is a cross sectional view of the needle throw-out mechanism on the main shaft taken substantially along the line 3—3 in FIG. 1,

FIG. 4 is a head end elevational view of the sewing machine of FIG. 1 with the face plate removed and the subbase partly in section,

FIG. 5 is a detail bottom plan view of a portion of the pattern cam at the standard end of the sewing machine with the parts in stop position,

FIG. 6 is a detail standard end elevational view of the subbase portion of the sewing machine corresponding to FIG. 5, and

FIG. 7 is an enlarged detail top plan view of the mechanism in the work supporting bed with portions of the machine frame broken away.

FIGS. 8 to 11 and companion views 8A to 11A are enlarged detail head end and front side views respectively of the loop taker mechanism partly broken away and partly in section showing the positions of the parts during successive operations of the sewing machine:

FIGS. 8 and 8A show the parts positioned for replenishing thread on the bobbin,

FIGS. 9 and 9A show the parts positioned for sewing,

FIGS. 10 and 10A show the positions of the parts one-half revolution of the loop-seizing beak before the end of the sewing cycle, and

FIGS. 11 and 11A show the positions of the parts in stop position at the end of the sewing cycle ready for the thread cutting operation.

FIG. 12 is an enlarged detail bottom plan view of the thread cutter mechanism at the head end of the work supporting bed with the parts ready for cutting.

With reference to FIG. 1 of the drawings, the invention is illustrated as incorporated in a conventional cyclic sewing machine of the type used for group stitching such as button sewing, buttonhole sewing, and tacking. It is, of course, within the scope of the invention to embody the invention in many different types of sewing machines, and the sewing machine illustrated in the drawings is utilized for purposes of example only.

As shown in FIG. 1, the sewing machine illustrated in the drawings is a conventional machine which has a frame including a work supporting bed **20** with a hollow standard **21** rising from one end. A hollow bracket arm **22** is connected to the top of the standard and extends laterally over the work supporting bed. A head **23** is formed at the free end of the bracket arm. The machine has a subbase **24** beneath the work supporting bed having four legs **25** which support the subbase and the sewing machine. Within the confines of the frame and presently to be described are a needle reciprocating mechanism, a loop taker mechanism, actuating mechanism for the needle and loop taker, including a stop motion mechanism, a thread cutting mechanism and a work clamp mechanism all of which are known per se in the art, and most of which are disclosed and described in detail in the United States Patent No. 3,038,429 of S. J. Ketterer et al. to

which reference may be had. In the United States Patent No. 3,038,429, however, the above mentioned mechanisms are arranged so as to replenish thread on the bobbin from the thread carried by the needle, while in this invention these mechanisms occur in novel combination with and are timed in a novel manner to cooperate with devices for replenishing the bobbin with thread from a source other than that used to supply the needle, as will be described hereinbelow.

As shown in FIG. 4, the needle reciprocating mechanism includes a needle **30** which is connected to a needle bar **31** by means of a setscrew **32**. The needle bar is slidably mounted in bearings in the head of the sewing machine. Reciprocating motion is imparted to the needle bar by means of a counterbalanced compound crank **33** which is connected to the end of a main shaft **34** which extends longitudinally through the hollow bracket arm and is rotatably supported in bearings. A drive link **35** is pivotally connected between the compound crank and a bracket on the needle bar. A take-up lever **36** formed in the shape of a bell crank has one arm pivotally connected to the intermediate arm **37** of the compound crank and the other arm extending through an elongated slot **38** in the head. An anchor link **39** is pivotally connected between the inside of the head and the fulcrum of the bell crank shaped take-up lever.

Mounted in the head end of the work supporting bed is the loop taker mechanism. The loop taker mechanism as illustrated in FIG. 8A, for example, takes the form known in the art as a rotary hook and includes a loop-seizing beak **50** which is adapted to engage loops of thread presented by the needle. The beak is formed on the flange of a cup-shaped loop taker body **51** which has a hollow hub for connection to a hollow bed shaft **52** by means of at least one setscrew. An annular raceway **53** is formed within the loop taker body to accommodate a bearing rib **54** formed on a bobbin case **55** which is constrained from rotation with the loop taker body by a rotation restraining lug **56** carried by the machine frame. The bobbin case has a needle clearance slot **57** directly beneath a needle aperture **58** in a throat plate **59** and an L-shaped thread slot **60**, in which a thread tensioning leaf spring **61** is arranged so as to impose tension on thread in the slot **60**. A flanged bobbin **62** is freely journaled inside the bobbin case by means of a screw **63**.

Inside the cup-shaped loop taker body **51**, a threaded guiding means comprising a bobbin winding member **70** is connected to the end of a slide rod **71** which is shiftable axially in the hollow bed shaft **52**. A bobbin driving pin **72** extends through an aperture **73** in the bobbin winding member and is biased to project beyond the bobbin winding member by means of a leaf spring **74** which is secured to the back surface of the bobbin winding member. The pin seeks and mates with a recess **75** formed in the bobbin when the bobbin winding member is pressed against the bobbin. At the same time, a projection **76** protruding from the circumference of the bobbin winding member serves to nip and restrain on the beak **50** any thread loop seized thereby.

The endwise position of the slide rod **71** to which the bobbin winding member is fast is controlled by bobbin winding control means including a cam **80** mounted on the circumference of a pattern cam **81** as shown in FIG. 5. To this end, a collar **82** is secured on the slide rod near the end opposite from the bobbin winding member as shown in FIG. 1. Hereinafter, if not otherwise noted, reference is implied to FIG. 1 for general details of the various mechanisms and to FIG. 5 for specific details of the pattern cam **81**. Returning to FIG. 1, a compression spring **83** which is mounted on the slide rod between the collar and the end of the hollow bed shaft **52** normally serves to bias the slide rod and the bobbin winding member away from the bobbin. The end of the slide rod seats in a recess **84** formed in a block **85** which is connected to the end of a plunger **86**. A shock absorbing cushion may be inserted in the recess. The plunger is held in a bore **87** formed in the end of a stud **88** by means of a transverse pin **89** which slides in slots **90** in the stud. A compression spring **91** mounted on the plunger between the stud and the block normally serves to bias the plunger away from the stud thus acting as a shock absorber. On the end opposite from the plunger, the stud is threaded to receive a knurled knob **92** which is used for adjustment purposes as best illustrated in FIG. 7. A clamp **93** carried on the stud by means of a screw bears against the knurled knob to hold it against rotation after adjustment. A pin **94** having vertical slots to which a bifurcated rock arm **95** is connected protrudes from the threaded end of the stud. The rock arm is connected to a hollow rock shaft **96** to which a cam follower finger **97** is connected at its bottom. The cam follower finger is biased against the cam **80** on the circumference of the pattern cam by spring means to control the position of the slide rod and the bobbin winding member. With reference to FIGS. 5, 6 and 7, the cam **80** is so positioned on the circumference of the pattern cam **81** as to press the bobbin winding member against the bobbin near the conclusion of each sewing cycle and has a cam surface **98** adapted to continue to hold the bobbin winding member against the bobbin as the pattern cam rotates in a counterclockwise direction, as viewed from the bottom and indicated by the arrow, for an initial period at the beginning of each succeeding cycle of sewing machine operation. The cam **80** and cam surface **98** thus determine both the timing and duration of the bobbin thread replenishing operation by rocking the rock shaft **96** and hence the rock arm **95** to shift the stud **88**, plunger **86**, block **85**, and slide rod **71** axially.

As shown in detail in FIG. 1, the pattern cam **81** is mounted horizontally in the subbase by means of screws **110** which connect it to a gear **111**. The gear rotates on a flanged bearing spindle **112** which is connected to the bottom of the subbase by means of a screw **113** and is held against rotation by means of a pin **114**. The gear and the pattern cam are held on the flanged bearing spindle by means of a screw **115** having a flange. Power for rotation is imparted to the pattern cam by means of a cam shaft **116**. The cam shaft has a gear **117** connected to its bottom which meshes with the gear which is connected to the pattern cam. A worm wheel **118** connected to the top of the cam shaft meshes with a worm **119** on the main shaft to complete the power train to the main shaft.

Referring again to the loop taker mechanism and particularly to FIG. 10A, an auxiliary hook **130** as disclosed in the aforementioned United States patent to Ketterer et al., No. 3,038,429, is slidably mounted on the circumference of a cylindrical thread camming member **131** which encompasses the cup-shaped loop taker body **51**. As described in detail in the above referred-to Ketterer patent, an annular leaf spring **132** is secured on the back surface of the loop taker body **51** and is connected to the auxiliary hook so as to bias the auxiliary hook into a retracted position within the cylindrical thread camming member **131** so that no thread can be seized by the auxiliary hook. As shown in FIG. 7, a bracket **133** which is connected to a slide bar **134** to the rear of the annular leaf spring has a finger **135** adapted to bear against the annular leaf spring when the slide bar **134** is shifted toward the loop taker thus to urge the auxiliary hook into an operative thread engaging position beyond the thread camming member **131**. A thread engaging finger **136** which is adapted to engage and hold any thread seized by the auxiliary hook **130** opposite the cylindrical thread camming member **131** is carried on the bracket **133**.

The slide bar **134** which actuates the auxiliary hook is controlled by a cam track **140** formed in the bottom of the pattern cam **81** as shown in FIG. 5. To this end, as shown in FIG. 7, a slide block **141** is pivotally connected on top of the slide bar **134** at the standard end

of the sewing machine. The slide block is freely embraced by a slideway formed in the free end of a rock arm **142** which is connected to the top of a hollow rock shaft **143** as shown in FIG. 6. A second rock arm **144** is connected to the bottom of the hollow rock shaft and a link **145** is pivotally connected between the free end of the rock arm and a second link **146** which is pivotally anchored to one of the legs. The second link carries a cam follower roller **147** which rides in the cam track to control the movement of the slide bar **134** and the auxiliary hook **130** as well as a curved needle thread engaging finger **160** and the thread cutting mechanism **179** presently to be described. The irregular portion **148** of the cam track shown in FIG. 5 initiates operation of the foregoing mechanisms before the end of the sewing cycle.

As shown in FIG. 8A, for example, the curved needle thread engaging finger **160** is mounted in the work supporting bed in front of the bobbin case with its free end disposed opposite an indentation or hole **161** in the bobbin case. The thread finger has a shoulder or flange **162** as shown in FIG. 7 at its upper end and a shaft **163** journaled in a bore formed in a block **164** which is connected to the top of a bracket **165** by means of a screw. The bobbin case rotation restraining lug **56** preferably extends from the block **164** into a notch **166** in the stationary bobbin case. The bracket **165** is connected to the bottom of the work supporting bed by means of a bolt and nut **167**. A rock arm **168** is fixedly connected to the shaft **163**, and a cam follower **169** is connected to the free end of the rock arm. The cam follower rides in a cam track **170** formed in the circumference of a gear segment **171** which is rotatably supported between the upper part of the bracket and the bottom of the work supporting bed by means of a shoulder screw **172**. A rack **173** which meshes with the teeth of the gear segment **171** is connected to the end of the slide bar **134** for operation by the irregular portion **148** of the cam track formed in the bottom of the pattern cam **81** as shown in FIG. 5.

The thread cutting mechanism indicated generally at **179** as shown in FIGS. 7 and 12 is also mounted in the work supporting bed and in front of the loop taker mechanism. The thread cutting mechanism includes opposed knife blades **180** and **181** and an arcuate thread camming finger **182**. The thread camming finger **182** and one knife blade **180** are mounted by means of a screw **183** on a bracket **184** extending from the gear segment **171**. The other knife blade **181** is pivotally mounted on a pin **185** protruding from an arcuate bar **186** which is connected to the bottom of the work supporting bed by means of screws **187** passing through slots **188** in the bar **186** provided for adjustment purposes. The knife blade **181** is formed with a substantially rectangular cam follower opening **189** which embraces a cam **190** formed around the circumference of the gear segment. The knife blade **181** terminates in a sharpened edge **191** normally disposed to one side of the needle aperture **58**. The other knife blade **180** has a sharpened edge **192** normally disposed at the opposite side of the needle aperture and a needle loop separating lug **193**. The sharpened edges **191, 192** of the knives cross directly beneath the needle aperture in the throat plate when the thread cutting mechanism is operated.

Initiation of a thread cutting operation is effected along with movement of the curved needle thread engaging finger **160** by rotation of the gear segment **171** by means of the rack connected to the slide bar **134** which is activated by the irregular portion **148** of the cam track formed in the bottom of the pattern cam. This initiation of the thread cutting operation by the pattern cam shifts the thread cutting mechanism into the position illustrated in FIGS. 10 and 10A in which the needle loop separating lug **193** first advances slightly into the needle thread loop which has been directed onto the finger **160** and then backs off a short distance. The sharpened edges **191, 192** have not yet crossed to sever the threads. To permit completion of the thread cutting operation, a radial clearance opening **200** is provided in the outer circumference of the cam track for the cam follower roller **146** at the stop position at the end of the sewing cycle as shown in FIG. 5. The slide bar and the cam follower roller are shifted by means of connections to a lever **201** as shown in FIG. 1 mounted on the standard which may be depressed by a foot treadle or the like. The connections between the lever **201** and the slide bar **134** include a slide block **202** pivotally connected to an intermediate portion of the slide bar **134** and a second lever **203** having a slideway which freely embraces the slide block. The second lever **203** is pivotally anchored to the inside of the hollow standard and a link **204** is pivotally connected between the levers **201** and **203** to complete the connections necessary for manual operation of the thread cutter mechanism.

The loop taker is rotated in timed relationship with the reciprocation of the needle at the rate of two revolutions for each needle reciprocation by means of a lug type timing belt **210** which is looped tautly around sprocket wheels **211** and **212** connected to the hollow bed shaft and the main shaft respectively. The sprocket wheel **212** on the mainshaft has twice as many teeth as the sprocket wheel **211** on the hollow bed shaft to establish the two to one speed ratio.

The stop mechanism indicated generally at **220** as shown in FIG. 1 is of the type disclosed in the United States patent to Ivanko, No. 2,721,526, Oct. 25, 1955 to which reference may be had for a complete description. Depression of a starting lever **221** on the frame serves to shift the stop motion mechanism into a latch retained running position to start each sewing cycle. The stop mechanism is released for return to the stopped position by a trip cam **222** mounted on the bottom of the pattern cam **81** as shown in FIG. 5 which is engaged by a cam follower lever **223** to terminate the sewing cycle. The cam follower lever is connected to the bottom of a rock shaft **224** which is mounted in the hollow rock shaft **143** as shown in FIG. 6. Connections are provided between the top of the rock shaft to release the latch retained stop mechanism in a manner well known in the art.

Briefly, the work clamp mechanism as shown in FIG. 1 includes a bifurcated upper member **230** and a lower member **231**. The lower member is connected to the end of a plate **232** and the upper member is mounted in a gooseneck **233** which is in turn mounted on the plate. Leaf springs **234** are provided to bias the upper member against the lower member. The upper member is provided with lift lugs **235** which are adapted to engage a lift arm **236** which is connected to the bottom of a presser bar **237**. The work clamp may be shifted to influence the pattern of stitches formed during each cycle of sewing operation by two cam tracks **238** and **239** formed in the top of the pattern cam and the work clamp may be opened by the lever **201** at the completion of the sewing operation through connections which are well known.

Thus far, a conventional cyclic sewing machine has been described in which thread is presented to the loop taker mechanism by the needle. As shown in FIG. 4, the source of supply for the needle thread is a spool **250** rotatably held on a spindle **251** which is connected to a bracket **252** on the standard. One or more guide **253** are provided on the front side of the bracket arm, and a tensioning device **254** is mounted on the front side of the head. Two additional guides **255** and **256** are provided beneath the head. Thread is strung from the spool **250**, through the guide or guides **253**, around the tensioning device **254**, through an eye **257** in the take-up lever, through the guides **255** and **256**, and finally through an eye **258** in the needle.

In order to practice this invention, a mechanism for introducing thread to the bobbin in the loop taker from a

second source of supply separate and distinct from the needle thread is provided in addition to the mechanism already described. The new mechanism includes a thread introducing finger **270** positioned near the loop taker to introduce thread from the second source of supply to the loop-taker beak **50**. The thread introducing finger **270** is fixedly connected to the end of a slide rod **271** by means of a screw **272**. As shown in FIG. 1, the slide rod is mounted in a hollow tube **273** which is mounted in the work supporting bed. Two collars **274** and **275** as shown in FIGS. 1 and 7 are fixedly connected to the slide rod by means of setscrews. One of the collars **275** has a pin **276** protruding from its upper circumference, and a spring **277** bearing against the work supporting bed as shown in FIG. 2 is mounted on the slide rod between the collars to bias the pin and ultimately the thread introducing finger **270** towards the rear side of the work supporting bed. The pin is held in a slot **278** in a bracket **279** which is connected by screws to a slide bar **280** lengthwise shiftably supported in the bed.

The slide bar **280** to which the thread introducing finger **270** is connected is actuated by a cam **290** mounted on the circumference of the pattern cam **81** as shown in FIG. 5. As shown in FIG. 7, a slide block **291** is pivotally mounted on top of the slide bar at the standard end of the machine. The slide block is freely engaged by a slideway formed in the free end of a rock arm **292** which is connected to the top of a rock shaft **293** rotatably mounted in the hollow rock shaft **96** as shown in FIG. 6. A cam follower finger **294** connected to the bottom of the rock shaft **293** is biased against the cam **290** by spring means to control the position of the finger **270**. The cam **290** is so positioned on the circumference of the pattern cam **81** as to move the thread introducing finger laterally and towards the loop-taker just prior to the last pass of the loop taker beak past the needle aperture **58** in the throat plate **59** before the end of the sewing cycle. As discussed heretofore, the loop taker partakes of two revolutions for each reciprocation of the needle, and the loop-taker beak during sewing seizes a needle thread loop on only every other revolution. During sewing therefore, the loop-taker beak does not engage a needle thread loop during every other revolution and these loop taker revolutions during which needle thread loops are not seized may be termed idle on alternate revolutions. It is just prior to the last of these idle revolutions of the loop-taker beak that the thread introducing finger **270** is shifted towards the loop taker as described above so as to present to the beak **50** the thread from a source other than that of the needle thread. Shift of the bobbin winding member **70** into engagement with the bobbin so as to carry the finger **76** into thread gripping relation against the loop-taker beak **50** is also timed to occur during the last idle revolution of the loop taker beak in each cycle of sewing operation so as to grip and restrain on the beak the thread from the separate source of supply which is presented to the loop-taker beak by the thread introducing finger **270**.

As shown in FIG. 4, thread for presentation to the loop taker mechanism by the thread introducing finger **270** originates from a second spool **300** constituting a second source of thread supply. The spool is held on a spindle **301** protruding from the top of the subbase. A second tensioning device **302** having a guide **303** is mounted on the front side of the standard. A tubular guide **304** is connected along the side of the work supporting bed by means of a bracket **305** and screws. The finger has an eye bracket **306** mounted on an intermediate portion. Thread is strung from the second spool **300**, through the guide **303**, around the tensioning device **302**, through the tubular guide **304**, through the eye bracket **306**, and finally through an eye **307** in the end of the finger. It is within the scope of the invention to use a second needle mechanism in lieu of the thread introducing finger mechanism for introducing thread to the loop taker mechanism from the second source of supply. When the sewing machine illustrated in the accompanying drawings is stopped between cycles of operation, therefore, the thread from the separate source of supply will be nipped and restrained on the loop-taker beak **50** and, as illustrated in FIGS. 8 and 8A, the thread will have in fact been introduced to the bobbin but not yet wound thereon. The winding of this thread on the bobbin takes place during the initial revolution or revolutions of the loop taker at the start of the next succeeding cycle of sewing machine operation, the number of such thread winding revolutions depending upon the length of bobbin thread required.

In order to prevent the needle thread from being seized by the loop-taker beak and interfering with the bobbin thread replenishing operation, a needle throw-out mechanism is provided. It is, of course, within the scope of the invention to use other means to prevent the needle thread from interfering with the bobbin thread replenishing operation such as for instance any of the various needle thread loop deflecting or "stealing" devices which are ordinarily used to effect skipped stitches. The needle throw-out mechanism, however, provides a preferred means for preventing introduction of the needle thread to the loop taker mechanism and is therefore included in the embodiment in which the present invention is incorporated.

As shown in FIGS. 1 and 3, the needle throw-out mechanism includes a pair of opposed clutch plates **310** and **311** which are mounted on abutting ends of the main shaft which is bisected. The clutch plate **311** has a flanged narrow neck portion **312** and a pair of pins **313** spaced diametrically apart in bores in the clutch plate. The pins protrude from the clutch plate and seek correspondingly spaced bores **314** in the opposed clutch plate. A compression spring **315** is mounted on the main shaft between the pin carrying clutch plate and one of the main shaft bearings to bias the pin carrying clutch plate against the opposed clutch plate. A bell crank **316** is fulcrumed in the rear side of the bracket arm with a bifurcated arm **317** as shown in FIG. 3 in engagement with the narrow neck portion of the pin carrying clutch plate. The other arm **318** is pivotally connected to the top of a cam follower rod **319**. As shown in FIG. 4, a cam **320** on top of the gear **111** to which the pattern cam is connected actuates the cam follower rod and the needle throw-out mechanism. The cam is so positioned on top of the gear to throw out the needle reciprocating mechanism at the beginning of the bobbin thread replenishing operation and has a cam surface **321** adapted to immobilize the needle throughout the bobbin thread replenishing operation.

In operation, the machine of this invention is adapted to perform bobbin thread replenishing, sewing and thread cutting operations automatically and in a predetermined sequence. This sequence of operations will now be described with particular reference to FIGS. 8 to 12.

Referring to FIGS. 10 and 10A the loop taker and associated parts are illustrated together with the threads in the positions occupied as the loop taker beak **50** approaches the throat plate needle aperture on the last pass of the loop-seizing beak in a cycle of machine operation. The workpiece W is illustrated in FIGS. 10 and 10A in an abnormal position raised above the throat plate more clearly to illustrate the arrangement of the various threads. The series of stitches in the workpiece formed during the machine cycle about to be completed are indicated in the order of their formation as **S–1**, **S–2**, **S–3** and **S–4**, these stitches being formed by the concatenation of a needle thread N with a bobbin thread B. The length of bobbin thread **B–1** from the first stitch **S–1** in the previous tack of stitches extends through the throat plate needle aperture **58**, through the eye **307** in the thread introducing finger **270** and thence to the spool **300** constituting the second source of thread supply. This length of the bobbin thread **B–1** will be introduced to the bobbin and used for replenishing the bobbin thread supply for use in the

formation of the succeeding tack of stitches. The length of bobbin thread B–2 extending from the last stitch S–4 is the extremity of the thread which had been previously wound on the bobbin. The thread length B–2 immediately prior to the position of parts illustrated in FIGS. 10 and 10A had been seized by the auxiliary hook **130** and held by the thread engaging finger **136** opposite the thread camming member **131** on the loop taker and by this combined action completely withdrawn from the bobbin **62**. As illustrated in FIGS. 10 and 10A, the last loop formed in the needle thread by the loop taker has been transferred onto the finger **160** and is detained thereon for entry by the needle loop separating lug **193** associated with the thread cutting mechanism. In each sequence, the bobbin thread replenishing operation begins just prior to one-half loop taker revolution before the end of each sewing cycle when the thread introducing finger **270** is moved towards the loop taker mechanism through movement of the slide rod **271** and the slide bar **280** caused by the cam **290** on the circumference of the pattern cam **81** so that the loop-taker beak **50** can seize a bight of thread from between the finger and the work fabrics as shown in FIGS. 10 and 10A.

Since the loop taker beak rotates twice for each reciprocation of the needle and the needle is in raised position at the end of the sewing cycle, the needle is raised during the last idle or alternate loop taker revolution before the end of the sewing cycle. Before the end of the sewing cycle, the bobbin winding member **70** will be pressed against the bobbin **62** through movement of the slide rod **71** caused by the cam **80** on the circumference of the pattern cam, and the projection **76** on the circumference of the bobbin winder will nip and restrain the thread from the separate source seized by the hook to the back of the hook as shown in FIGS. 11 and 11A. In the position of parts illustrated in FIGS. 11 and 11A, the sewing machine is at rest having been stopped between cycles of operation; but the work clamp, which has been omitted from these figures more clearly to illustrate the thread arrangement, has not yet been raised and the operation of the thread cutting mechanism has not been completed to sever the threads.

When the work clamp is raised, the thread cutting mechanism will be operated to sever the bobbin thread length B–2, the bobbin thread length B–1 between the point where it is nipped against the loop taker-beak **50** and the first stitch S–1 in the workpiece W, and one limb of the loop needle thread N. FIGS. 8 and 8A illustrate the position of parts and thread arrangement after the work clamp has been raised, the previously stitched workpiece removed and a fresh workpiece placed above the throat plate; the sewing mechine remaining at rest between cycles of operation as in FIGS. 11 and 11A.

When the sewing machine is next started, winding of thread B from the separate source of supply onto the bobbin will occur. The needle reciprocating mechanism is immobilized by the needle throw-out mechanism through movement of the cam follower rod **319** caused by the cam **320** on the top of the gear **111** to which the pattern cam is connected. The bell crank **316** is rotated counterclockwise, as viewed from the front side of the machine, by the cam follower rod to pull the pin carrying clutch plate **311** away from the opposed clutch plate, thus parting the bisected main shaft and isolating the needle reciprocating mechanism from the drive connection provided by the clutch plates. Proceeding from the position of parts as shown in FIGS. 8 and 8A, with thread from the second source of supply nipped to the back of the loop-seizing beak, thread B will be wound on the bobbin as the bobbin is rotated by the bobbin winding member **70**. Bobbin winding will terminate when the bobbin winding member **70** is retracted from the bobbin as the cam follower **294** leaves the cam surface **98**.

After the bobbin thread replenishing operation has been completed as determined by the length of the cam surface **98**, the needle reciprocating mechanism will be rendered effective. The pin carrying clutch plate is biased against the opposed clutch plate by the compression spring **315** and since the cam follower rod **319** will have reached the end of the cam surface **321** of the cam **320** on the top of the gear **111**, the pins **313** in the pin carrying clutch plate can find the bores **314** in the opposed clutch plate to reactuate the needle reciprocating mechanism preparatory to the sewing operation.

FIGS. 9 and 9A illustrate the position of the parts and of the threads during stitch formation and particularly during the formation of the second stitch S–2 in a workpiece W. In FIGS. 9 and 9A, as in FIGS. 10 and 11, the bobbin thread B may be considered in two lengths; a length B–1 which extends from the first stitch S–1 to the thread introducing finger **270**, and a length B–2 which extends from the last stitch S–2 to the bobbin **60**.

During the sewing operation, the thread carrying needle is reciprocated through the goods by the needle reciprocating mechanism. The rotary hook seizes a loop of needle thread and passes it around the thread which has been wound on the bobbin during the preceding bobbin replenishing operation. The needle thread is able to pass around the bobbin because the bobbin winding member has been biased away from the bobbin as shown in FIGS. 9 and 9A by the compression spring **83**. The thread from the needle pulls up an initial bight of thread from between the thread introducing finger **270** and the bobbin. This initial bight remains held against the goods throughout the sewing operation so that control of the thread from the separate source of supply is never lost. In a group stitch sewing machine such as that of the preferred embodiment, the first and last stitches of each tack will not be spaced at any great distance from each other, and in most instances the first and last stitches can be made to coincide so that no appreciable thread is wasted by the thread from the separate source of supply remaining connected to the goods throughout the sewing operation. This arrangement however, constitutes but one means for retaining control over the thread from the separate source of supply as it issues from the eye **307** of the thread introducing finger so that the thread can unerringly be presented to the loop-taker beak. It is within the contemplation of this invention to provide other means for accomplishing this control over the thread.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made by way of example and that numerous changes in the details of construction and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

Having set forth the nature of this invention, what is claimed herein is:

1. In a lockstitch sewing machine, a loop taker mechanism having a bobbin mounted inside, rotatable means for restraining thread, disconnectable means for rotating the bobbin and for rotating the means for restraining thread, and a loop-seizing beak which moves in a circular path, means carrying thread from a first source positioned in proximity to the loop taker mechanism for introducing thread to the bobbin for a winding operation by means of the loop-seizing beak in cooperation with the means for restraining thread, the means for rotating the bobbin and for rotating the means for restraining thread being connected thereto, a needle mechanism carrying thread from a second source for passing through goods to be sewn and for presenting loops of thread to the loop-seizing beak for passing around the bobbin, the means for rotating the bobbin and for rotating the means for restraining thread being disconnected therefrom to permit passage of thread from the second source around the bobbin to form lockstitches in the goods with the thread from the bobbin during a sewing operation, and means connected to the

loop taker mechanism, the means carrying thread from a first source, and the needle mechanism carrying thread from a second source for selectively controlling the winding and sewing operations.

2. In a lockstitch sewing machine having a frame, an endwise reciprocatory thread carrying needle carried on said frame, means for directing thread from a source of needle thread supply to said needle, a loop taker carried in said frame, actuating means for reciprocating said needle to present thread from said source of needle thread supply to said loop taker and for operating said loop taker in timed relation with said needle reciprocation in the formation of lockstitches, a bobbin, means constraining said bobbin within said loop taker to provide for passage of thread seized and manipulated by said loop taker completely about said bobbin, means for winding on said bobbin within said loop taker a thread seized and manipulated by said loop taker, said bobbin winding means including a thread guiding means, and means for shiftably supporting said thread guiding means and said bobbin for movement relatively to each other into and out of an effective bobbin winding position in which said thread guiding means will direct a thread seized and manipulated by said loop taker onto rather than completely about said bobbin, a thread introducing member, means for directing thread from a thread source separate from said needle thread supply to said thread introducing member, means shiftably supporting said thread introducing member in said frame for movement into and out of an effective position to present thread from said separate source of supply to said loop taker, bobbin winding control means operative simultaneously to shift said thread guide means and said thread introducing member into effective positions, and means effective during operation of said bobbin winding control means for rendering said needle ineffective to present thread from said source of needle thread supply to said loop taker.

3. In a lockstitch sewing machine having a frame, an endwise reciprocable thread carrying needle carried in said frame, means for directing thread from a source of needle thread supply to said needle, a rotary loop taker journaled in said frame, actuating means for imparting a plurality of revolutions to said loop taker in timed relation with each reciprocation of said needle to present thread from said source of needle thread supply to said loop taker on only one of said plurality of loop taker revolutions in the formation of lockstitches, a bobbin, means constraining said bobbin within said loop taker to provide for passage of thread seized and manipulated by said loop taker completely about said bobbin, means for winding on said bobbin within said loop taker a thread seized and manipulated by said loop taker, said bobbin winding means including a thread guiding means, and means for shiftably supporting said thread guiding means and said bobbin for movement relatively to each other into and out of an effective bobbin winding position in which said thread guiding means will direct a thread seized and manipulated by said loop taker onto rather than completely about said bobbin, a thread introducing member, means for directing thread from a thread source separate from said needle thread supply to said thread introducing member, means shiftably supporting said thread introducing member in said frame for movement into and out of an effective position to present thread from said separate source of supply to said loop taker, and bobbin winding control means operative to effect the shift of said thread guide means and said thread introducing member simultaneously into effective position during a revolution of the loop taker other than said one revolution during which the thread from said source of needle thread supply is presented to said loop taker by said needle.

4. A bobbin thread replenishing means for a sewing machine having a needle bar mounted in the frame, means for imparting endwise reciprocation to the needle bar, a needle connected to an end of the needle bar, a first supply of thread for the needle, a rotary loop taker, a loop-seizing beak on the loop taker, means for rotating the loop taker in timed relation with the reciprocation of the needle for forming stitches, a bobbin, means for journaling the bobbin in the loop taker, means for restraining thread, means for rotating the bobbin and the means for restraining thread capable of winding thread from said first supply seized by the loop-seizing beak and restrained by the means for restraining thread onto the bobbin in place in the loop taker, and means for actuating the means for rotating the bobbin and the means for restraining thread, said bobbin thread replenishing means comprising, in combination, a second supply of thread separate and distinct from said first supply, means for introducing thread from said second supply in lieu of said first supply to the loop-seizing beak of the loop taker for winding on the bobbin in place in the loop taker, means for actuating said means for introducing thread from said second supply for winding thread on the bobbin when the means for rotating the bobbin and the means for restraining thread are actuated, a needle throw-out mechanism and means for actuating the needle throw-out mechanism to prevent reciprocation of the needle when the means for introducing thread from said second supply is actuated for winding thread onto the bobbin in place in the loop taker.

5. A bobbin thread replenishing means for a sewing machine as claimed in claim 4 in which the means for introducing thread from said second supply of thread is a shiftable member having an eyelet for thread and said means for actuation of the means for introducing thread shifts the shiftable member so that thread can be seized by the loop-seizing beak of the loop taker for winding on the bobbin when the means for rotating the bobbin and the means for restraining thread is actuated.

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JORDAN FRANKLIN, *Primary Examiner.*

H. H. HUNTER, *Assistant Examiner.*