



## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a sewing machine, a bobbin to supply thread in the sewing machine, a bobbin case for the bobbin and a method of winding thread on the bobbin. The invention relates particularly, but not exclusively, to sewing machines intended for domestic or household use, and can be applied to industrial and other sewing machines, if desired. In general, the invention provides a novel and improved bobbin, bobbin case and bobbin winding method useful with sewing machines employing a loop-making hook rotating about a vertical axis, and other types of sewing machine.

### BACKGROUND OF THE INVENTION

**[0002]** Sewing machines which employ an upper and lower thread to form a seam or other sewn element employing lockstitches or other suitable stitches are sometimes subject to stitching problems which yield poor seams or other stitchwork.

**[0003]** Beitzel U.S. Patent No. 699,067 discloses a sewing machine of this type which employs a spool of thread supported in spool house mounted for rotation beneath a work bed to supply a lower thread to the needle.

**[0004]** Johnson U.S. Patent No. 4,182,250 and Rodda et al. U.S. Patent No. 4,487,142 both disclose sewing machine employing a rotating hook which functions as a loop taker. As disclosed in these patents a bobbin case, bearing a bobbin wound with thread, can be located beneath the sewing machine work bed, directly under the needle which is threaded with the upper thread. A hook travels around the bobbin case, rotating about a vertical axis, takes a loop from the upper thread and pulls it around the bobbin. The loop extends around the lower thread which runs from the bobbin to the fabric. As it advances, the hook sheds the loop and the sewing machine's take-up lever tightens the threads into a lockstitch or the like.

**[0005]** The above patents do not address the problem of poor stitch formation which may occur in a lockstitch or similar sewing machine which draws a lower thread from a bobbin contained in a bobbin case.

**[0006]** The foregoing description of background art may include insights, discoveries, understandings or disclosures, or associations together of disclosures, that were not known to the relevant art prior to the present invention but which were provided by the invention. Some such contributions of the invention may have been specifically pointed out herein, whereas other such contributions of the invention will be apparent from their context. Merely because a document may have been cited here, no admission is made that the field of the document, which may be quite different from that of the invention, is analogous to the field or fields of the present invention.

## SUMMARY OF THE INVENTION

**[0007]** It is an object of the invention to provide a sewing machine which addresses the problem of poor stitch formation which may occur in forming lockstitches or the like when drawing a lower thread from a bobbin contained in a bobbin case. Other objects of the invention lie in providing a bobbin, bobbin case and threading method useful in addressing this problem.

**[0008]** In one aspect, the invention provides a sewing machine which includes a needle mounted for reciprocal movement in opposed descending and ascending directions toward and away from a workpiece to sew the workpiece with an upper thread. In addition the machine includes a bobbin mounted to supply a lower thread to the needle. The bobbin can comprise a hub to support wound thread and respective first and second flanges located at opposed ends of the hub to retain the thread on the hub. Furthermore, the machine includes a bobbin case to support the bobbin for reciprocal movement beneath the workpiece, the bobbin case having a chamber to receive and seat the bobbin. In this novel sewing machine the bobbin and bobbin case are cooperably configured to seat the bobbin in the bobbin case chamber in a working orientation and to prevent seating of the bobbin in a nonworking orientation.

**[0009]** To this end, the second bobbin flange can be larger than the first bobbin flange. The bobbin case chamber can have a mouth and a narrower portion inwardly of the chamber mouth. The mouth can be capable of receiving the second bobbin flange and the narrower portion can be capable of receiving the smaller, first bobbin flange. This structure enables proper seating of the bobbin in the bobbin case chamber, but the narrower portion of the chamber is incapable of receiving the larger, second bobbin flange being thereby preventing seating of the bobbin in a nonworking orientation.

**[0010]** The bobbin hub can have an axial opening to receive a bobbin winder spindle in one axial direction. The hub opening may be at least partially obstructed to prevent insertion of the bobbin winder spindle into the hub opening in another axial direction opposed to the one axial direction. Embodiments of bobbin employing this construction fit the winder spindle in only one way. Employing a predetermined winder direction, incorrect winding can be avoided.

**[0011]** Surprisingly, it has been found that some stitching problems in lockstitch sewing machines employing a lower thread drawn from a bobbin mounted in a bobbin case are attributable to user error in replacing and/or re-winding empty bobbins. The invention provides structural measures useful in overcoming or mitigating these problems.

**[0012]** In another aspect, the invention provides a bobbin to supply thread in a sewing machine. The sewing machine can comprise a needle to sew the workpiece with an upper thread and a lower thread, the needle being mounted for reciprocal movement in opposed descend-

ing and ascending directions toward and away from the workpiece. The sewing machine can comprise a bobbin case to support the bobbin for reciprocal movement beneath the workpiece. The bobbin case can have a chamber to receive and seat the bobbin. The bobbin may comprise a hub to support wound thread and respective first and second flanges located at opposed ends of the hub to retain the thread on the hub. The bobbin and bobbin case can be cooperably configured to seat the bobbin in the bobbin case chamber in a working orientation and to prevent seating of the bobbin in a nonworking orientation.

**[0013]** The invention also provides a bobbin case having the described cooperative structure and provides such a bobbin case with the bobbin seated therein.

**[0014]** In a further aspect, the invention provides a method of winding thread on the bobbin of such a sewing machine which comprises a number of steps. The steps may comprise assembling the bobbin, when in need of thread, to the bobbin winder spindle by inserting the bobbin winder spindle into the bobbin hub in the one axial direction. Thread can then be wound on to the bobbin mounted on the bobbin winder spindle. In the event of an attempt to insert the bobbin winder spindle into the hub opening in the opposed axial direction, the method includes removing and reorienting the bobbin when the partial obstruction prevents the insertion attempt. Pursuant to the method, after removing and reorienting the incorrectly oriented bobbin, the bobbin winder spindle is now inserted into the bobbin and the bobbin is wound with thread.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

**[0015]** Some embodiments of the invention, and of making and using the invention, as well as the best mode contemplated of carrying out the invention, are described in detail below, by way of example, with reference to the accompanying drawings, in which like reference characters designate like elements throughout the several views, and in which:

- FIG. 1 is a front perspective view showing one embodiment of an error-resistant bobbin for a sewing machine, according to the invention;
- FIG. 2 is a front perspective view of a top portion of a sewing machine showing an embodiment of bobbin winder mechanism for winding the bobbin illustrated in FIG. 1 wherein the bobbin is mounted on a winder spindle;
- FIG. 3 is a view similar to FIG. 2 showing the bobbin detached from the winder spindle and having a desired orientation;
- FIG. 4a is a view similar to FIG. 3, showing a portion of the structure shown in FIG. 3 wherein the bobbin has an undesired orientation;
- FIG. 4b is a view similar to FIG. 4a, from a different angle, wherein the bobbin has the undesired

orientation shown in FIG. 4a;

- FIG. 5 is a front perspective view of the top portion of a sewing machine similar to that shown in FIG. 2, showing one embodiment of a bobbin winding method according to the invention;
- FIG. 6 is a cross-sectional view of one embodiment of an error-resistant bobbin case according to the invention, within which the bobbin illustrated in FIG. 1 is accommodated with a desired orientation;
- FIG. 7 is a cross-sectional view of a rotating hook mechanism employing a bobbin case such as that shown in FIG. 6 in which a bobbin like that illustrated in FIG. 1 has been properly installed;
- FIG. 7a is a view of the bobbin case shown in FIG. 6, with a bobbin, such as that illustrated in FIG. 1, properly installed;
- FIG. 8 is a top perspective view of the work bed of a sewing machine employing the rotating hook mechanism shown in FIG. 7, with a cover retracted to reveal the bobbin and bobbin case;
- FIG. 9 is a view similar to FIG. 7 showing an attempt to improperly install the bobbin in the bobbin case shown in FIG. 6; and
- FIG. 9a is a view similar to FIG. 7a also showing an attempt to improperly install the bobbin in the bobbin case.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0016]** It is an understanding of the invention that lock-stitch or similar sewing machine which draw a lower thread from a bobbin contained in a bobbin case are likely to consume a large amount of the lower thread. This circumstance requires frequent manually effected replacements of the lower thread bobbin. Typically, to do this, the operator or user must stop the sewing machine, remove the bobbin from the bobbin case and rewind the bobbin with new thread. The rewound bobbin must then be reinstalled in the bobbin case.

**[0017]** While removal and reinstallation of the bobbin may be a necessary procedure and may often be straightforward it is nevertheless a manual procedure which with known machines may be subject to one or more errors. It is an insight of this invention that such errors may lead to stitching problems and poor seams or other poor stitch-work.

**[0018]** The invention provides a novel, error-resistant bobbin useful for supplying thread to the needle of a sewing machine. It also provides a novel bobbin case which is cooperative with the bobbin.

**[0019]** In particular, but not exclusively, the novel bobbin is useful with sewing machines of the type comprising a needle mounted for reciprocal movement in opposed descending and ascending directions. Typically, in such machines, the needle is carried by a needle bar which

moves toward and away from a workpiece to sew the workpiece, which may for example be one or more layers of fabric, with an upper thread threaded through the needle. For certain stitches, for example straight stitches and zig-zag stitches, a second lower thread may be supplied to the needle from beneath a work bed which supports the fabric. The novel bobbin can be used to supply this lower thread, for which purpose it may be mounted beneath the work bed. When the bobbin runs out of thread, it has to be rewound. This may be accomplished by manually removing the bobbin from the bobbin case and mounting it on a winder spindle on top of the sewing machine where it is rewound with thread from a stock source such as a spool or reel of thread using a rotary drive supplied by the sewing machine. While the bobbin winding process is essentially simple, known methods are prone to certain errors. For example, the bobbin may be wound upside down or in the wrong direction or may be inserted into the bobbin case the wrong way round. Also, the winding operation may in some cases become uncontrolled, tangling knotting or even breaking the thread as a result of improper mounting of the bobbin on the winder spindle, or other factors. The bobbin and bobbin case and associated bobbin winder mechanism illustrated in the drawings can alleviate one or more of these problems.

**[0020]** The sewing machine can be a domestic sewing machine useful for sewing in a household or other domestic environment or other suitable location. However, the inventive bobbin may be employed with other sewing machines as will be apparent to those skilled in the art. Only portions of the complete sewing machine are shown. The structure not shown can take any suitable form, as is well known in the art and may for example comprise a portable unit or a table-mounted unit. While it is envisaged that the invention is particularly useful when embodied in a unit supported or mounted on a tabletop, bench or the like for operation by a seated user, it will be understood that the invention can be embodied in other sewing machines, as will be or may become apparent. Directional references such as "front", "rear" or "behind", "up", "down", "left" and "right", as used herein are to be understood as being from the perspective of such a user

**[0021]** As shown in FIG. 1, a sewing machine bobbin 10 can comprise a hollow, approximately cylindrical, central hub 12 to support wound thread (not shown in this figure) which hub is with its axis vertically disposed in FIG 1. Bobbin 10 can have a first flange 14 at one end of central hub 12 and a second flange 16 located at the other end of central hub 12, opposing flange 14, to retain the thread on the hub 12. As oriented in FIG. 1, bobbin flanges 14 and 16 can be described as lower and upper flanges respectively. In the embodiment shown, they are disposed perpendicularly to the axis of central hub 12.

**[0022]** To help control user errors in handling bobbin 10, as will be further explained herein, second flange 16 is distinctly larger in diameter than flange 14. Flange 16

can, for example, be from about 2 to about 10 percent larger in diameter than flange 14, although other proportions may be employed. As shown in FIG. 1, flanges 14 and 16 are uniformly thin disks with circular peripheries which are formed integrally and monolithically with central hub 12, for example as a one-piece molding. However, other shapes and configurations may be employed including, for example, a polygonal shape and a tapered cross-section in a radial plane. Also, while shown as being similar, one flange 14 or 16 may have a different geometry from the other. One or more intermediate flanges (not shown) could be provided, if desired, between flanges 14 and 16, for example to permit bobbin 10 to carry multiple threads. Such intermediate flanges, if provided, desirably are smaller than flange 16.

**[0023]** The peripheries of flanges 14 and 16, in the circular embodiment shown in FIG. 1, lie on a conical or frusto-conical surface.

**[0024]** Central hub 12 has an axial opening 18 to receive a bobbin winder spindle 30 (FIG. 2) in one axial direction. In the embodiment shown, central hub 12 is thin walled and hub opening 18 is a sizeable volume occupying much of the volume of central hub 12. Hub opening 18 is at least partially obstructed to prevent insertion of the bobbin winder spindle 30 into central hub 12 opening in the opposite axial direction so that bobbin 10 is a one-way fit on the winder spindle 30 and can only be assembled with the spindle in a properly oriented fashion. In the embodiment shown in FIG. 1, hub opening 18 is obstructed by the second bobbin flange which extends continuously across the whole cross-section of hub opening 18 to close it. Other obstructions may be employed to provide bobbin 10 with a desirable one-way character, for example a constricted diameter to hub opening 18 at second flange 16, a cross-member extending across hub opening 18 at or near second flange 16 or a tapering of hub opening 18 (and thence of the bobbin winder spindle 30) towards second flange 16.

**[0025]** Hub opening 18 is formed with a channel-like keyway 20, which may be a groove or slot and which extends axially along part of hub opening 18, and opens at one end into smaller, first flange 14. The other end of keyway 20 is blind. Other suitable keying, or spindle-cooperative locking structure, will be apparent to those skilled in the art. Second bobbin flange 16 has a threading aperture 22 adjacent central hub 12 for receiving the end of a thread to be wound on bobbin 10.

**[0026]** An optional strengthening fillet 24 can be provided around the junction between second flange 16 and central hub 12 and also around the junction between first flange 14 and central hub 12, which latter fillet is not shown.

**[0027]** Bobbin 10 can be constructed in one monolithic piece, as noted above, or may be fabricated from multiple components welded, adhered, fastened with fasteners or otherwise assembled together. In one embodiment of the invention, bobbin 10 is molded from a durable, and optionally resilient, material, for example a suitable ther-

mosetting synthetic polymeric resin, such as clear styrene acrylonitrile copolymer.

**[0028]** Bobbin 10 can have any suitable size and may for example be of a size suitable to accommodate from about 5 to about 100 meters of wound cotton thread of a type commonly used for domestic sewing such as 100% mercerized cotton thread N°50. One embodiment of the invention provides a bobbin 10 with a capacity for from about 25 to about 38 meters of such cotton thread. Such a bobbin could have dimensions of, for example, about 20 mm external diameter, 10 mm height and a central hub diameter of about 8.0 mm. Other bobbins may be in proportion or may have other suitable dimensions, as will be apparent to one skilled in the art.

**[0029]** Bobbin 10 can have any desired appearance and finish and may for example be transparent or opaque, colored or achromatic. In one embodiment of the invention, bobbin 10 is supplied in a range of transparent colors including pastel blues, greens pinks, yellows, secondary colors and stronger tints of the pastel hues.

**[0030]** Referring now to FIGS. 2-3 and 5, a bobbin winder mechanism 26 can be located on the top or back of a sewing machine 28, of which only a portion is shown in the drawings, or elsewhere on or off the sewing machine, as may be desired. It will be understood that those parts of the sewing machine that are neither illustrated nor described may have any suitable structure known or apparent to one skilled in the art in light of this disclosure, or as will become known or apparent as the art develops.

**[0031]** The bobbin winder mechanism comprises a bobbin winder spindle 30 projecting upwardly from the top of sewing machine 28 and which can be rotatably driven by sewing machine 28. Winder spindle 30 is receivable into hub opening 18. Winder spindle 30 and hub opening 18 have cooperative locking structure, in the vicinity of first bobbin flange 14, to lock bobbin 10 to the winder spindle 30 against rotation of bobbin 10 relatively to the winder spindle 30. As may be seen from Fig. 1, in the embodiment shown, the other end of bobbin 10, in the vicinity of second flange 16, lacks locking structure cooperative with the winder spindle 30.

**[0032]** Winder spindle 30 can be resiliently engageable in central hub opening 18 to grip central hub 12 for rotation therewith. Winder spindle 30 may be a close sliding fit in hub opening 18. In one embodiment of the invention, the winder spindle 30 is formed of a resilient material, has a transverse dimension nominally larger than axial opening 18 and is resiliently compressible laterally to be receivable in central hub 12 opening. Such compressibility can be provided by a transverse slot 32 opening at the free end 34 of winder spindle 30. With this construction, winder spindle 30 has a diameter at its free end which is slightly larger than that of hub opening 18. Free end 34 may be chamfered or otherwise shaped to guide it into hub opening 18.

**[0033]** The locking structure can comprise a key 36 rotatable with winder spindle 30 and which is configured to be accommodated in keyway 20. Key 36 may be

formed as an axial rib projecting from winder spindle 30, or may have other suitable structure.

**[0034]** Winder spindle 30 may be fabricated of any suitable material, for example a durable resilient plastic such as an acetal copolymer for example that supplied under the trademark HOSTAFORM® LW90 BSX (Hoechst A.G.).

**[0035]** Multiple stops 38 can be disposed peripherally around the winder spindle 30 to position central hub 12 along the winder spindle 30. In the embodiment illustrated, stops 38 have the form of longitudinal splines projecting radially from winder spindle 30. The upper end of each stop 38 provides a seat to support bobbin 10 during winding. Together, stops 38 provide a ring of support for bobbin 10 around winder spindle 30.

**[0036]** Winder spindle 30 can be freely rotatable about its vertical axis with a resistance and/or inertia which can be predetermined to facilitate a smooth winding operation. Winder spindle 30 is shown in the drawings in a drive-engaging position where it receives rotary drive from sewing machine 28. In the particular embodiment shown, rotary drive for bobbin 10 is provided by a drive boss 40 which receives rotational drive from sewing machine 28.

**[0037]** Drive boss 40 provides drive to bobbin 10, when seated on winder spindle 30, by frictional engagement therewith. For this purpose, drive boss 40 has a cylindrical shape with a cylindrical outer surface 42, a flat or domed top surface 44 and a peripheral recess 46 around the upper circumference edge of drive boss 40. Drive boss 40 is mounted on a drive shaft 48 which is drivingly connected, or connectable, with the sewing machine drive (not shown). Drive shaft 48 extends through an aperture 50 in the top housing of sewing machine 28. Drive boss 40 may have either a solid or hollow structure and outer surface 42 usefully has a matt or textured finish to help provide good driving engagement with flanges 14 and 16 of bobbin 10. If desired, transmission of drive to drive boss 40 may be controlled by a user actuated control means such as a switch (not shown).

**[0038]** Outer surface 42 of drive boss 40 can radially engage the periphery of smaller, lower flange 14 of bobbin 10 when bobbin 10 is located in its drive-engaging position, to apply drive thereto. Also, in another useful but not essential feature of the invention, when bobbin 10 is properly seated on winder spindle 30 against stops 38, larger, upper flange 16 of bobbin 10 engages in peripheral recess 46. Such engagement of flange 16 in recess 46 assists in the transmission of drive to bobbin 10 and in maintaining alignment of bobbin 10 on winder spindle 30 during winding. The axial position of one or more stops 38 along winder spindle 30 may be adjusted to facilitate snug engagement of bobbin flange 16 in recess 46 in drive boss 40.

**[0039]** In many embodiments, but not all, it is desirable to provide the user the ability to move winder spindle 30 away from drive boss 40 to disengage bobbin 10 from drive boss 40 to facilitate mounting of bobbin 10 on winder

spindle 30 and removal of the loaded bobbin. Desirably, such movement of winder spindle 30 can be effected by operation of a lever or dial or other mechanical device or by electronic or electrical means (not shown). For example, winder spindle 30 can be supported for arcuate lateral movement of its rotation axis toward and away from the drive position by means not shown. If desired, winder spindle 30 may latch into its out-of-engagement position. Furthermore, a drive switch or other drive engagement device (neither one is shown) can, if desired, be associated with the movement of bobbin winder spindle 30 to turn on the rotary drive to bobbin 10 as winder spindle 30 moves toward bobbin 10 and to disconnect or turn off the drive as winder spindle 30 moves away.

**[0040]** Also, if desired, winder spindle 30 can be resiliently urged into its drive position thereby applying a resilient urging force to engage bobbin 10 with drive boss 40. Such resilient urging engagement can promote consistent application of a drive force to bobbin 10 and reliable winding of thread on to bobbin 10. Sewing machine 28 can have an arcuate slot 52 formed in its housing to accommodate this lateral movement.

**[0041]** Other suitable drive means for applying a rotational drive to bobbin 10 will be apparent to one skilled in the art. For example winder spindle 30 may be rotated by sewing machine 28 and apply to bobbin 10. In this case, drive boss 40 can be replaced by an idler or a fixed guide that helps to guide and position bobbin 10 on winder spindle 30 but does not apply drive to it. Usefully, the drive means can be user-actuatable enabling the user to rotate or cease rotation of bobbin 10.

**[0042]** As shown in FIG. 5, a spool 54 loaded with thread can be mounted for rotation on a spool pin 56 to provide a source of supply of thread to bobbin 10. Desirably spool pin 56 can provide limited resistance to rotation of the bobbin, to avoid overrun. A spool holder 58 can be used to retain bobbin 10 in position on spool pin 56. Spool pin 56 can be disposed on sewing machine 28 conveniently adjacent winder spindle 30 and with any suitable orientation, for example with the longitudinal axis of spool pin 56 disposed approximately horizontally, or in another suitable location and orientation.

**[0043]** To control the running thread 60 traveling from spool 54 to bobbin 10, a thread guide 62 can be provided. Thread guide 62 can be spaced longitudinally away from spool pin 56, along the top of sewing machine 28, to receive thread 60 from spool 54 across spool holder 58 which guides thread leaving spool 54. A winder pretensioner 64 can be disposed just downstream of thread guide 62 about which thread 60 turns into the final leg of its travel to bobbin 10. This arrangement is intended to permit bobbin 10 to draw thread from spool 54 and to wind the thread neatly in continuous helical layers. Use of an appropriate pretensioner and one or more guides facilitates winding of bobbin 10 with a proper tension. Excess tension may lead to thread breakage, and undue slackness may cause surpluses, entanglement or knotting.

**[0044]** In using the bobbin winder apparatus of the invention, before mounting a bobbin 10 on winder spindle 30, the user ensures that a spool 54 of suitable thread is loaded on to spool pin 56. The thread end is drawn from spool pin 56, threaded over spool pin holder 58 and thread guide 62, around pretensioner 64 to bobbin 10. The thread end can be fed through threading aperture 22 and bobbin 10 can be given a turn or two to secure the thread end on bobbin 10 or it may be secured in another suitable manner.

**[0045]** The user then mounts bobbin 10 on bobbin winder spindle 30. The contrasting appearances provided by first flange 14 at one end of bobbin 10 with the large central aperture provided by hub opening 18 and the continuous surface of flange 16 which closes the other end of bobbin 10 makes it easy for the user to orient bobbin 10 correctly, with smaller flange 14 downward. With this orientation, bobbin 10 is pressed on to winder spindle 30, compressing slotted end 34 of winder spindle 30 to fit within hub opening 18. Winder spindle 30 can offer moderate resistance to the descent of bobbin 10, providing a good tight feel to the user. Bobbin 10 is pushed down winder spindle 30 until it is securely seated on stops 38. The combination of the resilient resistance provided by slotted spindle end 34 and the ability to positively seat the bobbin against stops 38, will help most users position bobbin 10 on winder spindle 30 to be properly aligned with drive boss 40 for driving engagement therewith.

**[0046]** In the event the user attempts to mount bobbin 10 on winder spindle 30 with larger flange 16 lowermost, such effort is rendered obviously impossible by engagement of the aperture-free flange with free end 34 of winder spindle 30. This difficulty is graphically illustrated in FIGS. 4a and 4b. Accordingly, the user may be expected to quickly abort the attempt and to correctly reorient bobbin 10 with flange 14 downward and hub opening 18 addressing winder spindle 30.

**[0047]** The foregoing operations desirably are performed with winder spindle 30 latched into its out-of-drive position. Once bobbin 10, with thread end attached, is properly mounted on winder spindle 30, the user can operate the appropriate control device to move winder spindle 30 into its driven position. This movement can bring bobbin 10 into engagement with winder boss 40 and may activate the drive to winder boss 40, if the drive is so switched. Smaller flange 14 of bobbin 10 is resiliently urged into engagement with outer surface of drive boss 40 and large flange 16 engages in peripheral recess 46.

**[0048]** Bobbin 10 is rotated by engagement with drive boss 40, drawing thread from spool 54 and winding bobbin 10. The cooperative locking action of key 36 on winder spindle 30 and keyway 20 in hub opening 10 of bobbin 10 ensures that there is no rotational slippage of bobbin 10 on winder spindle 30; which helps promote a smooth and effective winding action. The direction of winding is predetermined by the direction of rotation of drive boss 40 and the one way orientation of bobbin 10. It is not

subject to user selection; which avoids possible error in the direction of winding that could be problematic when the wound bobbin is utilized in the bobbin case.

**[0049]** When bobbin 10 is adequately wound, or at another desired moment, the user can activate the winder spindle drive control to terminate the rotation of bobbin 10, cut the thread and remove the wound bobbin from winder spindle 30. Wound bobbin 10 is now ready for loading into a bobbin case to supply thread to a sewing machine needle. An example of one suitable bobbin case and related mechanism that may be employed will now be described. Others will be apparent to those skilled in the art.

**[0050]** One bobbin case with which bobbin 10 is useful is a bobbin case such as is employed in a rotating hook sewing machine. In one known form of rotating hook machine, the bobbin case, bearing the bobbin is located beneath the sewing machine work bed, directly under the needle which is threaded with the upper thread. A hook travels around the bobbin case, rotating about a vertical axis, takes a loop from the upper thread and pulls it around the bobbin. The loop extends around the lower thread which runs from the bobbin to the fabric. As it advances, the hook sheds the loop and the sewing machine's take-up lever tightens the threads into a stitch.

**[0051]** One form of rotating hook machine employing a bobbin case is disclosed in Rodda et al., U.S. patent No. 4, 487,142 cited above. The hook rotating structure constituted by rotary loop taker 20 in Rodda et al., and its associated structure, which carries bobbin case 42 in Rodda et al., can be employed to support the novel bobbin case of the present invention for rotary movement beneath a sewing machine needle. The so-supported bobbin case of the invention can be employed to supply a lower thread to the needle for forming dual-thread stitches, for example lock stitches, employing a bobbin 10 supported in the inventive bobbin case.

**[0052]** A bobbin case according to one embodiment of the invention can have an internal frustoconical configuration with a smaller diameter in its lower portion to properly accommodate bobbin 10. Proper seating and alignment of a correctly wound bobbin in its bobbin case, as may be achieved with this embodiment of the invention can prevent variations in stitching, inconsistent sewing performance, tension variations, cording, and related problems that may otherwise occur.

**[0053]** The bobbin case of the present invention can also be employed in a relatively simple style of machine such as that shown in Beitzel U.S. Patent No. 699,067, which is incorporated by reference herein, where the instant bobbin case may replace cup-like spool holder c of Beitzel.

**[0054]** In the embodiment illustrated in FIGS. 6-9a, a bobbin case pursuant to the present invention, can accommodate bobbin 10 in only one orientation to reduce user error that may lead to thread-handling problems and/or poor stitching. This can be accomplished employing a bobbin such as bobbin 10 which has an end-for-

end asymmetry arising from the differences in size of flanges 14 and 16. In contrast, many known bobbins are reversible end-for-end and can be installed in a bobbin case in more than one way. Incorrect installation while apparently satisfactory to the user may adversely affect sewing quality.

**[0055]** Referring now to FIGS. 6-9a, the bobbin case there illustrated, referenced 70, has a cup-like configuration with a sidewall 71 and a mouth 72 through which bobbin 10 may be received into an interior chamber 74 within bobbin case 70. Bobbin case 70 has a bottom portion 75 structured to retain bobbin 10 in bobbin case 70. The exterior of bobbin case 70 is structured to be supported in a suitable rotary mechanism such as Rodda et al.'s rotary loop taker 20, for example by means of a peripheral lip 76. Externally, bobbin case 70 can have any desired structure consistent with its bobbin-support and thread supply functions.

**[0056]** Interior chamber 74 of bobbin case 70 is configured to closely fit bobbin 70 for which purpose it has, in its lower portion, a shape which, in the downward direction tapers or reduces in cross-section, being smaller at the bottom of chamber 74. In height, chamber 74 may approximate the height of bobbin 10 from flange to flange, and desirably may be just sufficient for chamber 74 to completely accommodate bobbin 10. The cross-sectional shape of bobbin case chamber 74 desirably may conform with the shape of bobbin flanges 14 and 16 and in one useful embodiment is circular. However, it will be understood that chamber 74 need not conform with the bobbin shape at all points of a given horizontal periphery and may so conform at multiple points or portions, or a single major portion of the periphery.

**[0057]** In the illustrated embodiment of bobbin case 70, interior chamber 74 has a middle diameter 78 and a bottom diameter 80. Middle diameter 78 is somewhat larger than bottom diameter 80. Thus, between middle diameter 78 and bottom diameter 80, interior chamber 74 has a part-conical or frusto-conical shape. Above middle diameter 78, the horizontal section of interior chamber 74 is at least as large as middle diameter 78. Pursuant to the invention, the dimensions and configuration of interior chamber are selected so that bobbin 10 can be properly accommodated and seated in only one orientation. Usefully, the geometry can be such that attempts to seat bobbin 10 in other than the proper orientation result in misalignments or other problems such that it is clearly impossible to operate the sewing machine.

**[0058]** For example, bottom diameter 80 may be selected to be approximately equal to the diameter of smaller flange 14 so that smaller flange 14 is a close fit into the bottom of chamber 74. The dimensioning may provide a small clearance sufficient to prevent smaller flange 14 from being gripped by chamber 74 in a way that would interfere with removal of bobbin 10. Middle diameter 78 may usefully be larger than bottom diameter 80, and can be somewhat less than the diameter of larger flange 16 of bobbin 10. The upper portion of interior chamber 74

can be sufficiently large to receive larger flange 16 of bobbin 10 with a small clearance. With these dimensions, bobbin 10 can be properly seated with smaller flange 14 downward. However, if larger flange 16 is downward, the flange will lodge near middle diameter 78, leaving flange 14 projecting from bobbin case 70. The projecting flange may render it impossible to assemble the bobbin case into the sewing machine. Nor can bobbin 10 be inserted into bobbin case chamber 74 with hub 12 horizontal and flanges 14 and 16 extending vertically. Thus, there is only one way in which bobbin 10 can be assembled with bobbin case 70, as is shown.

**[0059]** Bobbin case 70 as shown in FIG. 6 can be fabricated from a lightweight, durable wear-resistant synthetic plastic polymer, for example a phenolic resin such as a thermoset phenolic 525 or CB-7843.

**[0060]** While the described and illustrated embodiment of bobbin case chamber 70 may have an interior chamber 74 which has horizontal cross-sectional surfaces which lie on circles to closely accommodate or fit circular flanges 14 and 16 of bobbin 10, it will be understood that interior chamber 74 may have other cross-sectional shapes depending upon the shape of flanges 14 and 16, or other bobbin structures. For example, the cross-sectional shape or shapes could be square, polygonal, or the like or irregular.

**[0061]** As will be understood by one skilled in the art, the illustrated embodiment of bobbin case 70 of the invention can be employed in a sewing machine having a hook rotating structure and associated support mechanism such as is disclosed in Rodda et al., for lockstitch operation utilizing thread supplied by bobbin 10 from bobbin case 70, and replacing bobbin case insert 38 described by Rodda et al. The present invention includes such a sewing machine.

**[0062]** FIGS. 7-8 show bobbin case 70 supported in a rotating hook mechanism 81 of a sewing machine to supply thread (not shown) from bobbin 10 to the sewing machine's needle, as a lower thread. Conveniently, although not necessarily, the sewing machine of which portions are illustrated in FIGS. 7-9 may be the same machine as is partially illustrated in FIGS. 2-5.

**[0063]** The sewing machine shown in FIGS. 7-8 includes a spring guide 82 which cooperates with the bobbin case side wall 71, over which the thread runs, to guide the lower thread and tension it during sewing. Rotating hook mechanism 81 is supported in a volume beneath the work bed 84 of the sewing machine which volume is closable by a slidable cover 86. Cover 86 is closed in FIG. 7 and retracted, or open, in FIG. 8 to provide access to bobbin 10, enabling it to be changed when exhausted of thread or when a different thread is required. Cover 86 has a downward retaining rib 88. Desirably bobbin case 70 and other relevant components are dimensioned to provide a sufficient clearance 90 for the thread to pass as the hook rotates. Other elements of the rotating hook mechanism and the sewing machine can be as is known in the art.

**[0064]** In use, a user retracts cover 86, removes an existing bobbin 10 from bobbin case 70, if present and manually inserts a wound bobbin 10 which has been prepared as shown in FIG. 5. Properly oriented, for example as shown in FIG. 7a, with smaller flange 14 downward, bobbin 10 readily drops into place in bobbin case 70. Thread is drawn from bobbin 70 and positioned in the usual manner to supply lower thread to the needle. Cover 86 can be closed, ready for sewing.

**[0065]** In the event the user inserts bobbin 10 with an incorrect orientation, for example with larger flange 16 downward, as shown in FIG. 9 and FIG. 9a, flange 16 lodges near middle diameter and flange 14 projects above work bed 84. Cover 86 cannot be closed, sewing is prevented and this state of affairs will usually prompt the user to remove, rotate and reinsert bobbin 10 in the correct orientation. Because the direction of winding of the thread on bobbin 10 has been predetermined in the winding operation, the user is assured of sewing with a properly installed and correctly wound bobbin. So long as other components of the sewing machine are functioning properly, the user may reasonably expect to be able to generate quality stitching until bobbin 10 is exhausted of thread and needs changing.

**[0066]** Additional benefits obtainable with embodiments of novel bobbin case 70 are that it may easily be removed and reinstalled facilitating cleaning and lubricating of the rotating hook mechanism.

**[0067]** In the above description, where structures are described as having, including, or comprising specific components, or where methods are described as having, including, or comprising specific steps, it is contemplated that structures and methods of the present invention may also consist essentially of, or consist only of, the particular components or steps recited.

**[0068]** The foregoing detailed description is to be read in light of and in combination with the preceding background and invention summary descriptions wherein information regarding the best mode of practicing the invention may also be set forth and where modifications, alternative and useful embodiments of the invention may be suggested or set forth, as will be apparent to one skilled in the art.

**[0069]** While illustrative embodiments of the invention have been described above, it is, of course, understood that many and various modifications will be apparent to those of ordinary skill in the relevant art, or may become apparent as the art develops. Such modifications are contemplated as being within the spirit and scope of the invention or inventions disclosed in this specification.

## Claims

1. A sewing machine including:

a) a needle mounted for reciprocal movement in opposed descending and ascending direc-



tions toward and away from a workpiece to sew the workpiece with an upper thread;  
 b) a bobbin mounted to supply a lower thread to the needle, the bobbin comprising a hub to support wound thread and respective first and second flanges located at opposed ends of the hub to retain the thread on the hub; and  
 c) a bobbin case to support the bobbin for reciprocal movement beneath the workpiece, the bobbin case having a chamber to receive and seat the bobbin;

wherein the bobbin and bobbin case are cooperably configured to seat the bobbin in the bobbin case chamber in a working orientation and to prevent seating of the bobbin in a nonworking orientation.

2. A sewing machine according to claim 1 wherein the second bobbin flange is larger than the first bobbin flange, the bobbin case chamber has a mouth and a narrower portion inwardly of the chamber mouth wherein the mouth is capable of receiving the second bobbin flange and the narrower portion is capable of receiving the smaller, first bobbin flange, enabling seating of the bobbin in the bobbin case chamber, but is incapable of receiving the larger, second bobbin flange thereby preventing seating of the bobbin in a nonworking orientation.
3. A sewing machine according to claim 2 wherein the bobbin can be entirely accommodated and seated within the bobbin case chamber with the smaller, first bobbin flange disposed in said narrow portion and wherein insertion of the larger, second bobbin flange into the bobbin case chamber with a bobbin orientation disposing the second, larger bobbin flange in advance of the smaller, first bobbin flange prevents seating of the bobbin and causes the bobbin to project from the bobbin case chamber.
4. A sewing machine according to claim 2 wherein each of the first and second bobbin flanges has a circular periphery, wherein the bobbin case chamber has a frusto-conical shape tapering inwardly away from the chamber mouth to the narrower portion of the bobbin case chamber.
5. A sewing machine according to claim 1 wherein each of the first and second bobbin flanges is disk-shaped and has a circular periphery.
6. A sewing machine according to claim 1 wherein the bobbin hub has an axial opening to receive a bobbin winder spindle in one axial direction, the hub opening being at least partially obstructed to prevent insertion of the bobbin winder spindle into the hub opening in another axial direction opposed to the one axial direction.

7. A sewing machine according to claim 6 wherein the hub opening is at least partially obstructed by the second bobbin flange extending across the hub opening to close the hub opening.
8. A sewing machine according to claim 7 comprising a winder spindle for winding thread on to the bobbin wherein the winder spindle is receivable into the bobbin hub opening and the bobbin hub opening and the winder spindle have cooperative locking structure in the vicinity of the first bobbin flange to lock the bobbin to the winder spindle against rotation of the bobbin relatively to the winder spindle.
9. A sewing machine according to claim 8 wherein the bobbin lacks locking structure cooperative with the winder spindle in the vicinity of the second bobbin flange.
10. A sewing machine according to claim 9 wherein the locking structure comprises a key rotatable with the winder spindle and a keyway in the hub opening to receive the key.
11. A sewing machine according to claim 8 wherein the winder spindle is resiliently engageable in the bobbin hub opening to grip the bobbin hub for rotation with the winder spindle.
12. A sewing machine according to claim 11 wherein the winder spindle is formed of resilient material, has a transverse dimension nominally larger than the hub opening and is longitudinally slotted to be resiliently compressible and receivable in the bobbin hub opening.
13. A sewing machine according to claim 11 comprising multiple stops disposed peripherally around the winder spindle to position the bobbin hub along the winder spindle.
14. A sewing machine according to claim 8 wherein the second bobbin flange has an opening near or adjacent the bobbin hub for receiving thread to be wound on the bobbin.
15. A sewing machine according to claim 8 wherein the winder spindle is movable between a drive position where a driving force can rotate the bobbin and an out-of-drive position where the bobbin is not rotated by the driving force.
16. A sewing machine according to claim 15 comprising a rotatable drive boss located adjacent the spindle in the drive position to drive the bobbin for rotation on the spindle.
17. A sewing machine according to claim 16 comprising

a spool pin to receive a spool of thread to be wound on to the bobbin.

18. A sewing machine according to claim 2 wherein the bobbin is transparent.

19. A sewing machine according to claim 2 comprising a winder spindle for winding thread on to the bobbin wherein:

the bobbin hub has an axial opening to receive a bobbin winder spindle in one axial direction, the hub opening being at least partially obstructed to prevent insertion of the bobbin winder spindle into the hub opening in another axial direction opposed to the one axial direction;

the winder spindle is receivable into the bobbin hub opening and the hub opening and the winder spindle have cooperative locking structure to lock the bobbin to the winder spindle against rotation of the bobbin relatively to the winder spindle;

the winder spindle is resiliently engageable in the bobbin hub opening to grip the bobbin hub for rotation with the winder spindle; and the winder spindle is formed of resilient material, has a transverse dimension nominally larger than the hub opening and is longitudinally slotted to be resiliently compressible and receivable in the bobbin hub opening.

20. A sewing machine according to claim 2 wherein the bobbin case is reciprocally rotatable about an upwardly extending axis and, when the bobbin is mounted in the bobbin case, the bobbin hub extends upwardly, the second, larger bobbin flange is disposed at the top of the hub and the first bobbin flange is disposed at the bottom of the hub.

21. A sewing machine according to claim 2 comprising a rotating hook mechanism supporting the bobbin case, the rotating hook mechanism being operable to form a loop from thread drawn from the bobbin and supply the loop to the needle for stitch formation.

22. A bobbin to supply thread in a sewing machine, the sewing machine comprising a needle to sew the workpiece with an upper thread and a lower thread, the needle being mounted for reciprocal movement in opposed descending and ascending directions toward and away from the workpiece and comprising a bobbin case to support the bobbin for reciprocal movement beneath the workpiece, the bobbin case having a chamber to receive and seat the bobbin, wherein the bobbin comprises a hub to support wound thread and respective first and second flanges located at opposed ends of the hub to retain the thread on the hub and wherein the bobbin and bobbin

case are cooperably configured to seat the bobbin in the bobbin case chamber in a working orientation and to prevent seating of the bobbin in a nonworking orientation.

23. A bobbin according to claim 22 in combination with the bobbin case.

24. A method of winding thread on a bobbin on a sewing machine useful for sewing a workpiece with an upper thread and a lower thread, the method employing a needle mounted for reciprocal movement in descending and ascending directions toward and away from the workpiece to sew the workpiece, an upper thread being supplied downwardly to the needle and employing a bobbin locatable beneath the needle to supply the lower thread to the needle, wherein the bobbin comprises a hub to support wound thread, respective first and second flanges located at opposed ends of the hub to retain the thread on the hub, the bobbin hub having an axial opening to receive a bobbin winder spindle in one axial direction, the hub opening being at least partially obstructed to prevent insertion of the bobbin winder spindle into the hub opening in an opposed axial direction and wherein the method comprises the steps of:

- a) assembling the bobbin, when in need of thread, to the bobbin winder spindle by inserting the bobbin winder spindle into the bobbin hub in said one axial direction;
- b) winding thread on to the bobbin mounted on the bobbin winder spindle;
- c) in the event of an attempt to insert the bobbin winder spindle into the hub opening in said opposed axial direction, removing and reorienting the bobbin when said partial obstruction prevents the insertion attempt; and
- d) after performing step c), effecting steps a) and b).

25. A method according to claim 24 wherein the sewing machine comprises a bobbin case to support the bobbin for reciprocal movement beneath the workpiece, the bobbin case having a chamber to receive and seat the bobbin;

wherein the bobbin and bobbin case are cooperably configured to seat the bobbin in the bobbin case chamber in a working orientation and to prevent seating of the bobbin in a nonworking orientation and wherein the method further comprises the steps of:

- e) inserting and seating the wound bobbin in the bobbin case chamber; and
- f) in the event the wound bobbin is prevented from seating in the bobbin case chamber, removing the wound bobbin from the bobbin case chamber, reorienting the wound bobbin and

again attempting step e).

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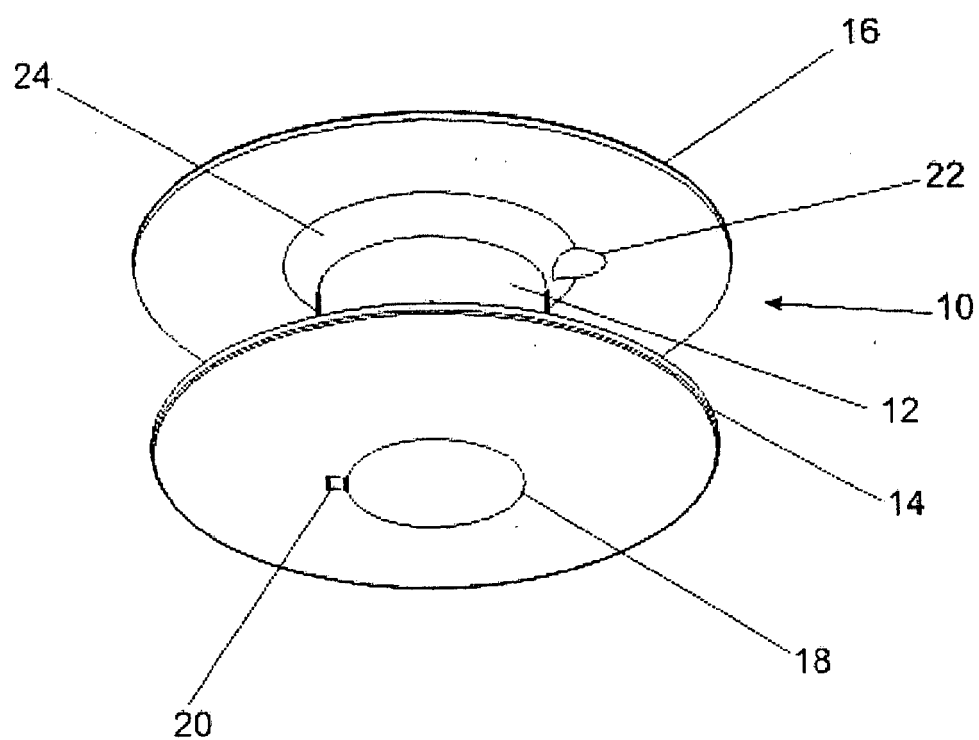
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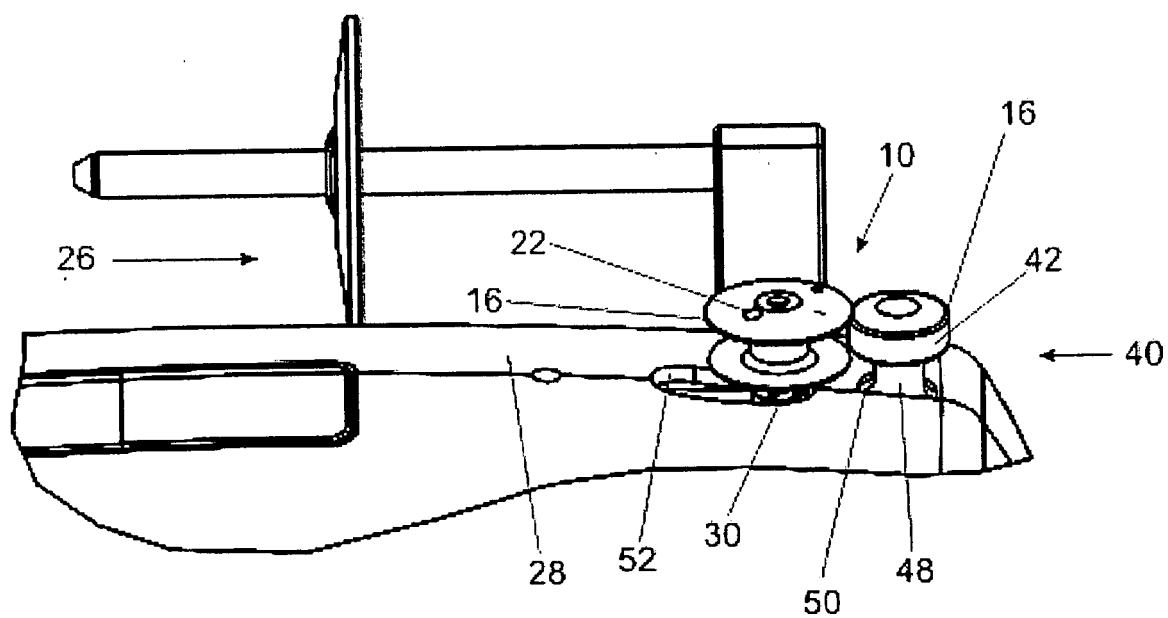
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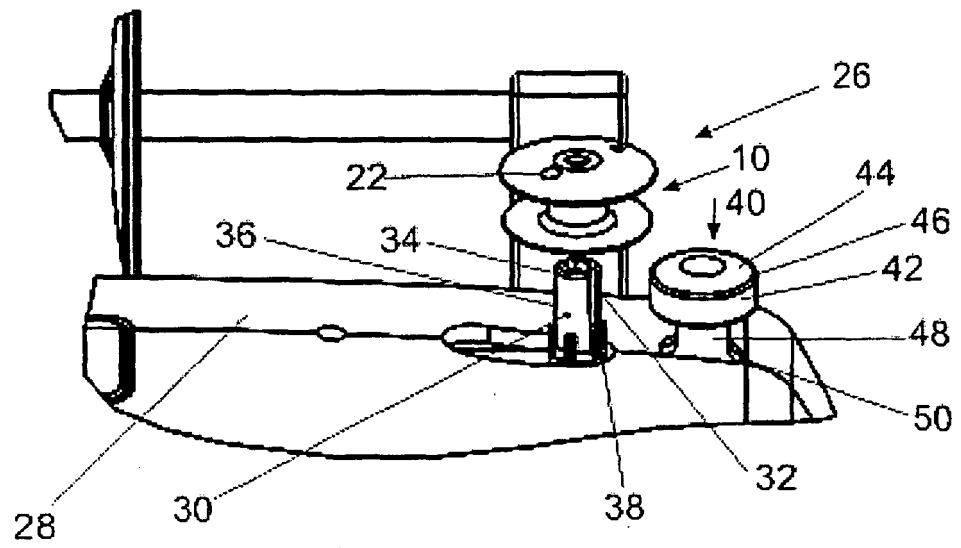
**FIG.1**



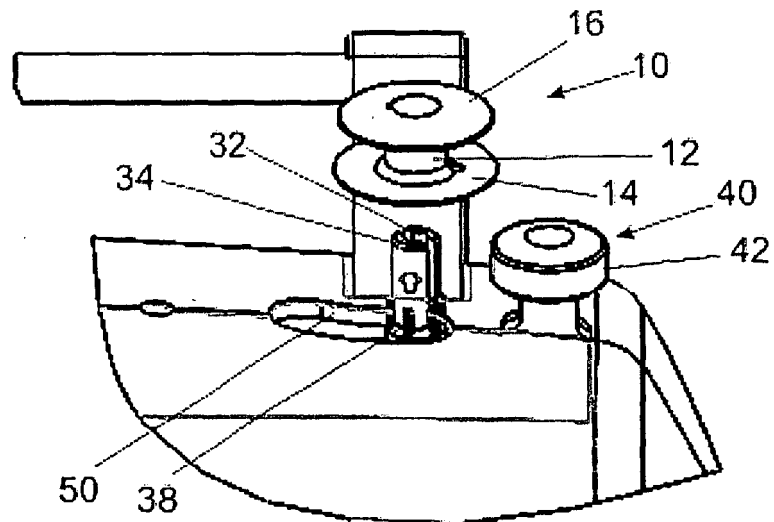
**FIG.2**



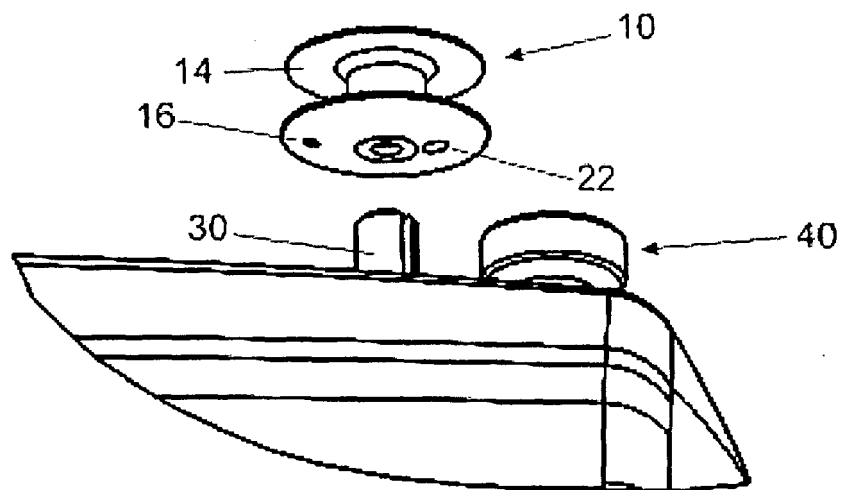
**FIG.3**



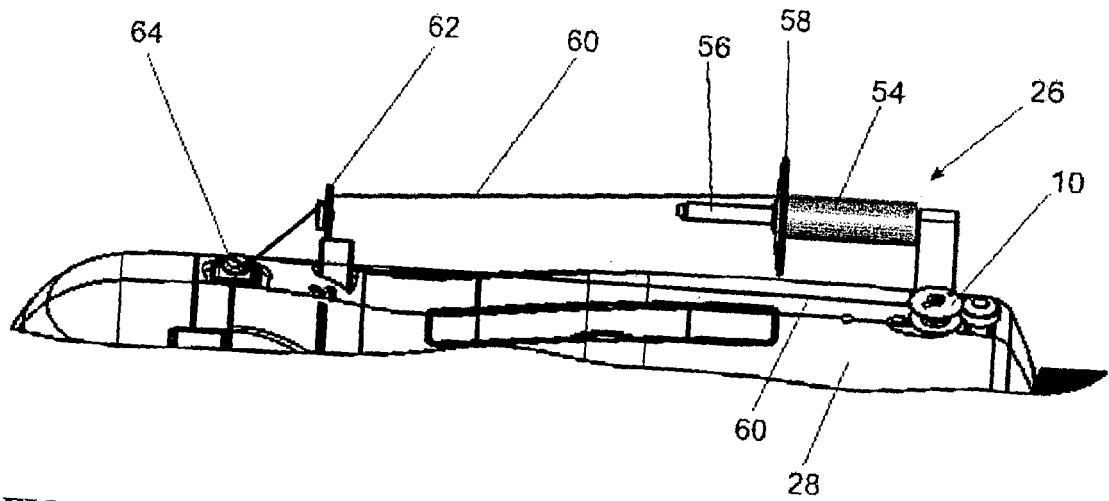
**FIG.4a**



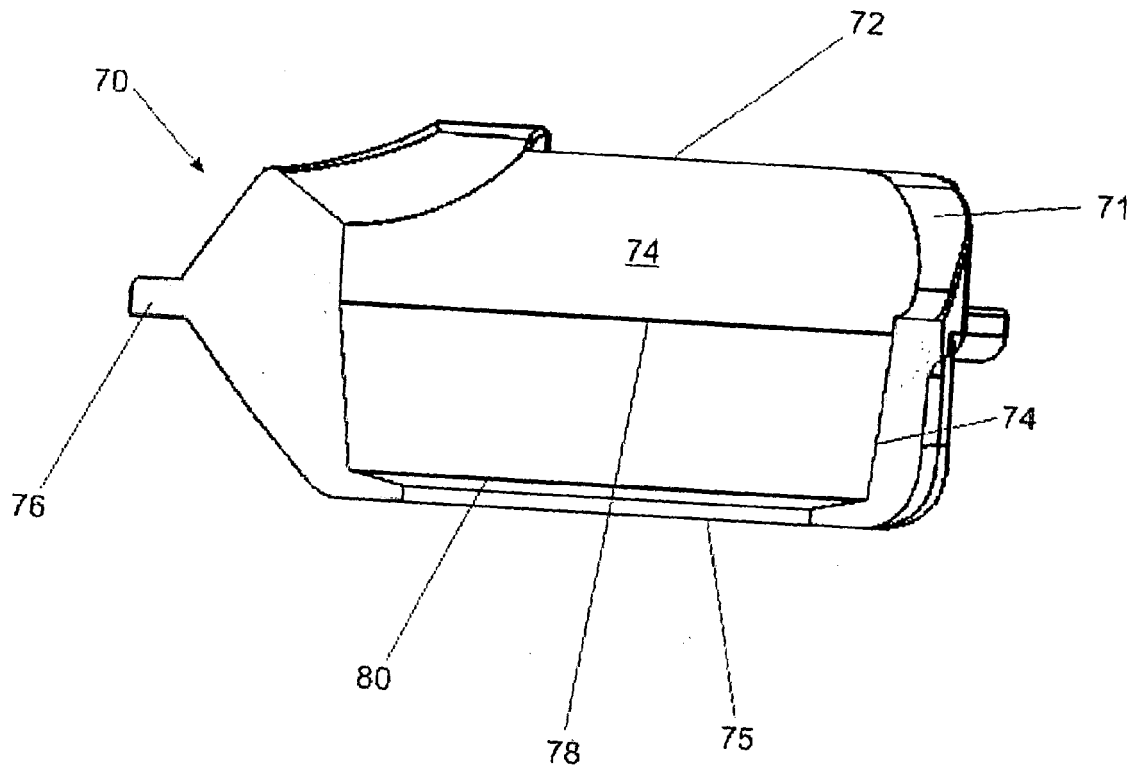
**FIG.4b**



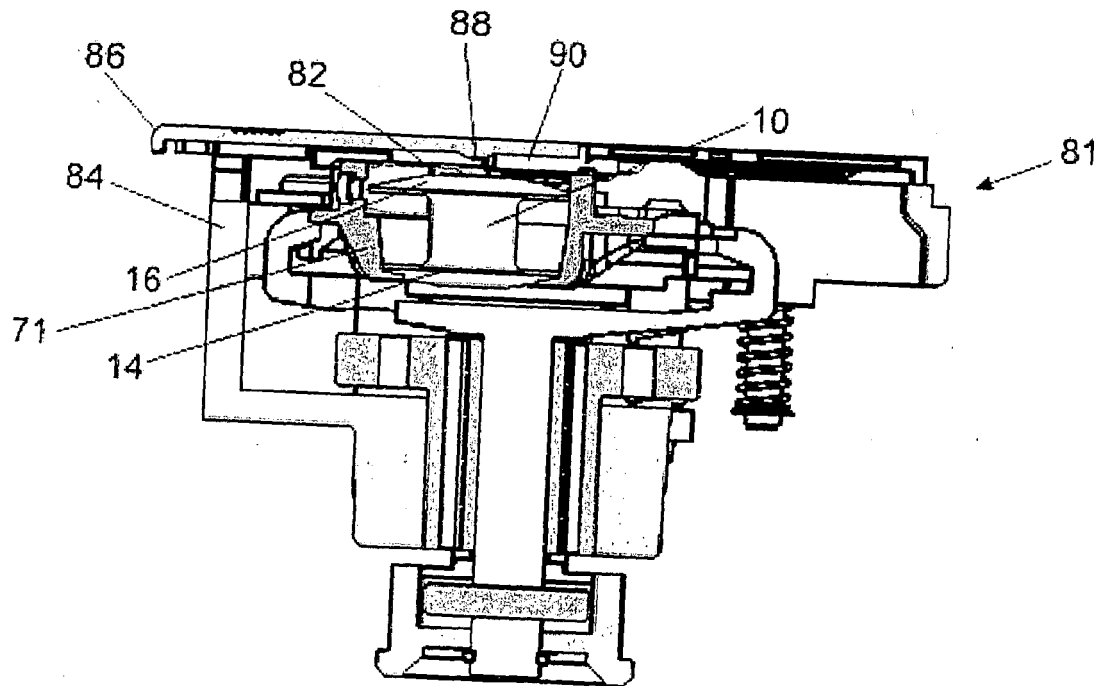
**FIG.5**



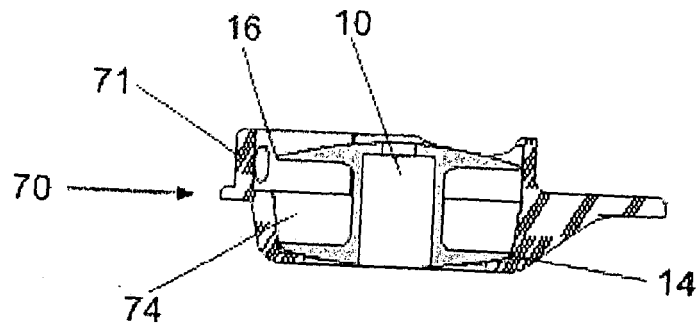
**FIG.6**



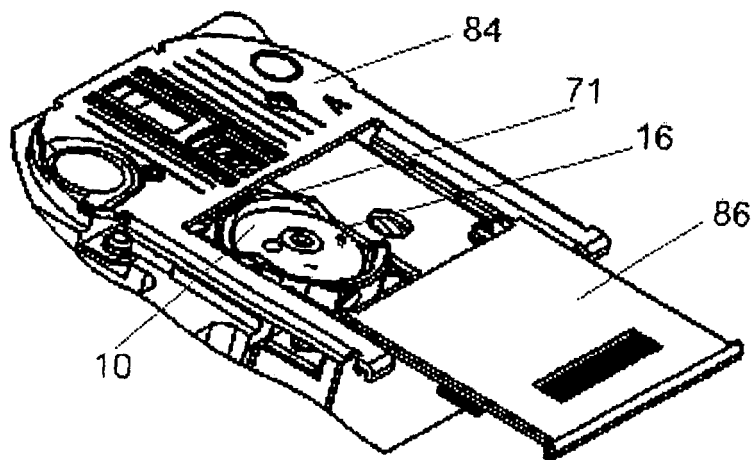
**FIG.7**



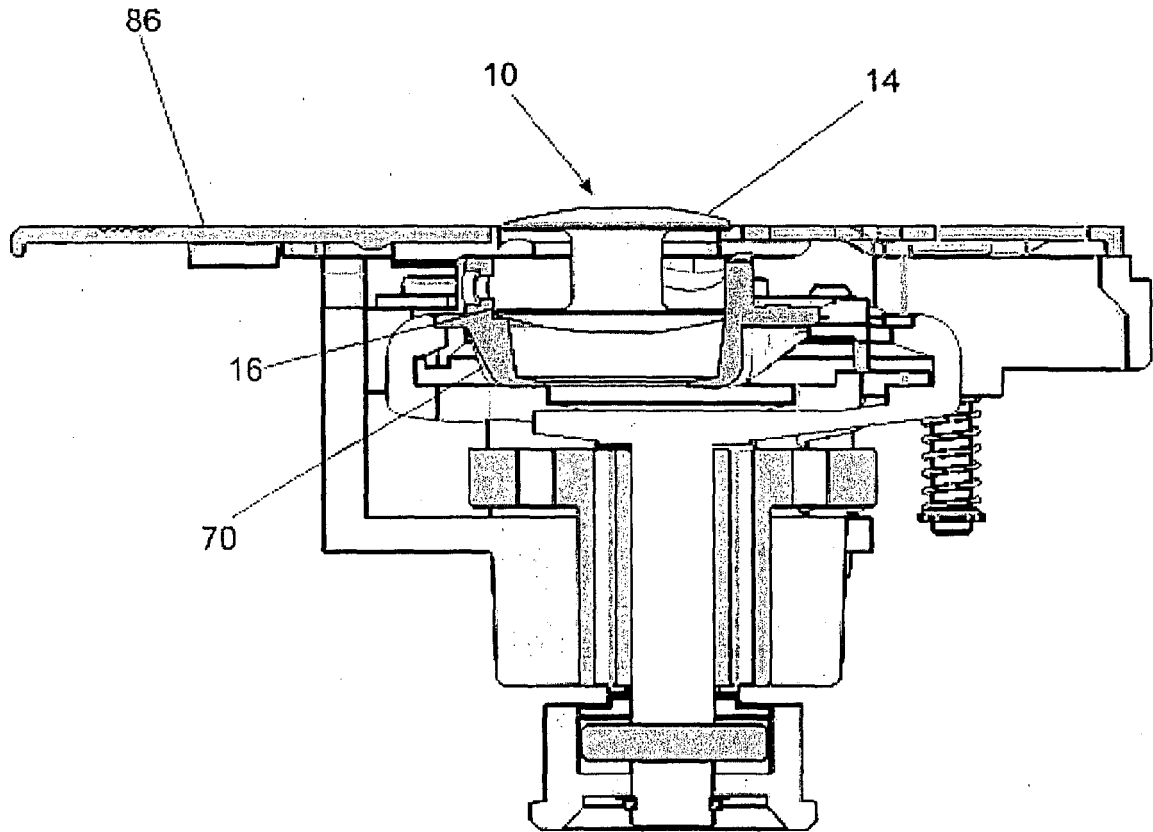
**FIG.7a**



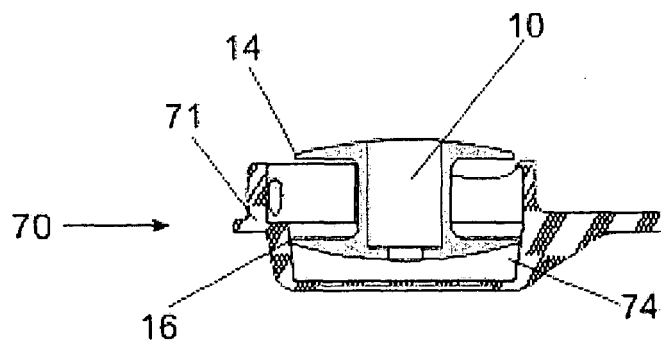
**FIG.8**



**FIG.9**



**FIG.9a**







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# EUROPEAN SEARCH REPORT

Application Number  
EP 07 01 2161

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 499 406 A (GREULICH ROBERT G ET AL) 10 March 1970 (1970-03-10)	1-9, 20-25	INV. D05B57/28
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			D05B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 September 2007	Examiner Debard, Michel
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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The members are as contained in the European Patent Office EDP file on  
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27-09-2007

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