May 10, 1938. C. F. RUBEL 2,116,982

BOBBIN FOR SEWING MACHINES

Filed Jan. 4, 1935

FIG. I.

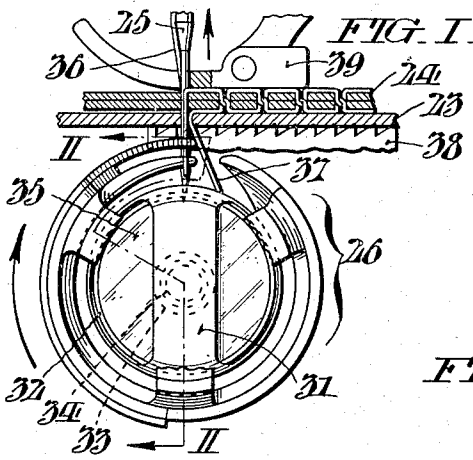


FIG. III.

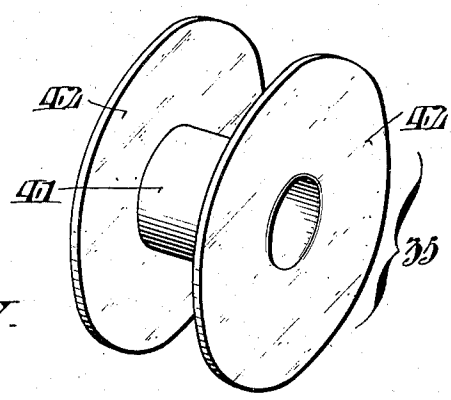


FIG. IV.

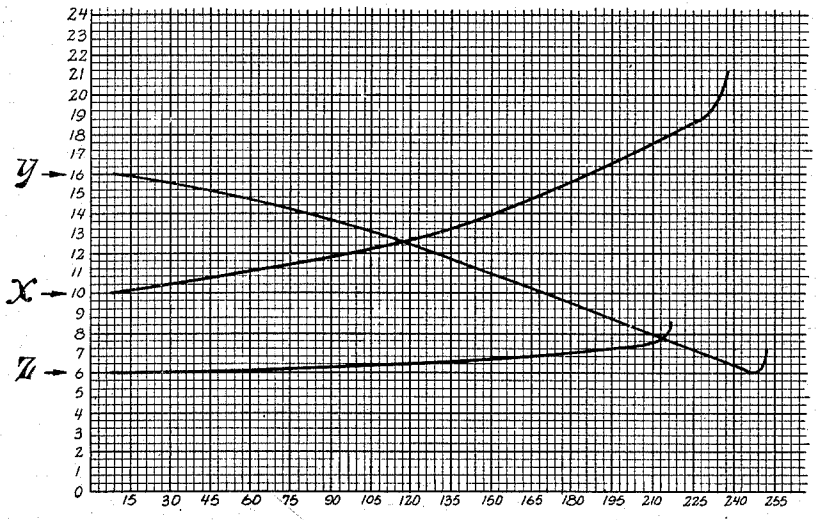
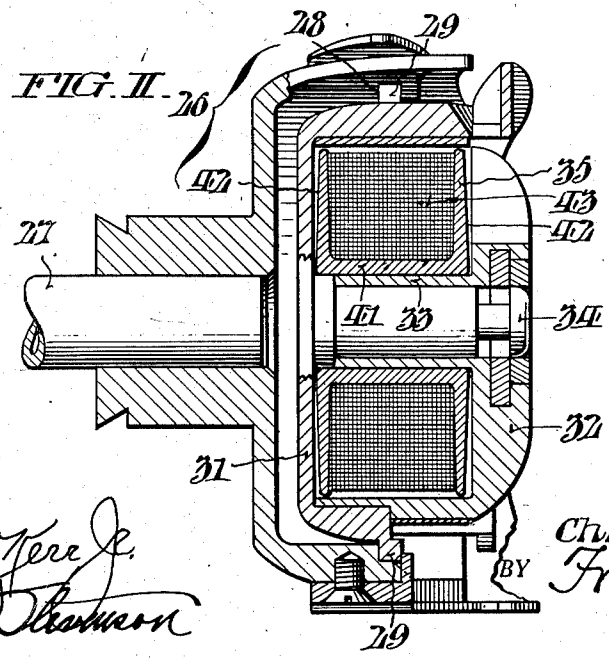


FIG. II.



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BOBBIN FOR SEWING MACHINES

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Application January 4, 1935, Serial No. 419

5 Claims. (Cl. 112—251)

This invention relates to bobbins for sewing machines, and more particularly to bobbins of the type associated with rotary hooks or loop taking mechanism of a like character.

The invention deals with the problem of preventing breaking of the bobbin thread under conditions where a very fine thread is used, or where the thread is subjected to an unusually severe strain on account of the machine's being operated at a high speed and with a relatively long length of stitch.

Heretofore it has been customary with rotary hook sewing machines to use a steel bobbin having a weight several times greater than that of its contained thread mass, and when such machines are operated at a high speed, especially where fine threads and long stitches are used, the bobbin thread is apt to break before the entire supply of thread on the bobbin has been used up. With this type of sewing machine, the bobbin thread is drawn out only during that part of the cycle in which the feed mechanism operates, though the pull caused by the movement of the fabric may be supplemented by other factors including the action of the take-up mechanism in drawing the loop of bobbin thread up to the point where the stitch is set. Inasmuch as the feed mechanism operates in timed relation to the stroke of the needle, if the machine is operated at a high speed, the bobbin thread will be drawn out with an intermittent pull of correspondingly high periodicity. Moreover, while the machine operates, the diameter of the thread mass carried on the bobbin becomes smaller; and the force required to pull off successive increments of thread of the same length becomes correspondingly greater, for the bobbin is rotated through more degrees of arc and the pull on the thread is applied closer to the axis of the bobbin. The gradual reduction in the weight of the thread mass is a factor tending to reduce the force required to pull off the thread, but where the bobbin is considerably heavier than its contained thread mass, which is the case with the ordinary steel bobbin, this factor is not sufficient to offset the previously mentioned factors which tend to increase this force.

In addition to the ordinary steel bobbins, it has been proposed for reasons of convenience and economy to employ ready wound bobbins made of paper or cardboard. Bobbins of this type are also characterized by a variable resistance to unwinding. Such a bobbin weighs considerably less than its contained thread mass so that the force required to pull off the thread decreases as the diameter of the thread mass diminishes. Furthermore, such bobbins are not re-fillable, and they are objectionable on account of the tendency of the thread to slip between the ends of the mass of wound thread and the non-rigid disks and to be caught there.

The principal object of the present invention is to provide a bobbin which is so designed and so proportioned in weight with respect to the thread mass adapted to be carried thereon, that it offers a substantially constant resistance to the drawing out of its thread as it unwinds at a uniform linear velocity, and thus avoids the above mentioned difficulties which have been experienced with older forms of bobbins.

Other advantages characterizing the present invention, including those derived from the use of a bobbin which produces a stitch of uniform character and which is sufficiently rigid to permit its re-filling, will become more apparent from the description hereinafter set forth of one example of the practice of the invention, having reference to the accompanying drawing.

Of the drawing:

Fig. I represents a fragmentary view showing the stitch forming parts of a sewing machine embodying this invention, the work plate of the machine being shown in cross section, and the rotary hook therebeneath being shown in end elevation.

Fig. II represents a cross section of the rotary hook and parts associated therewith, taken as indicated by the lines II—II of Fig. I.

Fig. III represents a perspective view of the bobbin associated with the rotary hook; and,

Fig. IV represents a graph showing the load characteristics of a bobbin of this invention as compared with steel and paper bobbins.

In the drawing the invention is shown as applied to a lock stitch sewing machine of the type described in the pending application for U. S. Letters Patent, Serial No. 670,186, filed May 9, 1933, of Norman V. Christensen and Charles F. Rubel.

The supporting bed of the machine, which serves as the cloth plate, is represented at **23**, and the work being sewn is represented at **24**. The stitch forming mechanism includes a needle **25** and a rotary hook **26**. The rotary hook **26** is of a conventional type, and is supported on a shaft **27** beneath the work support **23**.

As most clearly shown in Fig. II, the rotary hook **26** has an annular raceway **28** engaged by a peripheral rib **29** on the bobbin holder **31**.

Within the bobbin holder 31, the bobbin case 32 is inserted. This case 32 is formed with a sleeve 33 which surrounds a central stud 34 attached to the bobbin holder 31. The bobbin 35 fits within the bobbin case 32 in surrounding relation to the sleeve 33 and is adapted to rotate freely thereon.

In Fig. I of the drawing, the needle thread is indicated at 36 and the bobbin thread at 37. The work 24 is engaged from beneath by a feed dog 38 and from above by a presser foot 39. As is well understood by those skilled in the art, during one part of the cycle of operation the work 24 is moved transversely over the supporting bed 23 by the feed dog 38, and during another part of the cycle of operation the needle 25 passes through the work 24, and a thread loop is taken therefrom by the rotary hook 26 and carried around the bobbin thread 37 to form the stitch.

As most clearly shown in Fig. III, the bobbin 35 desirably consists of a tubular core 41 and circular disks 42 secured to the ends of the core. When the bobbin is initially placed in use, the thread is wound thereon, as indicated at 43 in Fig. II, in such manner as to substantially fill the space defined between the disks 42.

In accordance with the practice of this invention, the bobbin 35 is made of such material and of such physical proportions that the difficulties heretofore experienced with older forms of bobbins are avoided. On the one hand, the material of the bobbin must be sufficiently light in proportion to the weight of its contained thread mass that the inertia of the bobbin, i. e., its resistance to rotation incident to the thread pull, does not materially increase as the thread is drawn off at a uniform linear velocity. Whereas it is characteristic of the steel bobbins in common use that the resistance offered to rotation increases very considerably as the bobbin unwinds, with the result that when the machine operates at a high speed with a fine thread, the thread will break before the entire bobbin content is consumed, it is characteristic of the bobbin of this invention that the resistance to the thread pull does not increase to any material extent, and there is therefore no tendency for the thread to break under such conditions. On the other hand, the material of the bobbin must be rigid or non-flexible, in contra-distinction to paper bobbins, so that the shape of the disks will not become distorted and the bobbin may be re-filled and used for a long period of time.

Moreover, the bobbin of this invention is desirably so designed that the resistance offered to its rotation is substantially constant throughout all stages of thread consumption, thus producing an even stitch as well as avoiding any tendency of the thread to break. With the type of bobbin which is customarily employed in rotary hook machines, the outside diameter of the thread mass is substantially twice the inside diameter and I have found that to obtain a condition of constant load with a bobbin of this character the weight of the bobbin by itself should be substantially equal to the weight of the thread mass which it is adapted to contain. One material which may be used to produce a satisfactory bobbin having the desired load characteristics is an aluminum alloy known commercially as "lynite", but it is to be understood that the particular composition of the bobbin is relatively unimportant so long as the material is sufficiently rigid so that the bobbin may be re-wound and of such weight, in proportion to its contained thread mass, that the conditions outlined above are obtained.

With the type of bobbin customarily employed in rotary hook sewing machines, the angular velocity of the bobbin is substantially twice as great near the end of the thread consumption, when the thread pull is applied tangentially to the core, as it is at the initial stage, when the thread pull is applied tangentially to the circumference of the filled bobbin. From various tests and observations it appears that to produce a constant load bobbin the ratio of the weight of the bobbin by itself to the combined weight of the bobbin and its thread mass should bear the same proportion as the ratio of the initial angular velocity to the final angular velocity of the bobbin. Thus with bobbins which are so constructed that the initial angular velocity is substantially one half of the final angular velocity the weight of the bobbin by itself should be substantially one half of the combined weight of the bobbin and the initial thread mass.

The relation of the weight of the bobbin to the weight of the thread mass, and the effect of this relation upon the operation of the machine, is graphically illustrated in Fig. IV. The chart shown in this figure shows the characteristics of ordinary steel and paper bobbins, in comparison with the characteristics of a bobbin of this invention. The ordinates of the graph represent arbitrarily selected units of force required to draw out the bobbin thread at a uniform rate of speed. The abscissae represent feet of thread length, or alternatively seconds of time, and reading from left to right show the various stages of thread consumption from the point where the bobbin is filled to its capacity with the thread to the point where the thread is entirely consumed. The curve shown at x represents an example of the action of a steel bobbin, showing the force required to draw off the thread during various stages of thread consumption. The curve shown at y represents an example of the action of a paper bobbin under the same conditions; and the curve shown at z represents an example of the action of a lynite bobbin under the same conditions. The characteristics of the several bobbins selected for plotting these curves, including the weight of the bobbin by itself, the weight of the original thread mass, the length of the thread, and the weight of the combined bobbin and thread mass, are represented by the following table:

Type of bobbin	Weight of bobbin	Amount of thread	Weight of thread	Combined weight of bobbin and thread
	Grams	*Yards*	*Grams*	*Grams*
Lynite	1.855	72	1.780	3.635
Steel	3.747	72	1.780	5.527
Paper	.290	84	2.140	2.430

It will be observed from the above table that the weight of the lynite bobbin used for plotting the curves was approximately equal to the weight of the thread mass contained thereon, whereas the steel bobbin was several times heavier than its thread mass, and the paper bobbin was several times lighter than its thread mass. As shown by the curve x, the force required to draw off thread at a uniform rate of linear speed from a steel bobbin of the usual form increases very consider-

ably as the thread is consumed, this force being substantially twice as great at the end of the period of thread removal than at the beginning. As shown by the curve *y* the force required to draw the thread from a paper bobbin decreases very considerably from the beginning to the end of the period of thread removal, the initial force being more than twice as great as the final force. On the other hand, as shown by the curve represented at *z*, the force required to pull thread from a lynite bobbin made in accordance with this invention is substantially constant throughout all stages of thread consumption. The upturned hook at the right hand end of each curve represents the increase in the final load on the last two or three feet of thread which results from the irregular winding of the first few turns on the bobbin core.

As illustrated by the curves described above, where the bobbin is substantially equal in its weight to the weight of the contained thread mass, its inertia is substantially constant as the thread unwinds, and hence the force required to pull off successive increments of thread of the same length is substantially constant. This results in a stitch of uniform character and makes possible the operation of a machine at a high speed, using a relatively long length of stitch and a relatively fine thread. Accordingly, the present invention avoids many disadvantages inherent in bobbins which have heretofore been employed in sewing machines.

While this invention has been described with reference to a particular type of sewing machine, it will be understood that the invention is applicable to other types of sewing machines, and that changes may be made in the form of the bobbin and the surrounding parts without departing from the spirit of the invention as defined in the annexed claims.

Having thus described my invention, I claim:

1. A thread carrying bobbin for use in combination with loop taking mechanism of a sewing machine, said bobbin being so proportioned and of such material that the ratio of its initial angular velocity when the contained thread mass starts unwinding to its final angular velocity when the thread is entirely consumed is substantially equal to the ratio of the weight of the bobbin by itself to the combined weight of the bobbin and its initial thread mass.

2. A thread carrying bobbin for use in combination with loop taking mechanism of a sewing machine, said bobbin being designed to carry an initial thread mass whereof the outside diameter is substantially twice the inside diameter, and said bobbin having a weight substantially equal to that of said initial thread mass.

3. A thread carrying bobbin for use in combination with loop taking mechanism of a sewing machine, said bobbin comprising a tubular core and disks thereon defining a space for a mass of thread, the diameter of said thread mass being substantially twice the diameter of said core, and the combined weight of said core and disks being approximately equal to the weight of the contained thread mass filling said space.

4. A thread carrying bobbin for use in combination with loop taking mechanism of a sewing machine comprising a core serving as a bearing and disks thereon defining a space for a mass of thread, said core and disks being of such proportions and of such weight with relation to the weight of the thread mass adapted to fill said space that the inertia of the bobbin with its thread mass remains substantially constant as the thread unwinds at a uniform linear velocity.

5. In combination, a rotary hook for a sewing machine, and a thread carrying bobbin adapted to rotate freely therein, said bobbin being of a material of such stiffness that the bobbin may be re-filled and of such weight and proportions that the inertia of the bobbin and its contained thread mass remain substantially constant as the thread unwinds at a uniform linear velocity.

CHARLES F. RUBEL.