

June 6, 1944.

O. R. HAAS

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LOCKSTITCH SEWING MACHINE AND BOBBIN THEREFOR

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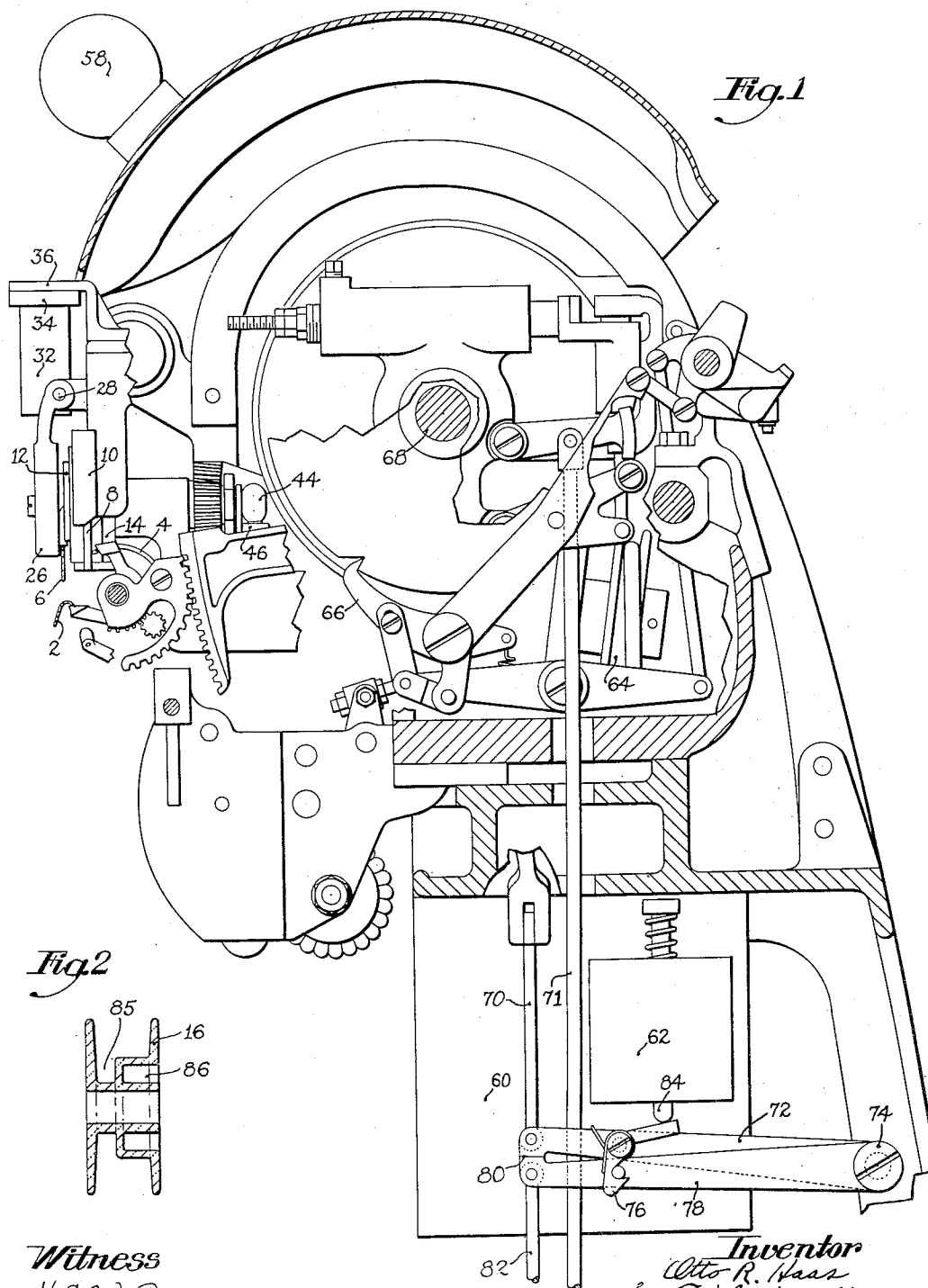


Fig. 2

Witness

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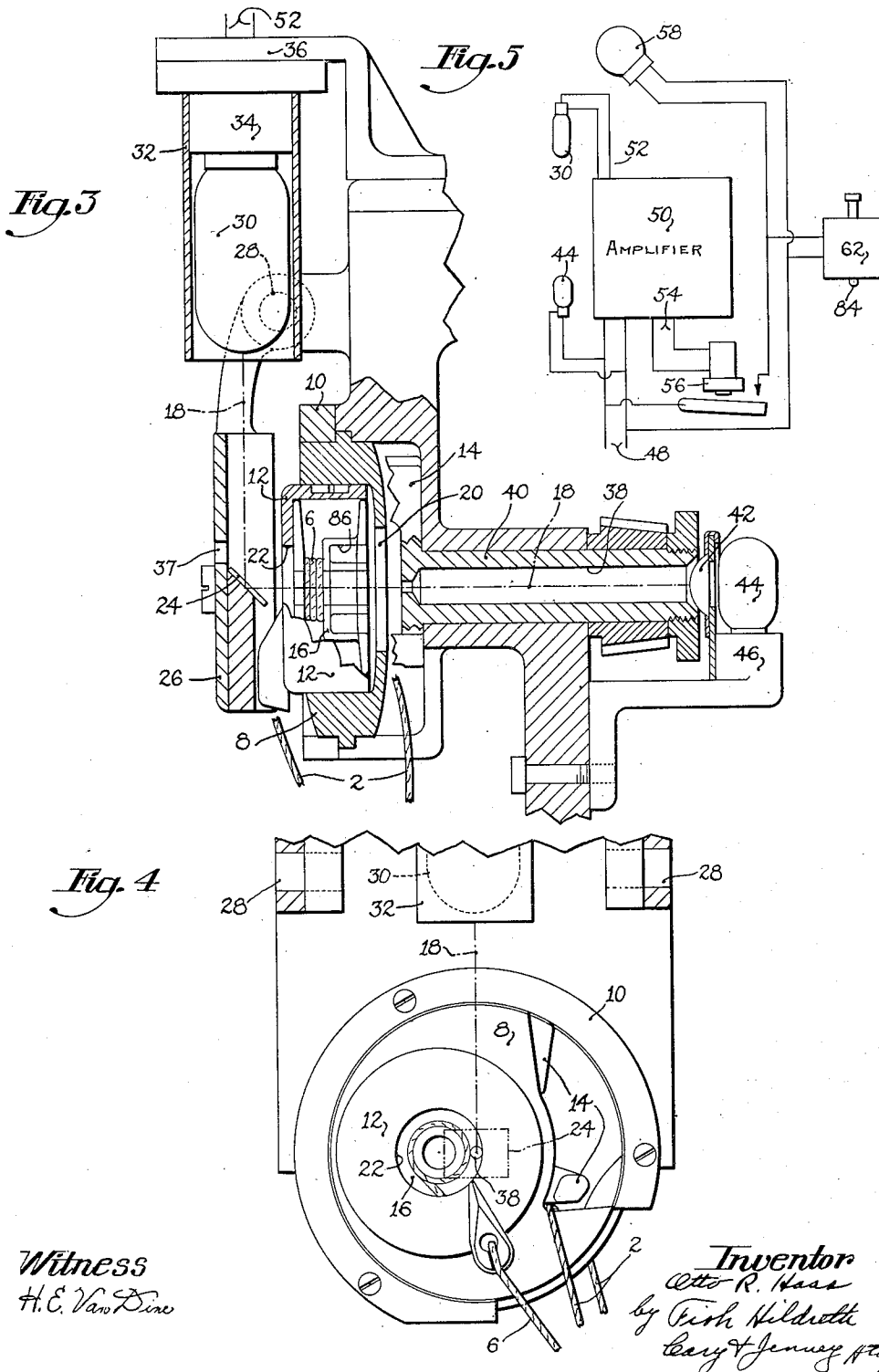
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UNITED STATES PATENT OFFICE

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LOCK-STITCH SEWING MACHINE AND
BOBBIN THEREFOR

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Application September 29, 1941, Serial No. 412,767

22 Claims. (Cl. 112—219)

The present invention relates to lockstitch sewing machines and more particularly to devices for rendering possible effective detection and accurate indication of approaching exhaustion in locking thread during operation of a shoe sewing machine of the type disclosed in U. S. Letters Patent to French and Meyer No. 473,870, of April 26, 1892, and present inventor's Letters Patent No. 2,328,011, granted August 31, 1943.

In the usual form of lockstitch sewing machine, a supply of locking thread is suitably supported to enable interlocking with successive loops of needle thread, which loops are carried around the locking thread supply by a loop taker. The problem of supporting the supply of locking thread in such a way that the needle thread loops may be carried about it without obstruction presents well-recognized mechanical problems and the use of any additional mechanical means for detecting and indicating approaching exhaustion of locking thread in the supply has heretofore been extremely difficult.

In U. S. Letters Patent to Topham No. 1,625,231, there is disclosed a lockstitch sewing machine having devices for indicating when there is less than a predetermined amount of locking thread remaining on a wound supply holder. This is accomplished by winding a portion of the supply of locking thread at the end first applied to the holder in a direction opposite from that in which the main bulk of thread is wound. Such an arrangement necessitates a special form of winding and the use of a winding machine similar to that disclosed in the present inventor's Patent No. 1,805,544 of May 19, 1931. Furthermore, with portions of thread wound in opposite directions on the holder, there is likelihood of the thread becoming tangled and broken during use, so that the advantage of the indicating devices may be lost or offset by other more troublesome difficulties.

The present invention has for its objects the provision of a lockstitch sewing machine having means for detecting and indicating approaching exhaustion of locking thread on a supply holder without the mechanical difficulties in mounting the supply of locking thread heretofore met in the use of machines equipped with such detecting and indicating devices. A further object of the invention is to provide a lockstitch sewing machine with means for detecting and indicating approaching exhaustion of locking thread, without the use of a holder having portions of thread wound in opposite directions, to which holder thread may be applied on an ordinary commercial form of winder. Still further objects relate to a novel and improved form of holder reel for supporting the supply of locking thread.

With these and other objects in view, the pres-

ent invention relates to the use in a lockstitch sewing machine having a needle, a loop taker and a supply of locking thread about which the loop taker passes each loop of needle thread, of means responsive to light impinging directly on the supply to detect and indicate an approaching condition of exhaustion in locking thread from the supply. By the use of light responsive means, it is unnecessary to provide mechanical devices acting on the locking thread or on a reel which comprises the holder for the supply of locking thread, thus eliminating a most troublesome mechanical difficulty from the problem of detection. Preferably, the light responsive means includes a device actuated by light directed through the space occupied normally by a full supply of locking thread, within which space each needle loop must necessarily pass while being carried about a locking thread supply.

In the present embodiment of the invention, means are provided for preventing momentary interception of light during passage of each needle loop from rendering the light actuated device from becoming ineffective after the approach of a condition of thread exhaustion. The light responsive device includes an electrically operated light cell and means for passing a beam of light through the axis about which a rotary type of loop taker rotates in carrying the needle loop about the locking thread supply. By so directing the light beam, a more advantageous mechanical arrangement for mounting the source of light is obtainable.

In order to insure a more reliable control of the light cell, a locking thread supply bobbin in the loop taker comprises a holder reel constructed with its side flanges at least composed of light-conducting material such as transparent or translucent synthetic resin. With the ordinary form of reel having flanges composed of metal or other opaque material, it is impossible to arrange the supply for easy inspection without weakening the flanges of the reel by the use of sight openings. In a machine having a light responsive cell for detecting approaching exhaustion of locking thread, the use of a transparent reel is particularly advantageous since it allows a substantially continuous indication to be given for the quantity of remaining thread available for sewing.

In the usual form of lockstitch sewing machine of the type disclosed in Patent No. 473,870 and in present inventor's Patent No. 2,328,011 referred to, a raceway is provided for supporting a cup-shaped rotary loop taker, the end wall of which loop taker has an axially disposed opening. In that machine, the driver for the loop taker is secured to a supporting shaft mounted for rotation with its axis in line with the opening of the loop taker and in the present illustrated form of the invention, the driver supporting shaft is drilled

to provide passage for a light beam directed through the opening in the loop taker and across the space occupied by the supply of thread on the reel. To protect the bobbin, the loop taker carries an eccentrically mounted circular thread case having a perforation in the line of the opening of the loop taker, which perforation is of sufficient diameter to provide a clear path in spite of its eccentricity for light passing through the opening and to one side of the hub on the bobbin reel.

To hold the thread case and enclosed supply of locking thread removably in place, a hinged thread case retainer is employed in the machine of Patent No. 473,870 and of Patent No. 2,328,011. The thread case retainer of the present machine has suitable means mounted thereon for deflecting the light passing through the space occupied by the locking thread supply from a direction axially of the loop taker towards a right angle direction. By so arranging the thread case retainer, the light sell may be located at one side of the loop taker where it will not obstruct the front of the loop taker.

Other features of the present invention include a special shape of reel constructed to hold an auxiliary supply of locking thread more or less separate from the main bulk contained in the bobbin, thus facilitating detection of thread consumption beyond an exact predetermined limit and means in the machine for preventing positively renewed sewing operations at the end of a seam when the supply of locking thread is insufficient for a new seam.

Referring to the accompanying drawings which illustrate so much of the machine disclosed in Patent No. 473,870 and in present inventor's above-identified Patent No. 2,328,011 as is necessary for an understanding of the invention, Fig. 1 is a sectional view in right-hand side elevation of a curved needle lockstitch shoe sewing machine embodying the invention; Fig. 2 is a sectional detail view of a special form of reel employed in the bobbin of the machine of Fig. 1; Fig. 3 is a sectional detail view on an enlarged scale of the loop taker and locking thread supply reel, together with the means for detecting approaching exhaustion of thread on the reel, looking from the right side of the machine; Fig. 4 is a view in front elevation of the parts shown in Fig. 3; and Fig. 5 is a diagrammatic view of the electrical wiring arrangement in the machine.

The illustrated machine is constructed to employ wax thread for sewing the outsoles to the welted and lasted uppers of a Goodyear welt shoe with a lockstitch seam, loops of thread 2 being carried successively through the work by a curved hook needle 4 and enchainned with a locking thread 6 by a loop taker in the form of a cup-shaped rotary shuttle 8, the circular side walls of which engage a raceway 10 secured to the frame of the machine. Within the hollow of the shuttle is mounted in eccentric relation to its circular side walls engaging the raceway, a circular cup-shaped thread case 12 within which is disposed a locking thread supply bobbin. The thread case has a relatively flat front wall, a circular side wall and a downwardly extending nose portion through which the locking thread passes from the supply bobbin towards the work. After the needle carries its loop of thread 2 through the work, it is transferred to the pointed beak of the shuttle which, as it rotates, spreads the sides of the loop and passes

the loop about the supply of locking thread in the thread case. To rotate the loop taker, a driver 14 having forwardly projecting fingers entering the open throat of the shuttle acts first against the heel portion of the shuttle to cause the needle loop to be passed around the thread case and then within the hook portion of the shuttle to rotate the loop taker in the reverse direction in preparation for another sewing cycle. As thus far described, the machine is the same in construction and mode of operation as the machine of the prior patent No. 2,328,011.

In order to enable the use of simple and easily applied thread supply detecting devices, the machine of the present invention is provided with means responsive to light impinging directly on the supply for causing a suitable indication to be given whenever the supply of locking thread on a reel 16 comprising the thread holder for the bobbin approaches the point of exhaustion or a point where there is insufficient thread to complete the outseam in a shoe without stopping operations. The reel 16, instead of being constructed of metal with sight openings in its side flanges, as in the machine of the patents, is composed, at least throughout its side flanges, and preferably in its entirety, of transparent or translucent synthetic resin material so that the quantity of locking thread on the reel may be observed at all times through the side flanges without resulting weakness caused by sight openings. Thus, the strength of the reel structure is improved sufficiently to enable practical use of weaker synthetic resin material in place of metal ordinarily employed.

To direct light through the space occupied normally by a full supply of locking thread and across the path taken by each needle loop as it passes over the thread case, a beam indicated by the dot-dash line 18 passes concentrically to the axis of shuttle rotation through an opening 20 in the end or base wall of the cup-shaped shuttle towards the rear flange of the reel 16 and into the space between the flanges in a direction axially of the hub of the reel. The eccentric arrangement of the thread case in the shuttle is such that if the beam of light is directed concentrically to the axis of shuttle rotation, it will pass sufficiently to one side of the hub on the reel to clear the last few turns on the hub and emerge from the forward flange of the reel when the supply approaches exhaustion. If there is a substantial amount of thread on the reel, the beam of light will be intercepted, obscured or obstructed and will not pass through both flanges. If there is insufficient locking thread remaining on the reel to complete a single outseam, the light beam continues through the bobbin towards the light responsive device.

The front wall of the thread case is provided with a perforation 22 of sufficient size to clear the light beam 18, in spite of the eccentricity of the case and regardless of the position of the shuttle. The perforation 22 also enables a clear view of the innermost turns of the locking thread on the reel. After passing through the nearly empty bobbin and the perforation in the thread case, the beam 18 is reflected from a direction axial to the shuttle into a right angle direction by a small mirror 24 secured to a hinged thread case retainer 26 engaging the nose of the thread case to prevent its rotation with the shuttle and to hold the thread case in place within the shuttle. The retainer 26 is hingedly mounted to swing towards and from the thread case on

a pair of pins 28 mounted in lugs on the machine frame and between the hinges formed by the pins is mounted an electrically actuated light responsive cell 30 of well-known construction. The retainer is cut out along its front face at 37 to enable the operator to view the supply in the bobbin during operation of the machine. The cell 30 is surrounded by a shield 32 and is mounted above the shuttle out of the swinging path of the retainer in a socket 34 fixed to a bracket 36 on the machine frame at a position intersected by the right angle portion of the light beam 18.

The light beam 18 is transmitted through the shuttle and across the path taken by each needle loop through a passage 38 in a shaft 40 to which the shuttle driver 14 is secured. The light beam passes through a simple optical system comprising a condensing lens 42 and a suitably concentrated filament light 44 is mounted in a socket 46 on the machine frame in line with the passage in the shuttle driver shaft. As the shuttle rotates, the centers of the thread case and bobbin are carried about the rotary axis of the shuttle and about the light beam which is coincident with the shuttle axis. During this movement of the thread case and bobbin, if the supply of thread is nearly exhausted, the light beam will activate the light cell 30 continuously, the circular space surrounding the thread on the bobbin permitting continuous passage of the light beam except at that time when the locking thread 6 extending from the hub of the reel 16 crosses the light beam. Also, the light beam is intercepted momentarily during each sewing cycle by the needle loop 2 while being carried about the thread case.

To avoid momentary suppression of a thread exhaustion indication when the light beam is intercepted by the locking thread extending from the bobbin or by the needle loop as it is carried about the thread case, means are provided for retarding the response of the indicating device to momentary changes in light acting on the cell 30. The light cell is energized by a source of electrical power illustrated in Fig. 5 by wires 48 connected to an amplifier 50 which in turn is connected by a circuit 52 to the light cell, the concentrated filament light 44 also being energized by the source 48. An output circuit 54 of the amplifier is connected to a retarded relay 55 which controls an indicating light 58 mounted on the machine frame in close proximity to the operator's normal line of vision while presenting a shoe to the stitch forming devices of the machine. The amplifier and retarded relay are mounted in an instrument box 60 secured to the machine frame. The retarded relay is so arranged that, after the supply of locking thread in the bobbin is substantially exhausted, interception of the light beam momentarily in each sewing cycle by the locking thread 6 and the loop of needle thread 2 will not operate to break the circuit of the indicating lamp 58, the relay responding only sluggishly to the momentary fluctuation of current in the output circuit 54.

To prevent operations of the machine from being started on a new seam when the supply of locking thread in the bobbin is insufficient to complete the seam, the contacts of the relay 56 also are connected to a solenoid 62 acting, when energized, to render the machine incapable of being restarted after having been stopped. The driving and stopping mechanism for the machine has high and low speed driving members includ-

ing a low speed driving pulley 64 (Fig. 1) and a hook member 66 for bringing the sewing shaft indicated at 68 definitely to a predetermined stopping position whenever a driving control rod 70 and stopping control rod 71, as described in the inventor's Patent No. 2,328,011 are raised. The lower end of the driving control rod 70 is pivotally connected to an arm 72 fulcrumed on a screw stud 74. The arm 72 has pivoted to it a latch 76 engaging a pin on a similar arm 78 also fulcrumed on the screw stud 74. The arm 78 is formed with a buffer surface 80 engaging a surface on the arm 72 and is connected to a treadle member or rod 82 similar to that disclosed in inventor's Patent No. 2,328,011. When the solenoid 62 is energized, a spring retracted plunger 84 in the solenoid is moved downwardly to a position where it engages a tail on the latch 76. As soon as the driving control rod 70 is raised into stopping position, the circuit through the solenoid 62 having been completed, upward movement of the driving control rod causes the latch 76 to be engaged by the plunger 84 and the connection between the arms 72 and 78 broken. If the supply of locking thread is not replenished, depression of the treadle rod 82 will no longer cause the machine to start in operation and no further work may be done by the machine. When the control rod is depressed by the operator in starting the machine, the latch 76 is moved away from the actuated position of the plunger 84 so that while the machine is running, operations will not be interrupted. The use of a retarded relay in controlling the circuit to the indicating light 58 is particularly useful where a starting control solenoid is employed, since it prevents passage of the needle loop in the final sewing cycle of the machine from causing both fluctuation in the indicating lamp and possibility of restarting the machine immediately after stopping, due to pulsations in movement of the plunger 84.

To reduce the amount of thread remaining in the bobbin to a length sufficient to complete a single outseam in a shoe before causing an indication to be given, in the present form of the reel 16, a separated reservoir portion 85 is provided. As illustrated in Figs. 2 and 3, there is an auxiliary supply of locking thread applied to the reservoir portion of the reel hub on a diameter smaller than that portion of the reel supporting the main bulk of the locking thread supply. To provide a construction which will enable passage of the light beam 18 through the space occupied by the auxiliary supply of locking thread only, the hub of the reel is shaped with a hollow enlargement 86 forming the support for and merging with one of the side flanges on the reel, the flange at the front of the reel, as illustrated in Fig. 2, being continuous and connected directly to the hub. One purpose of the hollow enlargement is to prevent filling the reel in any way except by applying the end of locking thread first wound on the reel to the reservoir portion of reduced diameter and to enable the operator to inspect the locking thread in the reservoir from either side of the reel even when the main bulk of thread still remains in the supply. Such a reel also may be wound on the usual form of bobbin winder without special attention on the part of the operator. A further advantage in the use of the hollow enlargement is in the use of a reel of composite construction having the central portion only of the reel surrounding the hub of transparent synthetic resin material where added

strength is desirable or where reinforcement is necessary.

In certain respects, the reel or locking thread holder of the present improved bobbin is similar to and may be used interchangeably with the reel disclosed in an application for patent by Ashworth Serial No. 412,807, filed of even date herewith. It also represents a further improvement in the bobbin reel and thread case over that disclosed in inventor's prior Patent No. 2,219,308 of October 29, 1940.

The nature and scope of the invention having been indicated, and a particular embodiment thereof having been described, what is claimed is:

1. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, a supply of locking thread about which the loop taker passes each loop of needle thread, and means for indicating approaching exhaustion of locking thread in the supply comprising a device actuated by light directed through the space normally occupied by a full supply of locking thread, and across the path taken by each needle loop as it is passed over the locking thread supply.
2. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, a supply of locking thread about which the loop taker passes each loop of needle thread, means for indicating approaching exhaustion of locking thread in the supply comprising a device actuated by light directed through the space normally occupied by a full supply of locking thread and across the path taken by each needle loop as it is passed over the locking thread supply, and response retarding means for preventing passage of each needle loop about the locking thread supply from rendering the light actuated device ineffective.
3. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker, a locking thread supply about which the loop taker passes each loop of needle thread, and means for indicating approaching exhaustion of locking thread in the supply comprising a light cell and means for passing a beam of light through the axis of rotation of the loop taker towards the light cell.
4. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a cup-shaped rotary loop taker having an opening in its base wall, a supply of locking thread within the loop taker arranged to obscure passage of light through the opening, and means for indicating approaching exhaustion of thread in the supply comprising a device actuated by light directed through said opening and across the path taken by each needle loop as it is passed about the locking thread supply by the loop taker.
5. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a cup-shaped rotary loop taker having an opening in its base wall, a supply of locking thread within the loop taker arranged to obscure passage of light through the opening, a device actuated by light directed through said opening and across the path taken by each needle loop as it is passed about the locking thread supply by the loop taker, and a light conducting reel within the loop taker on which the thread supply is mounted to cause the light to pass through the space normally occupied by a full supply of thread when the supply is nearly exhausted.
6. A lockstitch sewing machine having, in com-

bination, stitch forming devices including a needle, a cup-shaped rotary loop taker having an axially disposed opening in its base wall, a circular thread supply case eccentrically mounted in the loop taker and provided with a perforation in line with said opening, and means for indicating approaching exhaustion of thread in the thread case comprising a light conducting reel in the thread case for supporting the thread in position to obscure light passing through the opening and perforation and to cause the light to pass through the space normally occupied by a full supply of thread when the supply is nearly exhausted.

7. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker having an axially disposed opening in its base wall, a circular cup-shaped thread supply case eccentrically mounted in the loop taker and provided with an exposed front wall having a perforation in line with the rotary axis of the loop taker, means for indicating approaching exhaustion of thread in the thread case comprising a light conducting, thread holding reel having a central hub portion disposed in the thread case with the hub portion out of line with the axis of the loop taker to cause the thread on the reel when filled with thread to obscure light passing through the opening and perforation.

8. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker, a locking thread supply about which the loop taker passes each loop of needle thread, a retainer for holding the supply of locking thread within the loop taker, and a thread supply exhaustion indicator comprising a source of light located in a position to illuminate the supply of locking thread, and means on the retainer for deflecting light passing through the space normally occupied by the locking thread in the supply from a direction axial of the loop taker to one at an angle thereto.

9. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker, a locking thread supply about which the loop taker passes each loop of needle thread, a case having a perforation in one wall thereof for supporting the supply of locking thread within the loop taker, a hinged retainer for releasably holding the thread case in position, and a thread supply exhaustion indicator comprising a source of light located in position to direct light through the perforation in the thread case, and means on the retainer for deflecting the light passing through the perforation in the thread case arranged to swing with the retainer towards and from the thread case.

10. A bobbin for a shoe sewing machine comprising a reel having a hub, side flanges at the ends of the hub, an enlargement on said hub between the flanges forming with other portions of the reel a reservoir for holding separately a predetermined wound length at the first end of thread applied to the reel on a portion of smaller radius than that portion of the hub on which the main bulk of thread is supported to provide thread sufficient to complete a single outseam of a shoe when the main bulk is exhausted.

11. A bobbin for a sewing machine comprising a reel having a hub, side flanges at the ends of the hub, and a hollow cylindrical enlargement merging with one of the side flanges on the hub, the other of said flanges and the enlargement being composed of transparent material to provide

a reservoir visible from either side of the reel to enable detection of approaching thread exhaustion.

12. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, a supply of locking thread about which the loop taker passes each loop of needle thread, and a holder for supporting the supply of locking thread comprising a reel having a hub, side flanges on the hub, and a hollow cylindrical enlargement on the hub merging with one of the side flanges, the other of said flanges and the wall of said hollow enlargement being composed of transparent material to provide a reservoir visible from either side of the reel, and means responsive to light passing through the side flanges and the wall of the enlargement on the reel for indicating reduction of thread in the reservoir.

13. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker having an axially disposed opening in an end wall, a locking thread holder comprising a hub and side flanges eccentrically mounted in the loop taker and located sufficiently off center in the loop taker to bring the hub out of line with the loop taker rotary axis, and means responsive to light passing along the axis of the loop taker for indicating approaching thread exhaustion in the holder.

14. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a rotary loop taker having an axially disposed opening in an end wall, a locking thread holder comprising a hub and side flanges eccentrically mounted in the loop taker and located sufficiently off center in the loop taker to bring the hub out of line with the rotary axis of the loop taker, means responsive to light passing along the axis of the loop taker for detecting approaching exhaustion of thread on the holder, and a retarded relay for rendering the responsive means unaffected by a momentary interruption of light.

15. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, and a supply of locking thread about which the loop taker passes each loop of needle thread, means for detecting approaching exhaustion of locking thread in the supply, and means controlled by the detecting means for preventing renewed sewing operations at the end of a seam when the supply of locking thread is insufficient for a new seam.

16. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, and a supply of locking thread about which the loop taker passes each loop of needle thread, means for detecting approaching exhaustion of locking thread in the supply, driving and stopping mechanisms, a treadle member for controlling the driving and stopping mechanisms, and means acting only in the stopping position of the treadle to disconnect the treadle member from the driving and stopping mechanisms when the supply of locking thread is insufficient for a new seam.

17. A lockstitch sewing machine having, in combination, stitch forming devices, driving and stopping mechanisms, a treadle member, separable connections between the driving and stopping mechanisms and the treadle member for controlling the driving and stopping mechanisms,

a latch on that portion of the connections joined to the driving and stopping mechanisms, a projection on that portion of the connections joined to the treadle member to be engaged by the latch, and means for actuating the latch to disconnect said connections only when the treadle member is released.

18. A lockstitch sewing machine having, in combination, stitch forming devices, driving and stopping mechanisms, a treadle member, separable connections between the driving and stopping mechanisms and the treadle member for controlling the driving and stopping mechanisms, a latch on that portion of the connections joined to the driving and stopping mechanisms, a projection on that portion of the connections joined to the treadle member to be engaged by the latch, and a device actuated in advance of thread exhaustion to cause the latch to be disengaged from the projection as the treadle member is being released.

19. A lockstitch sewing machine having, in combination, stitch forming devices, driving and stopping mechanisms, a treadle member, separable connections between the driving and stopping mechanisms and the treadle member for controlling the driving and stopping mechanisms, a latch on that portion of the connections joined to the driving and stopping mechanisms, a projection on that portion of the connections joined to the treadle member to be engaged by the latch, and a device actuated by approaching thread exhaustion having limited motion towards and from the path of movement of the latch to cause the latch to be disengaged from the projection as the treadle member is being released.

20. A lockstitch sewing machine having, in combination, stitch forming devices, a bobbin for a supply of locking thread, a source of light, a light responsive device, and means for directing light from said source towards said device through a space within the bobbin normally occupied by the thread but becoming empty of thread as the supply thereof approaches exhaustion.

21. A lockstitch sewing machine having, in combination, stitch forming devices including a needle, a loop taker, a locking thread supply case within the loop taker formed with a circular side and a flat exposed end wall, the exposed end wall of which is formed with a perforation, and a reel comprising side flanges within the thread case with the side wall of the thread case surrounding the reel, a flange of the reel adjacent the perforation in the thread case wall being composed of transparent material to enable continuous inspection of a supply of thread contained on the reel.

22. A lockstitch sewing machine having in combination, stitch forming devices including a needle, a loop taker, a locking thread supply case formed with a circular side and a flat exposed end wall, the exposed end wall of which is formed with a perforation, a reel comprising side flanges within the thread case with the side wall of the thread case surrounding the reel, a flange of the reel adjacent the perforation in the thread case wall being composed of transparent material to enable continuous inspection of a supply of thread contained on the reel, and a source of light for directing light through the perforation and transparent side flange.

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