July 29, 1947.

G. SAUER 2,424,855

LOCK STITCH SEWING MACHINE AND METHOD OF LUBRICATING THE SAME

Filed March 28, 1942

4 Sheets-Sheet 3

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This invention relates to improvements in sewing machines and particularly lock stitch machines, in which the stitch forming devices include one or more rotary hooks having their axes vertically disposed. It relates also to an improved method of lubricating the raceway of a rotary hook in such a machine.

A problem has been presented, in connection with machines of the above-noted character, in the way of affording proper lubrication of the hook raceway. This raceway, formed in the rotating member of the hook, cooperates with a rib on the stationary component or bobbin case of the unit. At the high speeds at which it is desirable to operate machines of this character, in present-day practice, it is very important that adequate lubrication be provided for the hook raceway; otherwise the hook and the associated parts will quickly become overheated and give rise to serious consequences. It should be observed in this connection, that the hook makes two revolutions for each cycle of the machine. On the other hand, too much lubrication is also objectionable since any excess oil, which may accumulate in the raceway, is likely to be thrown and scattered about by the rapidly rotating hook and thus soil the threads and the material being stitched.

An object of the present invention has been to provide adequate, but not excessive, lubrication for the wearing surfaces of a rotating hook, with its connected shaft and particularly the above-mentioned raceway. Toward this end, a reservoir is preferably associated directly with the hook and forms a unitary assembly with the latter. The reservoir is of substantial capacity so that it requires filling only at infrequent intervals, i.e., not more than two or three times a day when the machine is operating more or less continuously. The reservoir, due to its unitary association with the rotary hook, is adapted to be readily adjusted on the frame of the machine to bring about the desired relationship between the hook and its cooperating needle. This phase of the construction is such that a single machine, produced in accordance with the invention, is adapted for use on a variety of different types of work. The machine may embody a plurality of hooks, each having its associated lubrication system and each adapted to cooperate with a separate needle. In such a machine the relative spacing of the hooks and the needles may be varied, as desired, to suit any particular type of work to be performed. Thus, the machine admits of large scale production.

A special feature of the invention is the provision of positive means for feeding the lubricant, in closely regulated amounts, from the reservoir to the hook raceway. For this purpose positive pumping means is preferably associated directly with the hook shaft and is operated, upon rotation of the latter, in a way to force oil delivered to the interior of the shaft into the hook raceway. To insure close regulation of the lubricant and avoid an over-abundant supply of the same to the raceway, a readily controllable valve is provided at an appropriate point in the connection between the reservoir and the interior of the hook shaft. The lubricant is supplied to the hollow of the shaft, preferably by gravity, in just the right amount to provide adequate lubrication without wastage of the oil and danger of soiling the work. Moreover, the construction as a whole is such that this proper supply of the lubricant, to meet the requirements of the hook raceway, takes place regardless of the height of the oil in the reservoir.

A further feature of the invention is in the particular construction and arrangement of the lubricant reservoir for each of the rotary hooks. This construction is such as to provide a reservoir of maximum capacity within the available space and is also such as to provide automatic lubrication of certain relatively moving parts in addition to the hook raceway. Thus, provision is made for the lubrication of certain oscillating parts concerned with the functioning of the rotary hook. Since the movement of these parts is relatively small, it is not necessary to provide a constant supply of lubricant to the relatively sliding surfaces. It is sufficient to supply lubricant thereto periodically and this is accomplished by the present invention upon each filling of the reservoir. The parts referred to are arranged to be immersed in the lubricant within the reservoir whenever the latter is substantially filled. At the same time provision is made for adequate lubrication, by the oil from the reservoir, of the bearings for the hook shaft.

With the foregoing objects, features and advantages of the invention in view, an illustrative embodiment of the same will now be described in detail in conjunction with the accompanying drawings, in which:

Fig. 1 is a bottom plan view of a portion of the base of a machine to which the invention has been applied, a part of one of the oil reservoirs being partly broken away to disclose the interior.

Fig. 2 is a top plan view, on a somewhat enlarged scale, of the same portion of the base of
the machine, certain cover plates being removed to disclose the mechanism more clearly.

Fig. 3 is a transverse, vertical, section across the base portion of the machine, taken along the line 3—3 of Fig. 1 through the axis of one of the vertical hook units.

Fig. 4 is a vertical, sectional view, along the line 4—4 of Fig. 6, through the axis of one of the vertical hook units.

Fig. 5 is a vertical, sectional view through the hook unit, taken along the broken line 5—5 of Fig. 6.

Fig. 6 is a horizontal, sectional view taken just beneath the rotary hook in Figure 4, with a cover plate for the lubricant reservoir removed.

Fig. 7 is a perspective view of one of the rotary hooks with its connected shaft, the latter being broken away in part.

Fig. 8 is a perspective view of a core pin provided within the hollow shaft of the rotary hook.

Fig. 9 is an exploded, perspective view of the several parts of the rotary hook shown in Fig. 7.

Fig. 10 is a top plan view of the rotary hook with portions broken away to disclose certain details, and

Fig. 11 is an exploded, perspective view showing, in detail, certain devices cooperating with the rotary hook.

For purposes of illustration, the invention has been disclosed as applied to a machine of the type more fully set forth in the application of Oscar Quist, Ser. No. 326,828, filed March 30, 1940, now matured, Ser. No. 2,238,848, dated Sept. 14, 1943. As disclosed in said prior application, the machine comprises a vertical standard rising from one end of a base portion 9 and having at its upper end a laterally extending arm which overhangs the base portion. In this extension or arm, suitable devices are provided for supporting and operating a needle bar carrying at its lower end a plurality of vertically reciprocable needles 10, indicated in cross section in Figure 2. A shaft supported by the standard is provided with a combined pulley and hand wheel through which power is supplied to the various operating devices in the machine.

Within the base portion of the machine there is provided an oscillating shaft 11 (Fig. 1) supported by bearings 12 and having secured thereon an arm 13 having attached to its upper end a feed dog bar adapted to carry a feed dog 15 (Fig. 2). For further details as to the means for oscillating the shaft 11, and as to the mounting and operation of the feed dog 15, reference may be had to said Quist application. It will be understood that portions of the feed dog are arranged to pass upwardly through, and longitudinally of, slots 16 formed in a plate 17 forming part of the work supporting surface of the machine.

Also extending longitudinally of the base portion of the machine and suitably journal in bearings carried by the frame is a rotatable shaft 18. This shaft is connected with the pulley wheel, hereinbefore mentioned, through gearing of the type disclosed in said Quist application, so as to rotate in unison with the main drive of the machine which operates the needle bar. An eccentric carried by the shaft 18 cooperating with a strap 19 (Fig. 1) serves to impart the desired lifting and lowering movements to the feed dog, as explained in the Quist application. A pair of spiral gears 20 secured to the shaft 18 meshes with cooperating spiral gears 21, each of which is secured by a set screw 22 to a hollow, vertically extending shaft 23 at the upper end of which a rotary hook 24, designated generally as 24, is secured. Since the two hook units, each including a shaft 23 and its associated hook 24, are substantially identical, except for the fact that certain parts or unit are of righthand construction while those of the other are of lefthand construction, only one unit will be described in detail.

The relative sizes of the gears 20 and 21 is such that the hook shaft 23 will be rotated at twice the angular speed of the shaft 18 and, hence, will make two revolutions for each stitch forming cycle of the machine. Shaft 23 is journaled in suitable bushings 25 and 26 mounted in spaced portions of a block or frame 27 constituting the main support for the rotary hook and the associated devices. The spiral gear 21 is secured to the shaft 23 between the bushings 25 and 26 within a recess 28 formed between the spaced portions of the frame 27. Frame 27 is adjustably carried by the base portion 9 of the machine and for this purpose is provided with a split collar extension 29 adapted to surround a bushes 30 extending through and projecting laterally from one of the bearing supports 31 for the shaft 18. A clamping screw 32 cooperating with lugs formed on the split collar 29 may be turned to either clamp or release the frame with respect to the bushing 30. At its opposite end the frame 21 is provided with an extension 33 having a rounded upper surface 34 adapted to cooperate with a flat face on a portion 35 of the base 9. A screw 36 passing through an elongated slot 37 in the extension 33 has screw-threaded engagement with the portion 35 of the base and, when tightened, serves to clamp this end of the frame 21 in place. It will be seen from the foregoing that the frame 21 is capable of adjustment along the bushing 30 and portion 35 of the base by simply loosening the screws 32 and 36 and it may be clamped in any desired position by tightening these screws. At the same time the spiral gear 21 may be shifted along the shaft 18 by loosening the retaining screw 38, thus maintaining the proper relationship between the gears 20 and 21. As best seen in Figure 1, all of the clamping screws, 32, 33 and 38, are readily accessible from the under side of the base.

The adjustment end 33 may now be more clearly explained, as will be understood, is to enable the same mechanism to be accommodated to machines in which different spacings may be desired between the lines of stitching formed by the needles and rotary hooks. Thus, the machine lends itself to large scale production since various requirements may be met by the interchangeable use of a relatively small number of parts and by the proper adjustment of the parts described.

Between the clamping portions 29 and 33 of the frame 27 and laterally in line with the shaft 23, there is provided an enlarged lubricant reservoir 39 (Fig. 4). This reservoir is closed at its end by a plate 40 and a gasket 41 secured by screws 42. At its top is an inlet opening 43, this preferably having a map 44 adapted to a cup 45 with its lip 46 securely closed, in a well known manner, by a spring cap. The upper end of the reservoir is provided with an extension 45 which surrounds the shaft 23. This not only increases the capacity of the reservoir but also provides a chamber in which certain operating devices are housed and subjected to occasional lubrication. The top of the extension or chamber 45 is substantially closed by a plate
At the lower end of the reservoir 39 is provided a tube 47, one end of which extends through the wall of the reservoir, beneath the closure plate 46, and the other end 47a of which extends into and extends through the opposite wall of the reservoir communicating with a small chamber 49 surrounding the lower end of the shaft 23. A needle valve 50, having its tapered, pointed end 50a extending into a passage 47b in the end 47a of the tube, is adapted to regulate accurately the size of the inlet to the passage 47b through which the lubricant may flow. Adjacent its outer end the needle valve is provided with a screw-threaded portion 50b cooperating with a similarly threaded portion of the tube 47 so that the desired adjustment of the valve may be effected. A plurality of small openings 47c admits the lubricant from the reservoir 39 to the interior of the tube 47 and allows it to flow through the restricted passage around the point 50a of the needle valve.

The lower end of the small chamber 49 is closed by a screw cap 51 provided with a gasket 52 to form an effective seal. Removal of this cap allows complete drainage of the oil from the reservoir. Cap 51 is in axial alignment with the shaft 23 and is provided with a diametrically extending slot 51a adapted to receive a tongue 53 at the lower end of a core pin 54. This core pin has a slight clearance from the inner wall of the hollow shaft 23 and is provided with a spiral groove 55 (Fig. 8) throughout the major portion of its length. As indicated, however, the groove is preferably terminated a slight distance from the end of the pin and does not extend below the lower end of the shaft 23. The pin 54 is retained by the cap 51 and is held stationarily by the cooperation of tongue 53 with the groove 51a. During the rotation of the shaft 23, the stationary spiral groove 55 cooperating with the cylindrical inner surface of the hollow shaft will cause such oil as is delivered to the lower end of the shaft to be forced upwardly into a small chamber 56 formed at the top of the hollow shaft and from which extends a small tube 57 communicating with the raceway 58 to be lubricated. This raceway 58 will be understood, is formed in part in the inner wall of the rotating outer element of the hook and in part between a shoulder 59 (Fig. 9) on this element and the surface of a removable plate 60 which, when removed permits the introduction and removal of the inner element or stationary bobbin case 61. Ribs 62 provided on the outer surface of this bobbin case cooperate with the raceway and it is this cooperation which necessitates the lubrication provided by the present invention. The bobbin 63 which supplies the under thread in the stitch-forming operation is retained within the bobbin case in a well-known manner.

At the upper end of the shaft 23, just beneath the rotating hook element, the shaft is provided with an eccentric portion 64 which extends through an opening 65 in the cover plate 46. Beneath the cover plate there is formed in the eccentric a strap portion of a pitman 66 having an opening 67 at its free end adapted to be engaged over the head of a screw 68 carried by an arm 69 of a rock member. At the opposite end of the arm 69 there is formed an integral sleeve 70 adapted to fit over a reduced portion 71 at the upper end of a pin 72 inserted in a hole in the frame or block 71 and held therein by a screw 73 (Fig. 5). The sleeve is retained on the pin by a large-headed screw 74 cooperating with internal threads in the upper end of the pin. Integral with the upper end of the sleeve 76 is a laterally extending arm 75 is provided which carries at its free end a block 76 having a groove adapted to receive the shank of a member 77. This member is retained in the groove of the block 76 by means of a screw 78 (Fig. 5) which cooperates with an elongated slot 79 in the member to permit adjustment of the latter. The free end of the member 77 is arranged to cooperate with an upwardly inclined portion 80 of the bobbin case 61 to enable temporary disengagement of a projection 81 on the bobbin case from a cooperating retaining notch so that the needle thread loop, which has previously been passed around the bobbin case, may be completely released and drawn upwardly against the underside of the work. The cover plate 46 is cut out at one edge, as indicated at 82, in the region of the sleeve 76.

The operation of the improved construction is believed to be clear from the foregoing. However, a brief résumé will now be given. Periodically in the use of the machine, oil will be introduced into the reservoir 39 associated with each of the rotary hook units. This is accomplished through the cups 44. Upon each filling, the lubricant is preferably carried substantially to the top of the filling cup so that it temporarily submerges at least a portion of the eccentric 64 and the relatively moving surfaces of the parts operated by this eccentric. From the reservoir 39 the lubricant will pass through the openings into the tube 47 and from the latter around the needle valve and through passage 47b into the passage 48 and chamber 49. Assuming the machine to be at rest, the lubricant will seek a level within the hollow shaft 23 substantially the same as that in the reservoir. Now, as the machine is operated and the shaft 23 is rotated through the spiral gears 20 and 21, the oil within the shaft is forced by the action of the grooved core pin into the small chamber 56 and through the tube 57 to the raceway. As the lubricant is thus forced from the interior of the shaft, more lubricant is supplied to the shaft from the reservoir through the channels explained but it flows only at the rate permitted by the needle valve 50. This may readily be regulated to insure the delivery to the interior of the shaft of just sufficient lubricant to meet the requirements of the raceway. The wastage of excess lubricant is thus avoided and so also the soiling of the work and the threads is avoided. Whenever the reservoir is filled a certain amount of the lubricant will find its way into the bearing bushings 25 and even when the reservoir is only partly filled some of the lubricant will find its way into the bushing 26. Adequate lubrication of the shaft 23 is thus provided.

While an illustrative embodiment of the invention has been described in considerable detail, it will be understood that numerous variations may be made in the construction and arrangement of the parts and in the mode of operation of the system without departing from the general principles and scope of the invention. The terms and expressions used herein have been used as terms of description and not of limitation.

What I claim is:

1. In a sewing machine a loop-taking unit comprising a frame, bearings mounted in said frame in vertical alignment, a rotary hook of the raceway type having its axis disposed substantially vertically, a shaft rigidly connected with said hook and journaled in said bearings, said shaft.
having a longitudinal passage therein, a gear on said shaft between said bearings for rotating the shaft, an oil supply reservoir carried by said frame carrying a passage in said frame connecting said reservoir with said passage in the shaft for the delivery of oil thereto by gravity, a valve cooperate with said passage in the frame and adjustable exteriorly thereof for regulating the flow of oil to said passage in the shaft, said valve permitting delivery of oil to the passage in the shaft at a rate sufficient only to meet the lubrication requirements of said raceway, but being adjustable to either completely close off said passage or allow the flow of excess lubricant therethrough to flush out accumulated dirt, and stationary means carried by said frame cooperating with the shaft upon rotation thereof to cause delivery of the oil from the passage in the shaft by a positive pumping action to the raceway of said rotary hook.

2. In a sewing machine, stitch-forming devices including a rotary hook of the raceway type, a driving shaft connected with said hook, a block in which said shaft is journaled, means for rotating said shaft, a lubricant supply reservoir in said block, a passage extending longitudinally of said shaft and communicating at one end with said reservoir to receive lubricant by gravity therefrom and at the other end with the raceway of said hook, a perforated tube extending through said reservoir adjacent its bottom and arranged to deliver lubricant to said passage in the shaft, a valve extending into said tube and accessible exteriorly of said reservoir for adjustment to regulate the rate of delivery of lubricant from said reservoir to said passage, and means operable upon rotation of said shaft for acting upon the lubricant delivered to the passage therein and lifting the lubricant within said passage and causing it to be delivered by a positive pumping action to said raceway.

3. In a sewing machine, stitch-forming devices including a vertical axis rotary hook of the raceway type, a vertically disposed driving shaft connected with said hook, means for rotating said shaft, a lubricant supply reservoir, a passage extending longitudinally of said shaft and communicating at one end with said reservoir to receive lubricant by gravity therefrom and at the other end with the raceway of said hook, means between said reservoir and said passage for accurately regulating the delivery of lubricant to said passage in accordance with the lubrication requirements of the raceway, and means within the shaft and operable upon rotation of said shaft for lifting the lubricant delivered to said passage and causing it to be delivered by positive pumping action to said raceway, said last recited means comprising a spirally grooved core pin having the groove therein terminating within the shaft above the lower end of said passage, the portion of said core pin below the lower end of said groove having a relatively close fit within said passage.

4. In a sewing machine a loop-taking unit comprising a frame, a vertically disposed shaft journaled in said frame and having a longitudinally extending passage therein, a rotary hook secured to the upper end of said shaft, said hook having a raceway, a lubricant supply reservoir carried by said frame, said reservoir extending from substantially the level of the lower end of said shaft upwardly to a point substantially in line with the underside of said hook, means including a perforated tube serving to connect said reservoir with said passage in the shaft for delivering lubricant thereto by gravity from said reservoir, valve means extending into said tube and adjustable exteriorly of said frame for accurately regulating the amount of lubricant delivered to said passage in accordance with the lubricant requirements of the raceway, said adjustable means being adapted to readily enable delivery of excess lubricant to said passage for the purpose of flushing out accumulated dirt, and a plurality of impelling means operable in series upon rotation of said shaft for delivering the lubricant from the passage therein by positive pumping action to said raceway.

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