

Dec. 9, 1958

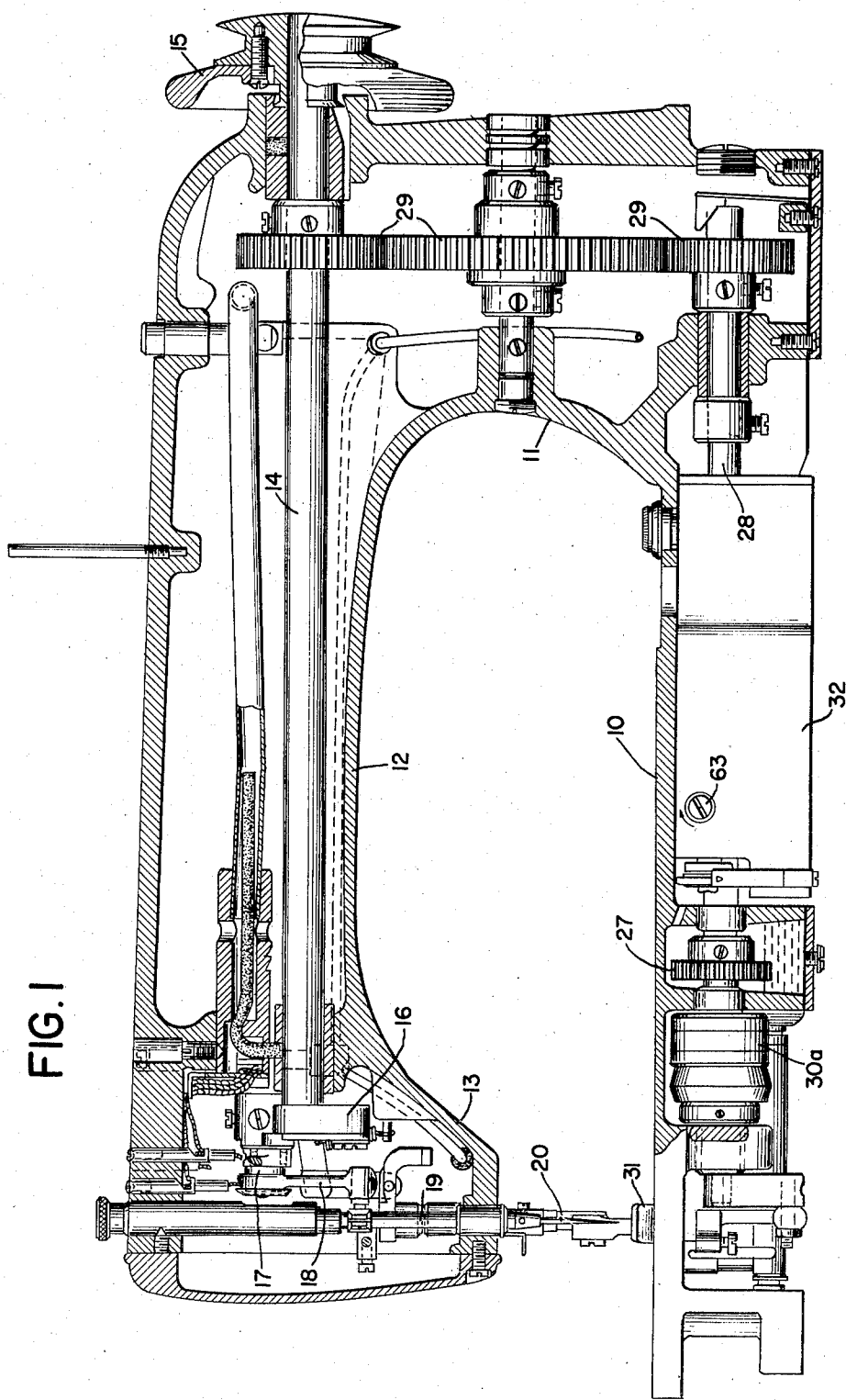
J. G. ATTWOOD ET AL

2,863,412

SEWING MACHINE LUBRICATION SYSTEMS

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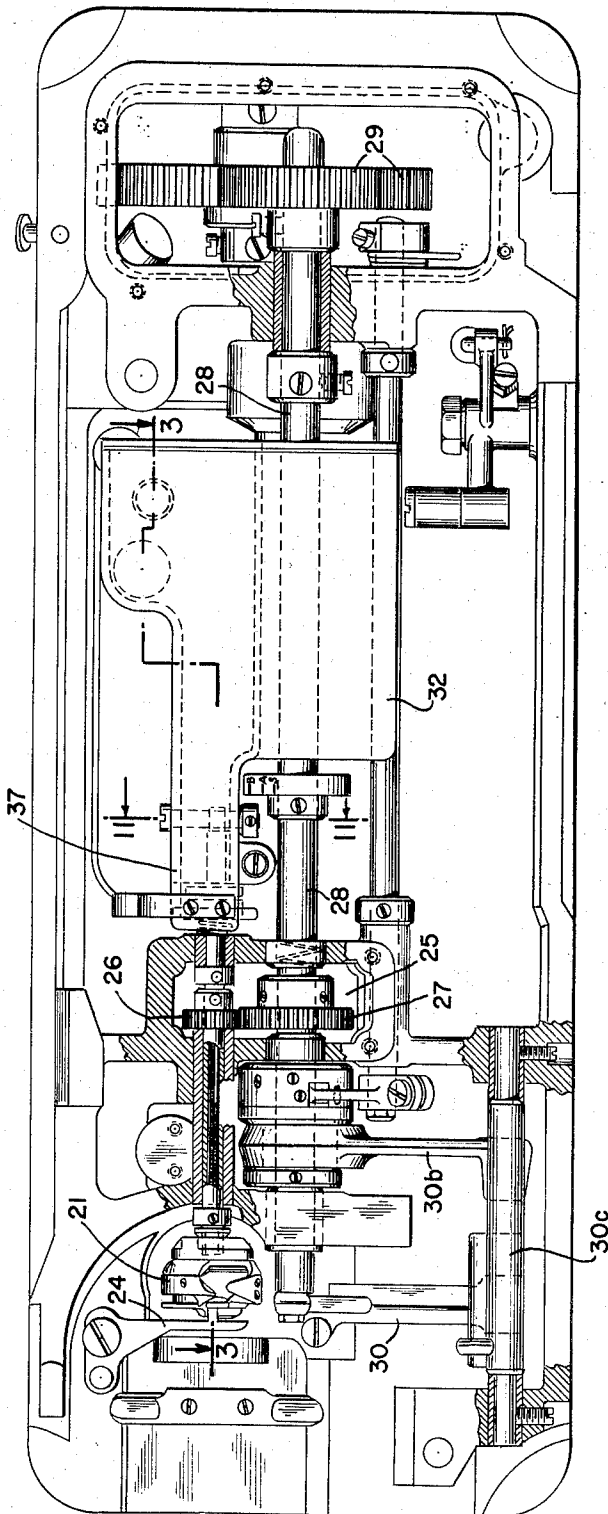
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SEWING MACHINE LUBRICATION SYSTEMS

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FIG. 2



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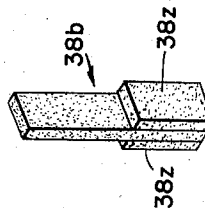
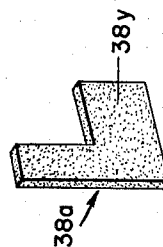
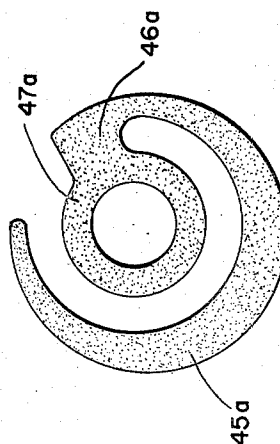
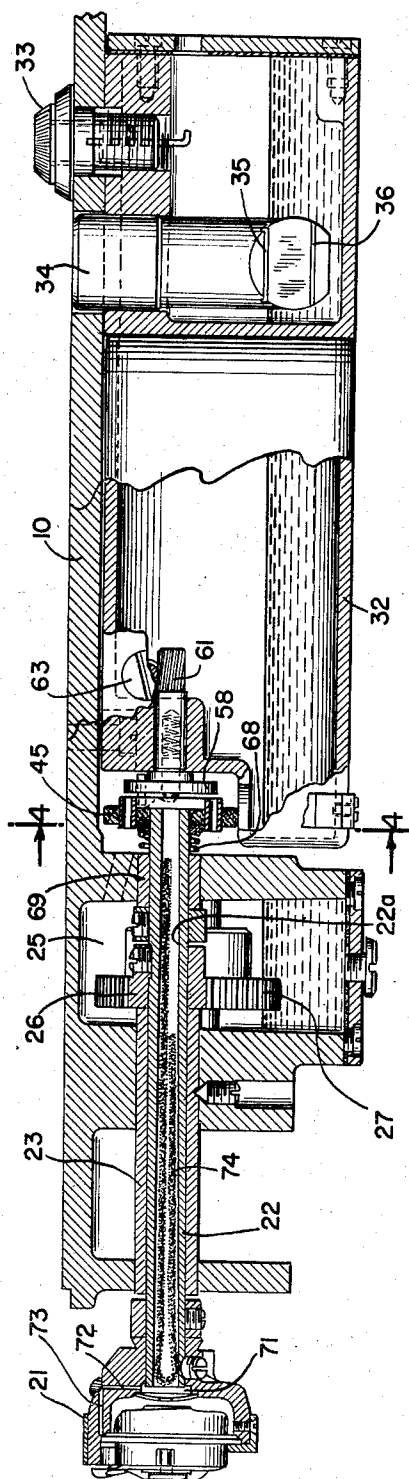
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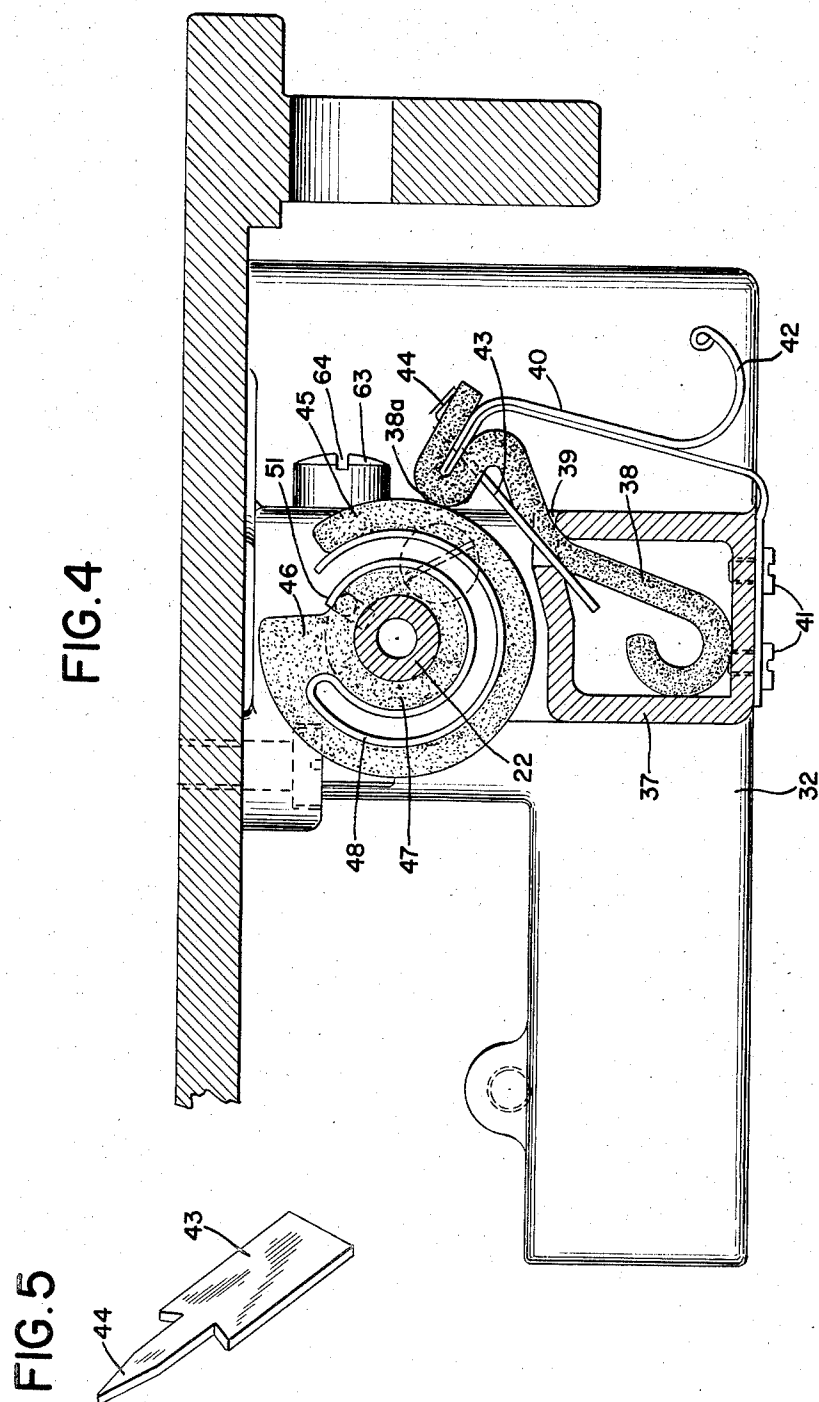
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FIG. 7.

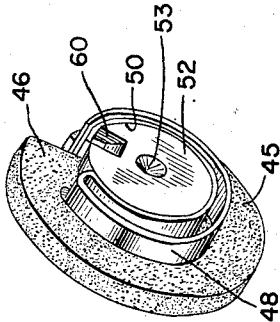


FIG. 6

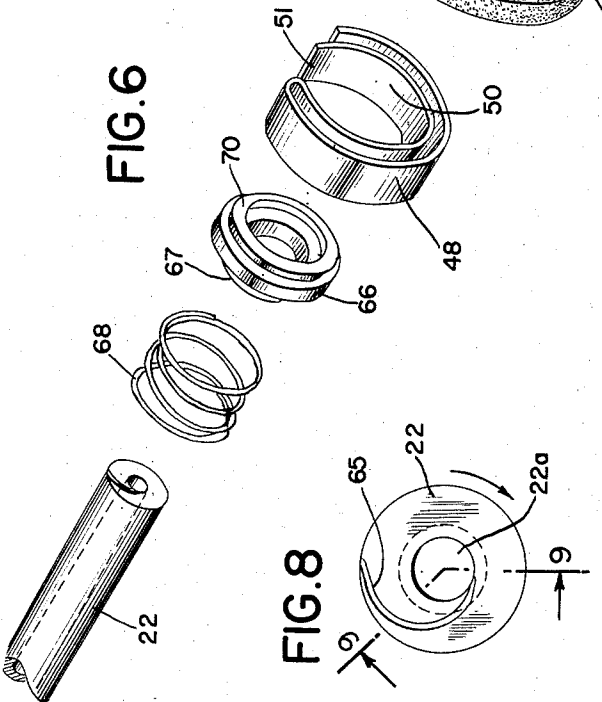


FIG. 8

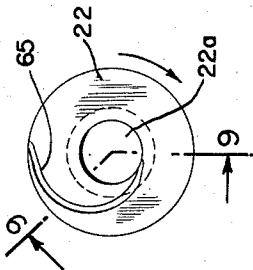


FIG. 10

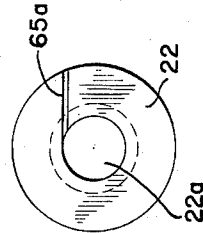
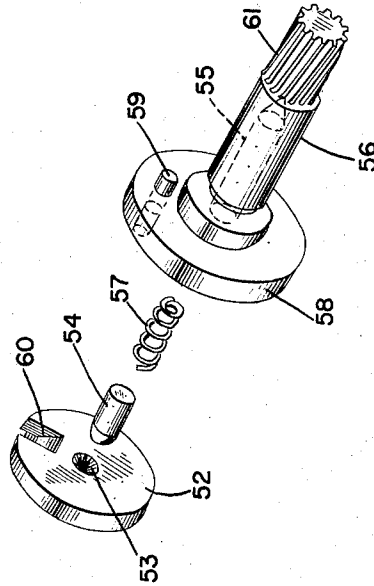
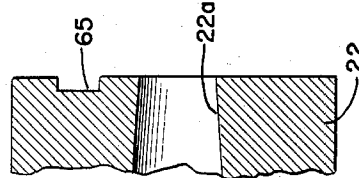


FIG. 9



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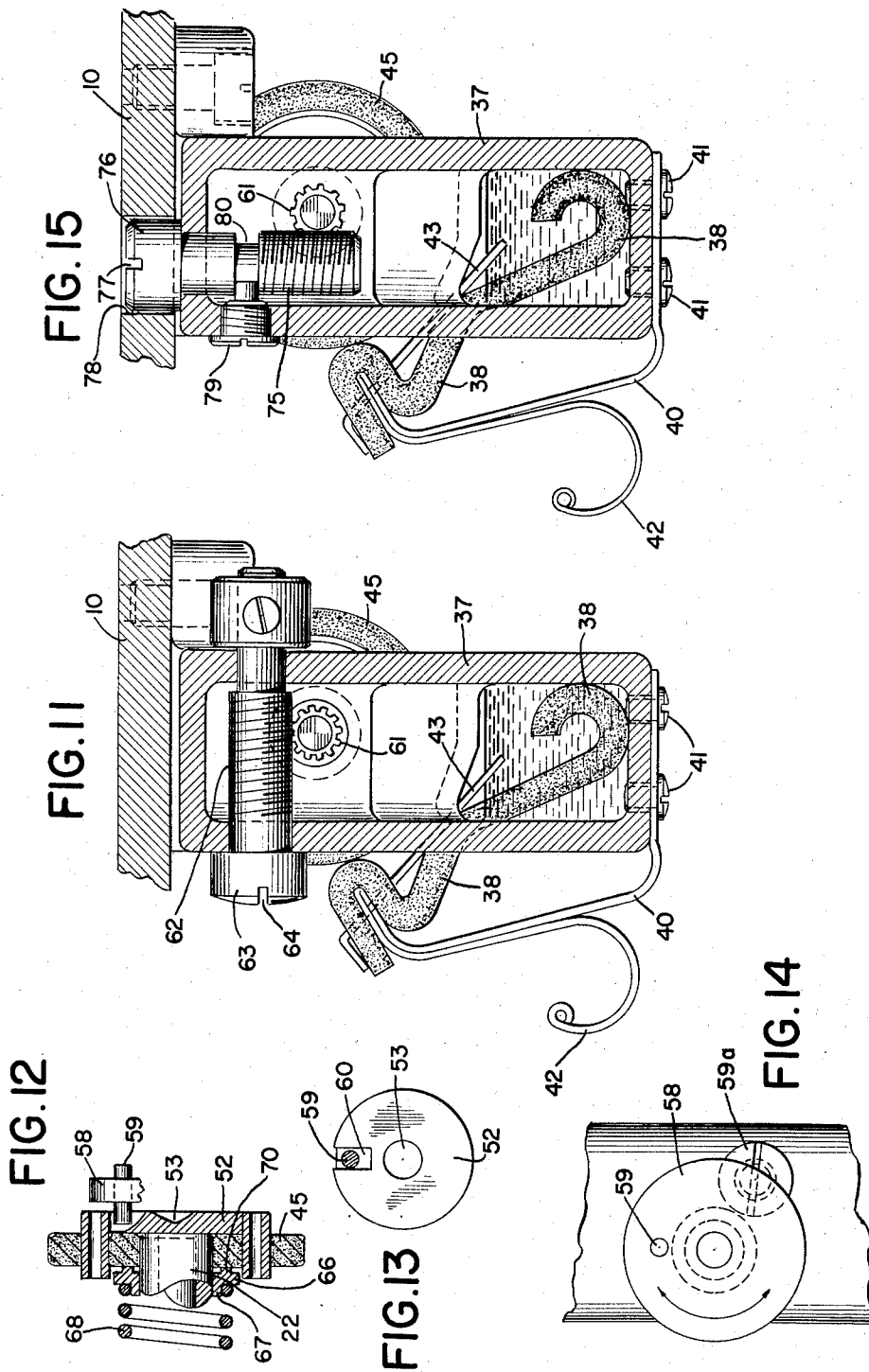
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SEWING MACHINE LUBRICATION SYSTEMS

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Application December 9, 1954, Serial No. 474,142

13 Claims. (Cl. 112-256)

This invention relates to improved lubricating systems for sewing machines and more particularly to devices for delivering a limited, predetermined amount of lubricant to a specific point, such as the raceway of a rotary hook.

Heretofore various schemes have been proposed for the delivery of precise amounts of lubricant to various bearing surfaces of a sewing machine and particularly the raceway of a rotary hook. A special problem is presented by sewing machines in the way of delivering an adequate amount of lubricant to various surfaces which are not fully enclosed, without delivering an excess which will be thrown by the rapidly moving parts. The raceway of a rotating hook element poses an especially difficult problem because of the high speed of rotation of the hook and the tendency to throw oil onto the stitching threads, or even through the openings in the throat plate onto the work being stitched. Schemes heretofore employed for regulating or controlling the supply of lubricant to a hook raceway, prior to the present invention, have usually involved a needle valve or the like in the path of delivery of the lubricant to the raceway or a valve of some character in a lubricant by-pass arranged to regulate the amount of lubricant delivered to the hook raceway by directing a greater or lesser amount of the total lubricant being pumped to the by-pass which serves to return the excess lubricant to the reservoir from which it is drawn. While these arrangements have proved reasonably satisfactory, they have not fully met the requirements due to the difficulty of regulating the control valves in a way to insure delivery of the optimum amount of lubricant to the raceway for different speeds of operation of the machine and other variable conditions encountered. Moreover, the operation of such systems has been adversely affected by the presence of lint or other foreign particles in the lubricant.

Another control means which has heretofore been suggested is the provision of a porous plug or the like in the line of transmission of the lubricant but this has been subject to the difficulty of accurately and uniformly providing such plugs with precisely the desired lubricant transmitting properties and due to the unavoidable variation in the action of such elements as a result of clogging with particles of dirt.

A primary object of the present invention has been to provide an arrangement for regulating or controlling the delivery of lubricant to a hook raceway, or other surfaces having the same type of precise lubrication requirements, which is reliable in its action over long periods of time and for varying conditions of operation of the machine.

An important feature of the invention is the provision of means for regulating the delivery of lubricant to a hook raceway or the like which depends for its control upon the variation in effective length of a porous capillary delivery element. Such means have been found to deliver, when properly regulated, the small amounts of

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lubricant desired for a hook raceway and to vary their rate of delivery quite precisely in accordance with the length of the path through which the lubricant is delivered. This makes possible the delivery of an accurately and finely controlled amount of lubricant to the surface to be lubricated.

In the preferred embodiment of the invention there is provided a rotary control member of porous, capillary character arranged for adjustment from a readily accessible point to vary the length of travel of the lubricant from the point of delivery of the lubricant to the member to the point of removal of the lubricant, by a suitable pumping means, for delivery to the surface requiring lubrication. Preferably the delivery of lubricant to the rotary control member is achieved through the provision of a porous wick-like element which has one end immersed in lubricant in a reservoir and serves to lift lubricant from the reservoir by capillary action and to deliver the lubricant to the periphery of the rotary member, by contact therewith, at a point determined by the adjustment of the latter. The wick-like element is preferably of looser construction or of greater porosity than the control member and is adapted to deliver lubricant at a faster rate than it is normally transmitted through the porous control member. In lifting the lubricant the wick-like element functions as a filter to prevent the transmission to the control member of lint and other foreign matter.

The pump means which picks up the lubricant from the control member and forces it to the hook raceway, or other surface requiring lubrication, is responsive to the speed of operation of the machine and serves to increase or decrease the rate of transmission of the lubricant through the control member, at a particular setting of the latter, in accordance with the speed of operation of the machine.

A special feature of the preferred arrangement is the provision of manually operable means for disengaging the wick element from the rotary control member when the latter is being adjusted from one setting to another. This serves to eliminate wear and tear upon the co-operating surfaces of the wick element and the rotary control member. It also facilitates accurate adjustment of these parts.

Other objects, advantages, and special features of the new lubrication system will be discussed in connection with the detailed description of certain illustrative forms of the invention which will now be given in conjunction with the accompanying drawings, in which:

Fig. 1 is a vertical longitudinal sectional view through a lockstitch sewing machine embodying the invention;

Fig. 2 is a bottom plan view of the machine with portions removed or broken away;

Fig. 3 is a view, partly in elevation and partly in vertical section taken along the line 3-3 of Fig. 2, showing the rotary hook and the driving connections and lubricating means therefor;

Fig. 4 is a transverse vertical sectional view through the machine taken along the line 4-4 of Fig. 3;

Fig. 5 is a detail view, in perspective, of a retainer element for a porous lubricant delivery element embodied in the machine;

Fig. 6 is an exploded perspective view of the parts forming the regulating means for the delivery of lubricant to the rotary hook;

Fig. 7 is a perspective view of a sub-assembly of certain of the parts shown in Fig. 6;

Fig. 8 is an end view of the hook shaft, as seen from the right in Fig. 3;

Fig. 9 is an enlarged axial sectional view through the of Fig. 8, the taper of the bore therein being indicated on an exaggerated scale;

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Fig. 10 is an end view of the hook shaft showing a modified form of lubricant impelling groove therein;

Fig. 11 is a transverse sectional view through the lubricant reservoir and associated parts, taken along the line 11—11 of Fig. 2;

Fig. 12 is a detail view, in axial section through the means for regulating the delivery of lubricant to the hook shaft;

Fig. 13 is a face view of a pressure disc forming part of the assembly of Fig. 12 as seen from the right in Fig. 12;

Fig. 14 is a face view of an adjusting element for the lubricant flow regulating means and certain associated devices;

Fig. 15 is a view similar to Fig. 11 showing a modified arrangement for adjusting the flow regulating means;

Fig. 16 is a detail view, in elevation of a modified form of porous member; and

Figs. 17 and 18 are detail views, in perspective, of modified forms of wick elements.

The invention has been illustrated as applied to a lock-stitch sewing machine of the general character illustrated in the patent to George M. Reimer, No. 2,643,625, granted June 30, 1953. It has a frame comprising work supporting base 10, a vertical standard 11, and an overhanging arm 12 terminating in a needle head 13. A main operating shaft 14 extends longitudinally through the overhanging arm and terminates at one end within the needle head and at its opposite end outwardly of the vertical standard of the frame. It is journaled in suitable bearings provided in the vertical standard and in a partition wall separating the main portion of the overhanging arm from the needle head. A combined handwheel and pulley 15 is secured to the shaft at the end thereof which extends outwardly from the vertical standard.

Within the needle head, the shaft 14 carries a crank member 16 having an eccentrically disposed element 17 which is connected by a link 18 with a needle bar 19. The latter carries at its lower end a needle 20 which, upon rotation of the shaft 14, is carried repeatedly from a position above the work support to a position in which its thread carrying eye is beneath the work support. Cooperating with the needle in the formation of lock-stitches is a rotary hook 21 (Figs. 2 and 3) which is secured to the end of a hook shaft 22 journaled in a bearing sleeve 23 carried by the base portion of the frame. It will be understood that the hook 21 has a rotary component which is rotated by the shaft and a stationary component, in the form of a bobbin case holder, which is held against rotation by means of a retainer 24 carried by the base portion of the frame. The present invention is concerned primarily with the means for insuring the delivery of a small, closely regulated amount of lubricant to the bearing surfaces between the rotary component and the stationary component of the hook. These bearing surfaces are conventionally in the form of a raceway provided in the rotary component and a rib projecting radially from the stationary component or bobbin case.

The hook shaft 22 extends through a small lubricant reservoir 25 and projects some distance beyond the latter toward the right in Fig. 3. Within the reservoir 25 there is secured to the shaft 22 a pinion 26 which meshes with a gear 27 carried by a rotary drive shaft 28 journaled in suitable bearings within the base portion of the frame. Shaft 28 extends through the lubricant reservoir 25 and to some distance beyond the left wall thereof (Fig. 2). This shaft is driven from the shaft 14 by gearing 29 within the vertical standard. The two shafts 14 and 28 are driven at the same angular speed but the gearing 26, 27 is such that the hook shaft is driven at twice this angular speed.

Cooperating with the stitch forming devices in the formation of a seam is any suitable form of work feeding mechanism which, as illustrated, may conveniently comprise a four-motion feed dog (not shown) driven from

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the shaft 28. Since the details of this mechanism form no part of the present invention it is believed unnecessary to describe it fully. Suffice it to say that the feed dog is carried by a feed bar 30 (Fig. 2) which is given lifting and lowering movements by means of an eccentric at the left end of the shaft 28 and is given feed and return movements by connections from the shaft 28 of the general character disclosed in the above mentioned patent to Reimer. As there disclosed, adjustment of the feed stroke may be effected by adjusting a variable eccentric 30a (Fig. 1) carried by the shaft 28 acting through a pitman 30b (Fig. 2) upon a feed rocker 30c. A presser foot 31 (Fig. 1) carried by a presser bar vertically disposed in the needle head, and spring urged downwardly in a known manner, cooperates with the work and with the feed dog to insure proper advance of the work.

Turning now to the means for lubricating the raceway of the rotary hook, in accordance with the invention, there is provided a lubricant reservoir 32 (Figs. 1, 2, 3, and 4) which is suitably secured to the underface of the work supporting portion of the base of the frame. This reservoir carries lubricant to a desired level, such as that indicated in Fig. 3. The lubricant may be introduced into the reservoir by removing a screw plug 33 accessible at the top of the work support of the base. To enable the operator to determine readily the level of the lubricant in the reservoir a transparent plug 34, formed preferably of Lucite, is suspended from the top of the reservoir and has its upper end visible through an opening in the work support. The lower end of this plug has one face inclined, as indicated in Fig. 3, and this face is provided with score lines 35 and 36 indicating, respectively, the maximum and minimum levels for the lubricant within the reservoir. Within a narrow extension 37 at the left end of the reservoir 32 (Figs 2 and 4) there is positioned a porous wick element 38 of relatively loose construction arranged to lift lubricant by capillary action. This wick element extends through an opening 39 at the top right hand corner (Fig. 4) of the extension 37 and is suitably folded over the end of a spring member 40. The latter has an extension thereof secured to the reservoir by means of screws 41 and preferably has a finger piece 42 by which it may be rocked downwardly and toward the right in Fig. 4. A retaining or clamping element 43, illustrated in detail in Fig. 5, extends along a portion of the surface of the wick 38 and outwardly through the opening 39 in the extension 37 of the reservoir. The outer end 44 of this clamping element is pointed or spear-shaped and is passed through the wicking and through an opening in the spring element 40 and then bent over, as shown in Fig. 4, to retain the wick in fixed relation to the spring element.

Spring element 40 serves to urge the folded portion 38a of the wicking against the periphery of a circular portion 45 of a porous member formed of felt or oilite or the like adapted, by capillary action, to convey to a further point the lubricant which is delivered to it by means of the wicking 38. The circular portion 45 of the porous member does not describe a complete circle but extends through an angle of about 330°. One end is free and the other end has a radially inwardly extending portion 46 carrying at its inner end a smaller circular portion 47 having a relatively tight bearing fit in relation to the hook shaft 22. To retain the porous member in the shape shown in Fig. 4 and hold it against rotation with the shaft 22, it is carried by a support 48 preferably formed of steel, or other metal, bent into the shape indicated. The porous member is preferably adhesively secured to the support member 48 with the portion 45 of the porous member surrounding the outer face of the support member and the portion 47 of the porous member fitting between the shaft 22 and the inner surface 50 of the support member 48 to which it is also adhesively secured. Portions 45 and 47 of the porous member are spaced radially in relation to each other to provide a

channel 49 for the insertion of the support member 48. As shown, the latter does not describe a complete circumference but provides, between the free ends of its circumferentially extending portion, an opening 51 through which the portion 46 of the porous member may extend radially inward. A disc 52, preferably formed of steel or other metal is inserted within the support member 48 and firmly secured thereto by soldering or the like to the inner surface 50 of the support member.

Suitable means are provided for exerting an axial pressure against the disc 52 to force this yieldingly against the end of the hook shaft 22, as best shown in Fig. 12. For this purpose the disc 52 is provided with a conical or spherical depression 53 at its center arranged to receive the nose of a spring urged plunger or pin 54. The latter is slidable within an axial opening or bore 55 in an adjustable shaft 56. A spring 57 interposed between the pin 54 and the inner end of the opening 55 serves to urge the pin and the disc 52, together with the support member 48 and porous member 45, 47, toward the left (Fig. 12).

At its end adjacent the disc 52 the shaft 56 has a radially extending flange 58 which has an eccentrically disposed pin 59 extending through it and projecting from the opposite faces of the flange. That part projecting toward the disc 52 cooperates with a notch 60 in the opposed face of the latter so that any turning movement imparted to the shaft 56 is transmitted to the disc 52. Shaft 56 has a spirally toothed portion 61 at its end within the extension 37 of the reservoir and this toothed portion cooperates with a worm or screw-threaded formation 62 on a bolt 63 extending transversely across the portion 37 of the reservoir and suitably journaled therein. The head of the bolt has a slot 64 adapted to receive a screw driver or the like for turning the bolt and thereby turning the shaft 56. It will be understood that this will bring about rotation of the disc 52, support member 48 and porous member 45, 47 in either a clockwise or counter clockwise direction (Fig. 4). When the control unit is thus being turned the finger piece 42 of the spring arm 40 may be depressed to disengage the nose 38a of the wicking from the portion 45 of the porous member. By suitable adjustment of the porous member in this manner, the point along the outer surface of the portion 45 of the member which is engaged by the nose 38a of the wick element 38 may be adjusted as desired. Such adjustment will vary the rate of delivery of lubricant from the wick element to the central portion 47 of the porous member. The path of travel of the lubricant circumferentially along the portion 45 of the porous member in a clockwise direction to the radially inwardly extending portion 46 will be varied and thus either increase or decrease the overall resistance to flow and hence the rate of delivery of the lubricant. To limit the extent of rotation of the shaft 56 and connected parts a stop screw 59a extends from the adjacent face of the lubricant reservoir into the path of that end of pin 59 which projects toward the reservoir. This is to guard against turning of the porous member 45 into a position in which the nose 38a would fall into the opening between the free end of the portion 45 of the porous member and the radially extending portion 46 thereof.

The lubricant delivered to the central portion 47 of the porous member is picked up by the cooperating face of the pressure disc 52 and is then pumped from that face to the bore of the hook shaft 22 by means of a spiral groove 65 formed in the end face of the shaft 22. The direction of rotation of the shaft is indicated by the arrow in Fig. 8. In pumping the lubricant into the bore of the shaft, the groove tends to draw the lubricant more rapidly through the portion 45 of the porous member, and this tendency increases with the speed of the shaft so that the system thus keeps up with the greater requirements of lubricant at higher speeds. The rate of trans-

mission of lubricant, however, is at all times inversely proportional, though not as a straight line function, to the length of the path of travel of the lubricant through the porous control member. By appropriately varying the cross-sectional area of the portion 45 of the porous member a straight line relationship between length of path and rate of delivery could be obtained, if desired.

In lieu of the spiral groove shown in Fig. 8 there may be provided a straight groove 65a (Fig. 10) which extends tangentially from the bore of the shaft. However, the spiral form is preferred. It should be understood that in lieu of providing the groove in the end of the shaft 22 the latter may be plain and a corresponding groove may be formed in the cooperating face of the pressure disc 52 in the area engaged by the end of the shaft. Such a groove would extend in the reverse direction from that provided in the end of the shaft. Two or more grooves could be provided in the end face of the shaft or in the cooperating surface of disc 52, if desired.

To provide a squeezing action upon the central portion 47 of the porous member and thus urge the inner wall surrounding the central opening thereof into engagement with the shaft 22, there is provided a ring 66 having a flange 67 arranged to receive one end of a light spring 68, the opposite end of which abuts against a bushing 69 forming a bearing for the shaft 22. Spring 68 urges the ring 66 toward the right (Fig. 12) and by means of an annular rib 70 on the right face thereof serves to provide the squeezing action mentioned. Spring 68, it will be understood, exerts a lighter pressure than the spring 57 and thus permits the latter to hold the porous regulating assembly against the end of the hook shaft in the manner explained.

Lubricant which is delivered to the bore 22a of the hook shaft is advanced along the latter toward the left (Figs. 2 and 3) and is delivered to a chamber 71 formed in the hook body from which it passes through a radially extending channel 72 and a channel 73, parallel with the axis of the hook, to the raceway of the latter. To facilitate and speed up the movement of the lubricant through the bore of the hook shaft the latter is preferably flared slightly from its right end toward its left end so that the diameter of the bore is greater at the left end than at the right. Within the bore of the hook shaft there is preferably provided a wick element 74 bent upon itself, in the manner shown in Fig. 3, and preferably stiffened by a wire core. This wick element coupled with the flare of the bore serves to retain a small amount of lubricant within the hook shaft and prevents its return by syphon action to the reservoir 32 when the machine is at rest. It has been found that without the wick element 74 it requires a period of 10 seconds to bring about delivery of lubricant to the raceway after the machine has been idle for a substantial period of time so that the bore of the hook shaft is substantially dry. This is even with the tapered formation of the bore of the shaft. If a non-tapered bore is provided this time factor is as much as 30 seconds. While this delay may not be serious, it is considered preferable to eliminate it and the arrangement disclosed, including the tapered bore and the provision of the wick element 74, serves to bring about substantially immediate delivery of lubricant to the hook raceway even after the machine has been idle for a substantial period.

While it should be understood that the invention is not limited to the particular dimensions and other details to be hereinafter specified, it has been found that a lubricant delivery and control system for a horizontal hook having the following characteristics is particularly effective. The hook shaft in the illustrative example has an outside diameter of .319 of an inch and is 4.45 inches long. Its bore has a diameter of $\frac{3}{32}$ of an inch at its smaller end and flares at the rate of $\frac{1}{4}$ inch per foot toward its discharge end within the hook. The pressure disc 52 has an outside diameter of .562 of an inch. Sup-

port member 48 has an outside diameter of $1\frac{3}{16}$ inch and an inside diameter of .562 inch. The thickness of the metal of which the support member is formed is .028 inch and its axial width is $\frac{1}{4}$ inch. Portion 45 of the porous control member has a radial thickness of $\frac{1}{8}$ inch and a width of $\frac{1}{8}$ inch. Portion 47 of the porous member has an outside diameter of $\frac{1}{16}$ of an inch and an opening at its center of .312 inch. This porous member is formed of a hard felt and is of denser construction than the wicking 38. A highly satisfactory porous member has been formed of $\frac{1}{8}$ inch American Felt Co. No. 7544; this conforms with the specifications for S. A. E. F-1 felt. It is a relatively dense felt formed largely of wool. The wicking may also be formed of a strip of felt and may have a width of $\frac{5}{16}$ of an inch and a thickness of $\frac{1}{8}$ of an inch. It may be formed of S. A. E. F-10 felt, such as sold by the American Felt Co. under No. 51018. This is likewise formed largely of wool but is of little more than half the density of S. A. E. F-1 felt. Sealing ring 66 has a maximum diameter of .370 inch and an outside diameter of .430 inch. This ring not only serves to urge the portion 47 of the porous member into engagement with the shaft 22 but also holds to a minimum the entry of air to the porous member and its delivery to the bore of the hook shaft.

In lieu of having the portion 45 of the porous member of uniform radial thickness and uniform width the member may be provided with the configuration illustrated in Fig. 16. As there shown, the portion 45a of the porous member varies in radial thickness from its free end toward its junction with the portion 46. It is of greatest thickness at its mid-portion and tapers off toward its free end toward its junction with the portion 46a. If desired the modified porous element could vary in width instead of, or in addition to, the indicated variation in radial thickness. The important thing is to vary the cross-sectional area through the portion 45a at different points along its length. It should be understood that this variation in cross-sectional area may be modified in any suitable way to achieve a desired control over the rate of flow of the lubricant. If desired, it may be such as to provide a straight line relationship between the rate of delivery of lubricant and the length of the portion 45 of the porous member through which the lubricant travels to the radial portion 46. Or the arrangement may be such as to increase substantially the overall variation in the rate of flow. If the portion 45 of the porous member is of uniform cross-sectional area, as indicated in Figs. 4 and 6, the rate of flow of the lubricant may vary as much as 10 to 1 as between the fastest and slowest rates of delivery. However, by suitable variation in cross-sectional area of the control portion of the porous member, a variation in the rate of flow of as much as 30 to 1 may be achieved.

A more porous or less dense felt than the S. A. E. F-10 may be used for the wicking 38, if desired, and when this is done the variation in the rate of delivery of lubricant, due to variation in the height of the lubricant in the reservoir is less. The overall variation in the rate of delivery due to the difference in height of the lubricant in the reservoir may be held to not more than 5%. If the wicking is formed of S. A. E. F-10 felt, the overall variation in the rate of delivery of the lubricant may be several times higher than this as the level of the lubricant in the reservoir changes. However, to reduce this variation in rate of delivery to a minimum, the portion of the wicking which is immersed in the lubricant within the reservoir may be of increased cross-sectional area, as indicated in Figs. 17 and 18. As shown in Fig. 17 the wicking 38a may have a laterally extending portion 38y which is immersed in the lubricant in the reservoir. In Fig. 18 the wicking 38b is shown as provided with one or more added sections of felt 38z which serves to increase the overall cross-sectional area of the portion which is immersed in the lubricant. With either of these

arrangements the overall variation in rate of delivery due to changes in the level of the lubricant in the reservoir may be held to about 5%.

In Fig. 15 there is shown a modified arrangement in which the adjusting bolt for the lubricant control unit is accessible from the top of the cloth plate or work supporting base of the frame instead of from the front of the latter. Aside from the arrangement of the adjusting means for the control unit the construction shown in Fig. 15 is the same as that hereinabove described and the various parts which have not been modified are identified by the same reference characters. The adjusting means comprises a bolt which is vertically disposed and has a screw thread or spiral formation 75 at its lower end cooperating with the spiral teeth 61 of the control unit. Enlarged head 76 of the bolt, provided with a slot 77 to receive a screw driver, extends into an opening 78 in the work supporting surface of the base 10 of the frame. Preferably the top of the bolt is flush with or slightly below the level of the work supporting surface. To retain the bolt against axial movement as it is turned, a screw 79 is provided, this having a reduced stem at its inner end cooperating with an annular groove 80 extending around the body of the bolt. If desired the screw 79 may be arranged to clamp the bolt against turning after it has been adjusted. However, this is not necessary.

It is believed that the mode of operation of the new lubricant control system will be clear from the foregoing detailed description so that a résumé of its operation is unnecessary. Certain distinct advantages of the system include the accurate and minute control over the rate of delivery of the lubricant from the reservoir to the hook raceway or the surface to be lubricated. At the same time the spiral groove pumping means provided in the unit serves to increase the rate of delivery of oil as the speed of the machine increases and its requirements for lubrication correspondingly increases. The pumping means disclosed is capable of developing a pumping head of at least 6 inches so that changes in the height of the lubricant in the reservoir will have very little, if any, effect upon the rate of flow. Any lint or other dirt in the lubricant within the reservoir is filtered out in the course of lifting it by the capillary action of the wicking 38. The system cannot become air-locked in view of the arrangement of the disc 52 and the sealing ring 66. By appropriate shaping and arrangement of the porous control member 45, 47 the rate of flow of lubricant can be made directly proportional, i. e. as a straight line function, to the number of turns applied to the adjusting bolt 62. However, to provide an indication of the adjustment of the unit, and thus facilitate its readjustment, the peripheral surface of the flange 58 may, if desired, be provided with indicia. It may be viewed in relation to an index mark suitably located on the front surface of the reservoir 32 or at the edge of an opening through the work supporting surface of the base portion of the frame just above the flange 58. A suitable transparent disc may be provided within such an opening to close the same, if employed.

The control unit provides a very uniform rate of delivery of the lubricant at any particular setting. At the same time the construction of the unit is such that no very close tolerances are required in the production of any of the parts. The metering of the lubricant is achieved at a point quite removed from the surfaces tending to generate heat, so that it is not affected to any great extent by changes in viscosity of the oil due to heating up of portions of the machine.

While a preferred embodiment of the invention and certain modifications thereof have been described in considerable detail, it will be understood that other changes may be made in the construction and arrangement of the several parts within the scope of the appended claims.

What is claimed is:

1. In a sewing machine a bearing surface requiring a precise amount of lubricant for most effective operation, means for delivering lubricant to said bearing surface which comprises a porous lubricant conducting member having a predetermined fixed porosity adapted to convey lubricant by capillary action, said member providing a path of variable length of transmission of lubricant, the length of said path determining the rate at which the lubricant is delivered, means for delivering lubricant to said member at one point along its length of transmission, pump means for receiving said lubricant from said member at a second point along its length of transmission and arranged to deliver the lubricant at a desired rate to said bearing surface only during operation of the machine, and means for shifting said member in relation to at least one of said two last-mentioned means to vary the distance between said two points and thereby vary the length of said path through which said lubricant must be transmitted through said member from said first point to said second point.

2. In a sewing machine a bearing surface requiring a precise amount of lubricant for most effective operation, means for delivering lubricant to said bearing surface which comprises a porous lubricant conducting member adapted to convey lubricant by capillary action, said member providing a path of variable length of transmission of lubricant, the length of said path determining the rate at which the lubricant is delivered, capillary means for delivering lubricant to said member at one point along its length of transmission, pump means for receiving said lubricant from said member at a second point along its length of transmission and operative only during operation of the machine for delivering the lubricant at a desired rate to said bearing surface, and means for varying the relationship between said member and at least one of said two last-mentioned means to vary the distance between said two points and thereby vary the length of said path through which said lubricant must be transmitted through said member from said first point to said second point without varying the porosity of said lubricant conducting member.

3. In a sewing machine a bearing surface requiring a precise amount of lubricant for most effective operation, means for delivering lubricant to said bearing surface which comprises a porous lubricant conducting member adapted to convey lubricant by capillary action, said member providing a path of variable length of transmission of lubricant, said member having a circularly disposed lubricant receiving portion and a radially extending delivery portion adjacent one end of said circularly disposed portion, means for delivering lubricant to said member at one point along said circularly disposed portion, means for receiving said lubricant from said member at said delivery portion and delivering said lubricant to said bearing surface, and means for varying the circumferential location of said one point along said circularly disposed portion.

4. In a sewing machine a bearing surface requiring a precise amount of lubricant for most effective operation, means for delivering lubricant to said bearing surface which comprises a porous lubricant conducting member adapted to convey lubricant by capillary action, said member providing a path of variable length of transmission of lubricant, said member having a circularly disposed lubricant receiving portion and a radially extending delivery portion adjacent one end of said circularly disposed portion, means for delivering lubricant to said member at one point along said circularly disposed portion, means for receiving said lubricant from said member at said delivery portion and delivering said lubricant to said bearing surface, said last mentioned means comprising a disc having a radially disposed surface in contact with said delivery portion of said member and a rotatable hollow shaft having a surface at one end thereof in contact with

said surface of said disc, one of said contacting surfaces of the disc and shaft being provided with a groove arranged to force oil into the interior of said shaft upon relative rotation of said shaft and disc, and means for varying the circumferential location of said one point along said circularly disposed portion.

5. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a horizontally extending rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level wholly below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, means for delivering lubricant from said reservoir to a point along said porous element, said last mentioned means comprising a wick element of greater porosity than said porous element, and means for varying the location of the point along said element at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft without altering the porosity of said porous element.

6. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a horizontally extending rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level wholly below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, means for delivering lubricant from said reservoir to a point along said porous element, and means for varying the location of the point along said element at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft without altering the porosity of said porous element, the bore of said shaft having a slight outward taper from the free end of the shaft toward the opposite end thereof to facilitate movement of the lubricant toward said opposite end.

7. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a horizontally extending rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level wholly below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous ele-

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ment into the bore of said shaft upon rotation thereof, a wick element within said bore of the shaft for retaining lubricant therein when the machine is idle, means for delivering lubricant from said reservoir to a point along said porous element, and means for varying the location of the point along said element at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft without altering the porosity of said element.

8. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, a wick element within said bore of the shaft for retaining lubricant therein when the machine is idle, said wick element only partially filling said bore and providing a passage along the surface of said bore for the delivery of lubricant along said surface, means for delivering lubricant from said reservoir to a point on said porous element, and means for varying the location of the point at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft.

9. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, a wick element within said bore of the shaft for retaining lubricant therein when the machine is idle, said wick element only partially filling said bore and providing a passage along the surface of said bore for the delivery of lubricant along said surface, the bore of said shaft having a slight outward taper from the free end of said shaft toward the opposite end thereof to facilitate movement of the lubricant toward said opposite end, means for delivering lubricant from said reservoir to a point on said porous element, and means for varying the location of the point at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft.

10. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of

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means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, means for delivering lubricant from said reservoir to a point on said porous element, said last mentioned means comprising a wick element of greater porosity than said porous element, resilient means for urging said wick element yieldingly against said porous element, and means for varying the location of the point at which said lubricant is so delivered to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft.

11. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, said element providing a path of variable length for transmission of said lubricant, means rotatable with said shaft for forcing the lubricant so delivered by said porous element into the bore of said shaft upon rotation thereof, means for delivering lubricant from said reservoir to a point on said porous element, said last mentioned means comprising a wick element of greater porosity than said porous element, resilient means for urging said wick element yieldingly against said porous element, manually operable means for disengaging said wick element from said porous element, and means for shifting said wick element and said porous element relative to each other while so disengaged to vary the location of the point at which said lubricant is delivered to said porous element to thereby vary the length of the path of travel of the lubricant through said porous element to the free end of said shaft.

12. In a sewing machine having stitch forming devices including a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component and having an axially extending bore in communication with said raceway, the combination of means for supplying lubricant to said bore of said shaft for delivery to said raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, a stationary porous element arranged for delivery of lubricant by capillary action to a point adjacent the free end of said shaft, a wick element having one end thereof immersed in the lubricant in said reservoir and having a portion thereof engaged with said porous element, means for turning said porous element to vary the point thereon engaged by said wick element, a disc yieldingly urged against a face of said porous element and against the end of said shaft, and cooperating formations on said disc and said shaft for pumping lubricant from said disc into the bore of said shaft.

13. In a sewing machine having a rotary hook with a rotary component and a stationary component, said hook having a raceway in one of said components cooperating with a rib on the other of said components, and a rotary shaft carrying said rotary component, the combination of means for supplying lubricant to said

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raceway which comprises a lubricant reservoir carrying lubricant at a level below said shaft, porous means arranged for delivery of lubricant by capillary action from said reservoir to a point adjacent said shaft for further delivery longitudinally thereof continuously during operation of the machine to a point adjacent said rotary component, means comprising passages in said rotary component for delivery of said lubricant by centrifugal force from said last mentioned point to said raceway, said porous means having a portion surrounding said shaft, means for varying the rate of delivery of lubricant to said portion of said porous means, and means for causing

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delivery of lubricant longitudinally of said shaft from said portion of said porous means including a member having flat surface engagement with said portion and spring means urging said member and said portion into surface engagement.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,863,412

December 9, 1958

John G. Attwood et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 44, for "requirements" read -- requirements --; column 2, line 70, after "the" insert -- end portion of the hook shaft, taken along the line 9-9 --.

Signed and sealed this 12th day of May 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents