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J. G. ATTWOOD

2,731,931

SEWING MACHINE OIL RETURN SYSTEM

Filed Oct. 1, 1952

5 Sheets-Sheet 1

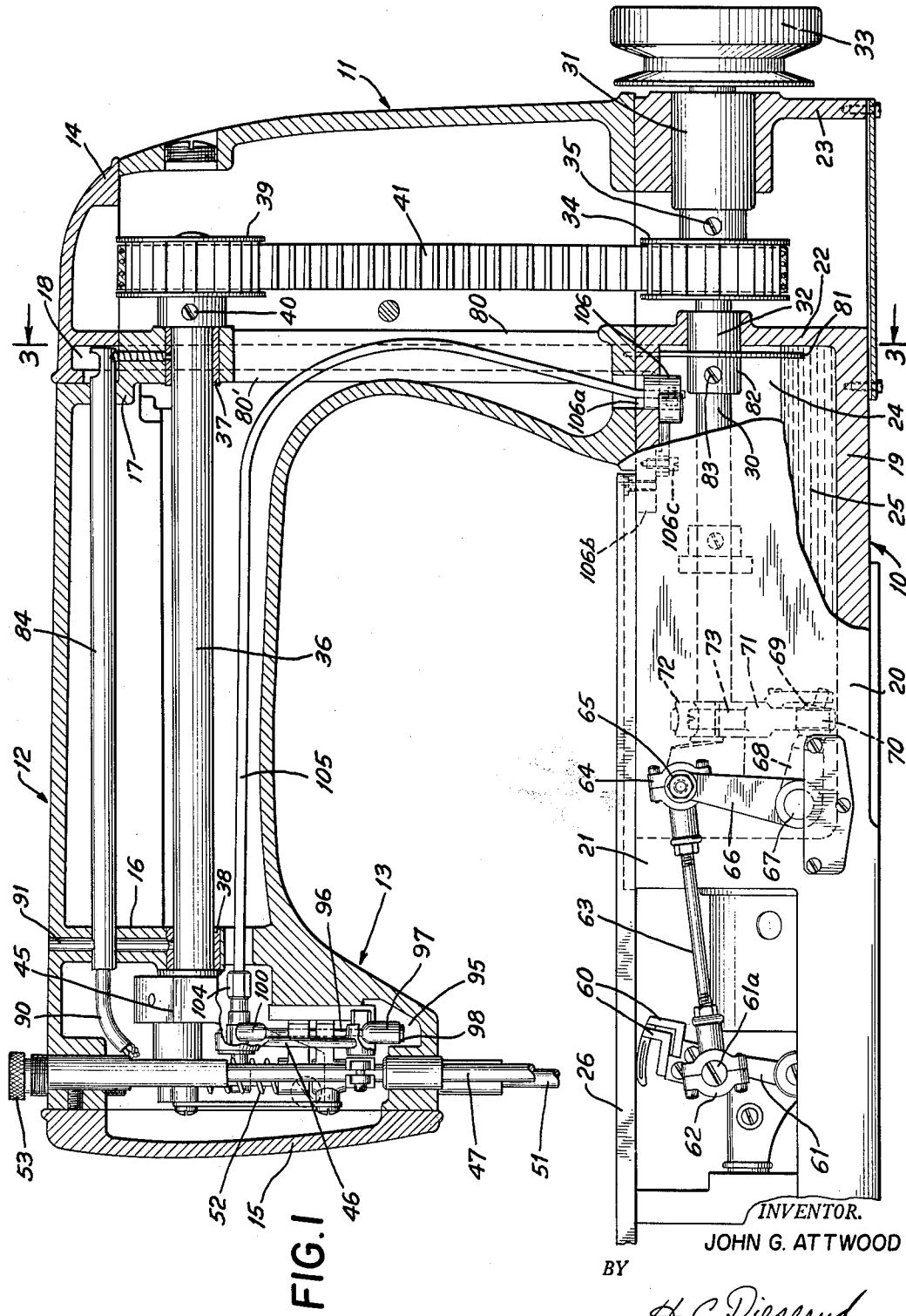


FIG. 1

INVENTOR.
JOHN G. ATTWOOD
BY
H. C. Diesend
ATTORNEY

Jan. 24, 1956

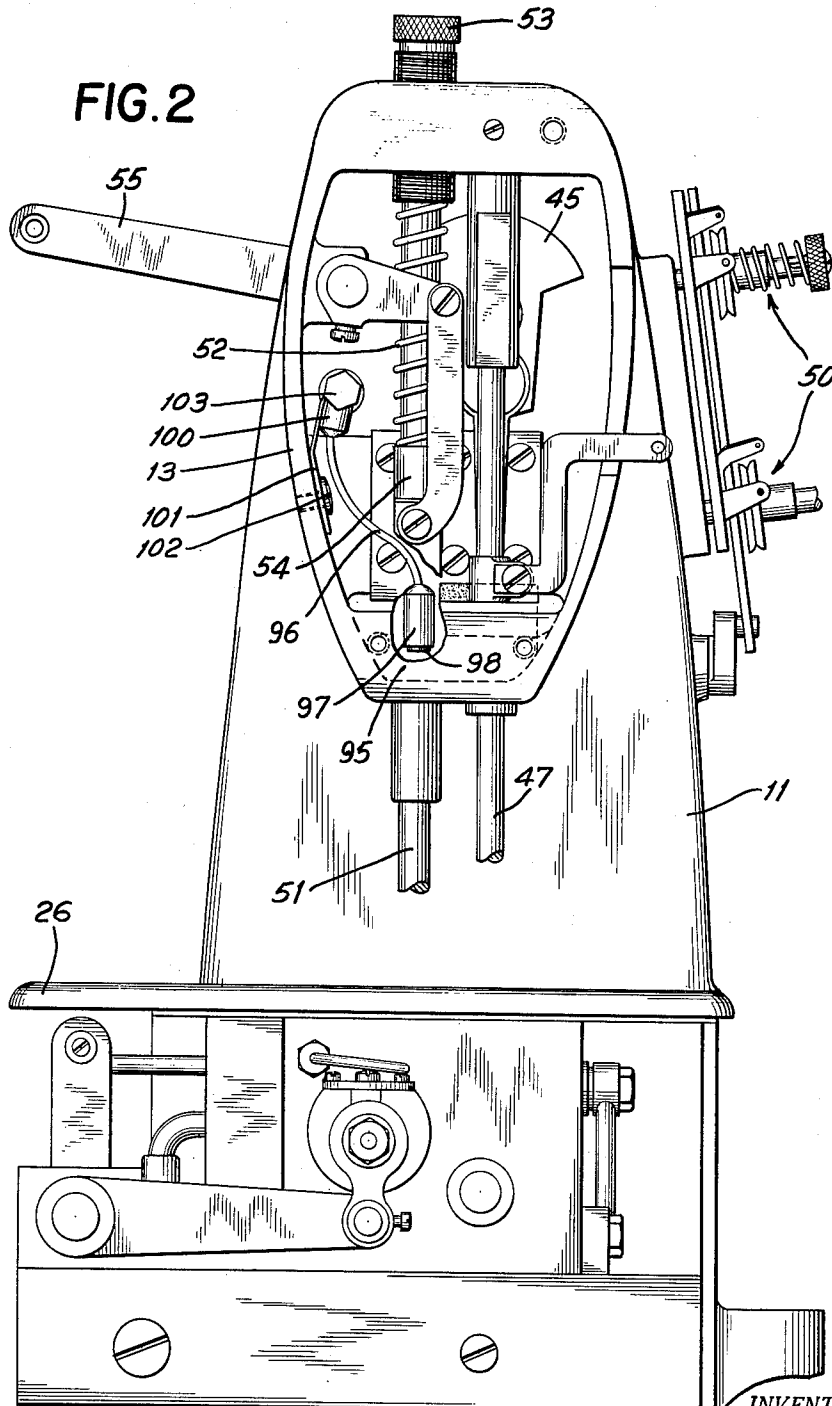
J. G. ATTWOOD

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5 Sheets-Sheet 2



INVENTOR.

JOHN G. ATTWOOD

BY

H. C. Diesend

ATTORNEY

Jan. 24, 1956

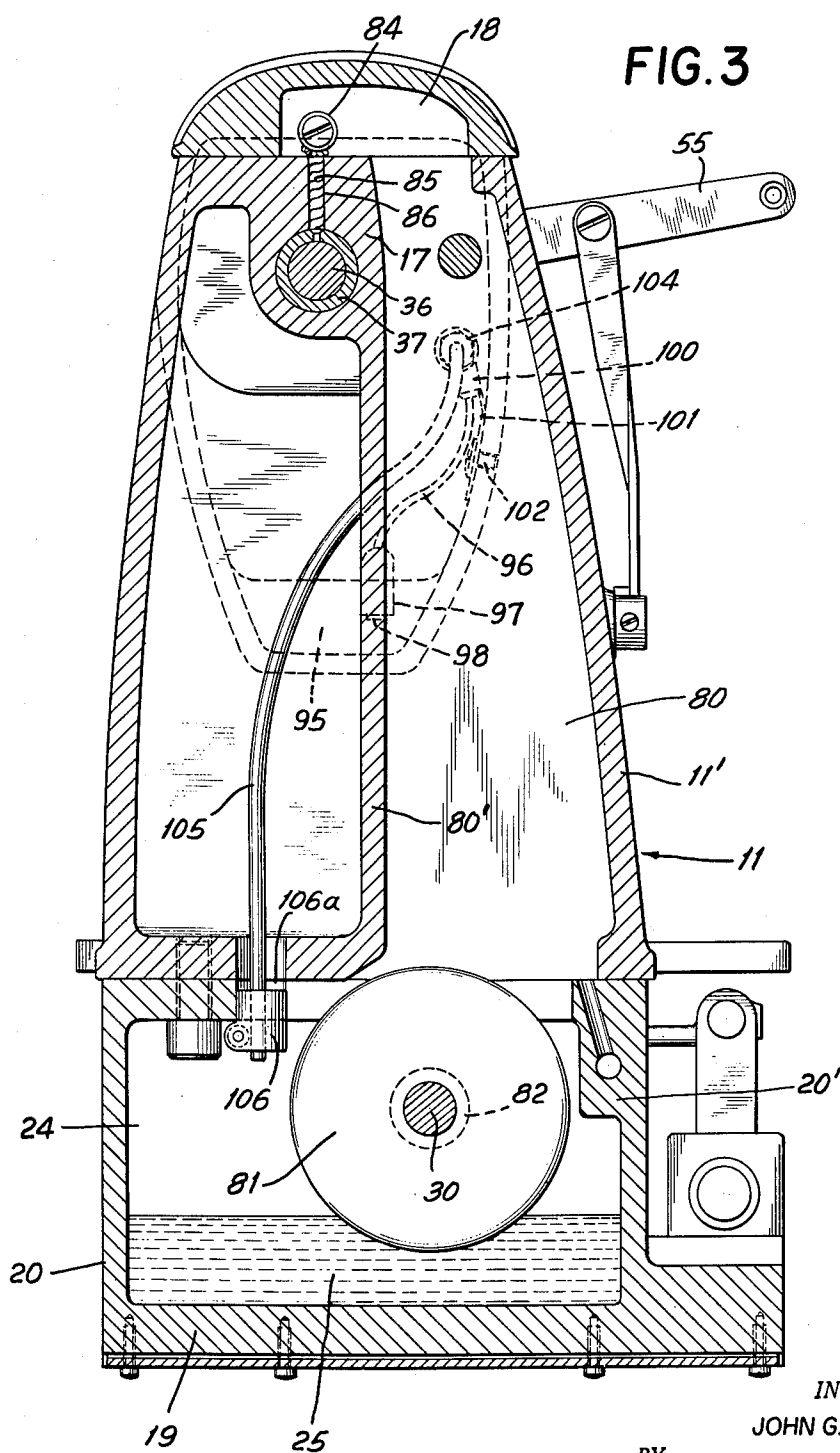
J. G. ATTWOOD

2,731,931

SEWING MACHINE OIL RETURN SYSTEM

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5 Sheets-Sheet 3



INVENTOR.

JOHN G. ATTWOOD

BY

H.C. Diesend
ATTORNEY

Jan. 24, 1956

J. G. ATTWOOD

2,731,931

SEWING MACHINE OIL RETURN SYSTEM

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5 Sheets-Sheet 4

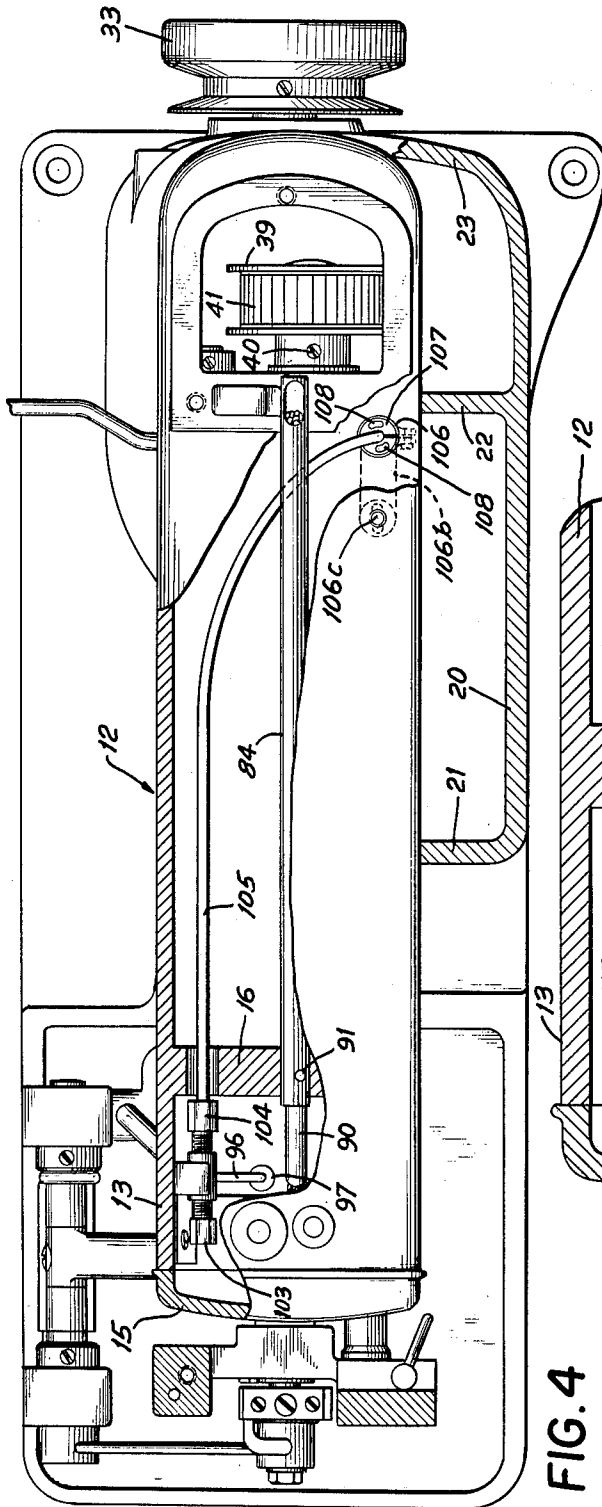


FIG. 4

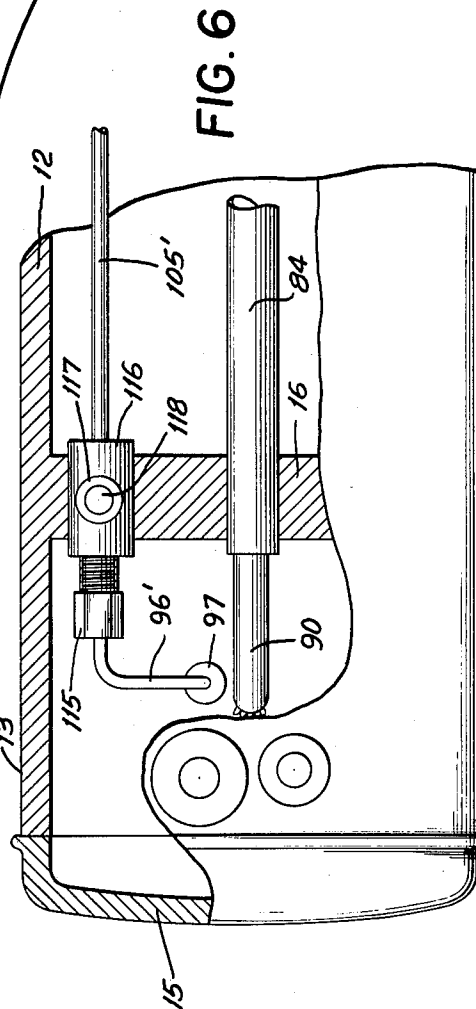


FIG. 6

INVENTOR.
JOHN G. ATTWOOD

BY

H. C. Dieznerud
ATTORNEY

Jan. 24, 1956

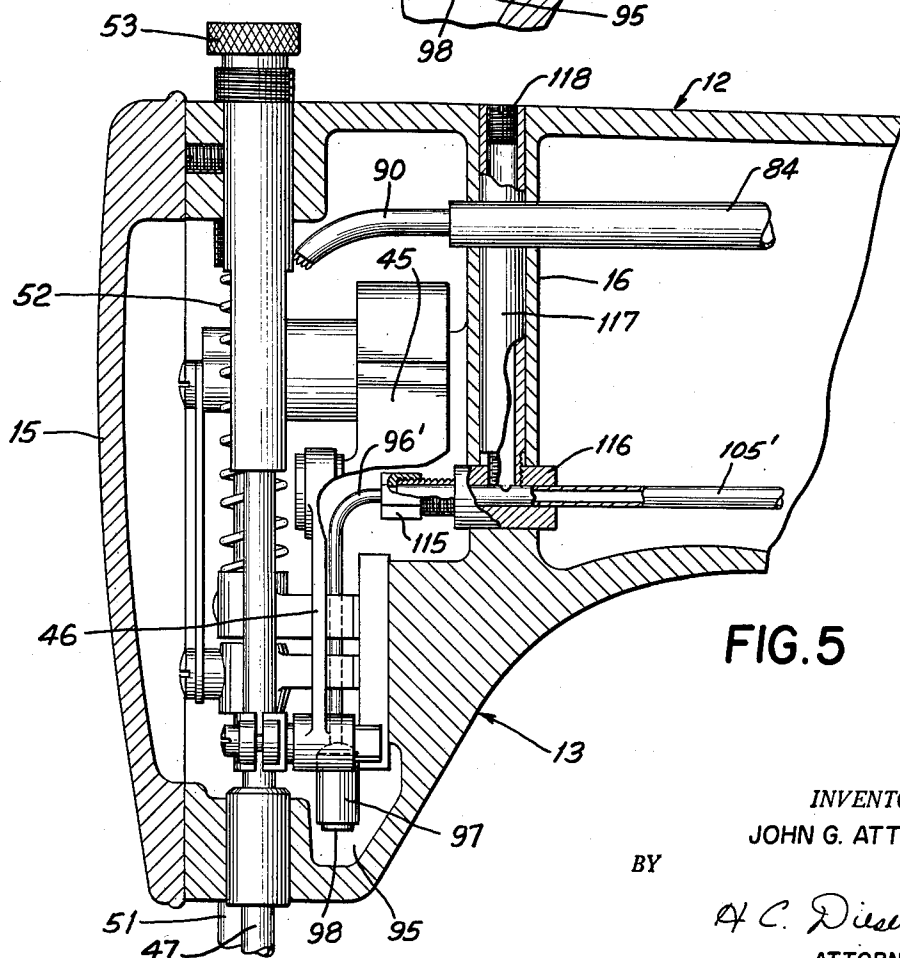
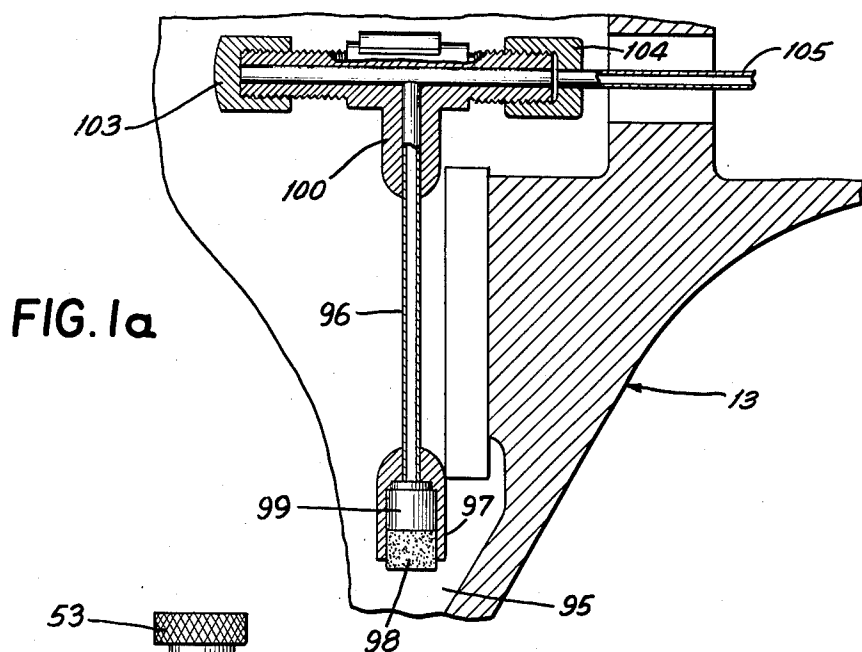
J. G. ATTWOOD

2,731,931

SEWING MACHINE OIL RETURN SYSTEM

Filed Oct. 1, 1952

5 Sheets-Sheet 5



INVENTOR.
JOHN G. ATTWOOD

BY

A. C. Disend
ATTORNEY

1

2,731,931

SEWING MACHINE OIL RETURN SYSTEM

John G. Attwood, Oak Park, Ill., assignor to Union Special Machine Company, Chicago, Ill., a corporation of Illinois

Application October 1, 1952, Serial No. 312,503

22 Claims. (Cl. 112—256)

The present invention relates to industrial sewing machines adapted for high speed operation and more particularly to machines of this character having incorporated therein means for supplying adequate lubrication to relatively movable parts that actuate stitch-forming elements of the machine.

The moving parts in a sewing machine head, and particularly the needle driving mechanism, require adequate lubrication and the importance of adequate lubrication increases at higher operating speeds. An important limitation in head lubricating systems heretofore employed has been the accumulation of surplus oil in the head. If an undue amount of oil collects in the head, there is considerable danger of its seeping through the presser and needle bar bearings onto the work below. Various means have been employed to overcome this difficulty. For example, metering of the exact amount of oil required for the head mechanism has been employed. This expedient has not proven satisfactory in many applications because, under some operating conditions, a greater amount of oil is needed than that normally required and because, in general, it is desirable to provide an excess amount of oil rather than just enough.

It has also been suggested that excess oil be returned to the machine sump through pumping apparatus, through wicking or by providing a gravitational path. An example of wicking means for eliminating excess oil is shown in U. S. Patent 2,393,815 issued January 29, 1946, to George Sauer et al. An arrangement of this type is not completely satisfactory in that, when the head sump becomes dry, the wick syphon loses its prime and because the height through which the wick has to lift the oil from the head sump to the machine arm is too great for the capillary action of a loose wick. Accordingly, in such an arrangement the system has to be primed each time the head sump is emptied of oil. While a tightly packed wick might be employed to provide suitable capillary action, the rate of oil flow therethrough would not be adequate for carrying off the excess oil with a wick of a diameter which could reasonably be used in the limited space available in a sewing machine.

In accordance with the foregoing, the principal object of the invention has been to provide an improved automatic oil return system for a sewing machine.

More particularly, it has been an object of the invention to provide an improved oil return system for a sewing machine which is wholly contained within the confines of the machine frame and which does not require moving parts for the operation thereof.

Another object of the invention has been to provide an oil return system of the above type which is simple, compact and rugged in construction and which is capable of operating in an effective and trouble free manner.

Still another object of the invention has been to provide an oil return system of the above type which is capable of retaining its prime under all conditions of machine operation and over extended periods of idleness.

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Other and further objects and features of the invention will appear from the following description.

In accordance with the invention, there is provided a sewing machine comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, the standard, overhanging arm and needle head being hollow, needle actuating elements contained within the needle head, means for delivering lubricant from the reservoir to the needle actuating elements, a sump within the needle head for collecting excess lubricant and located above the highest lubricant level in the reservoir, and means operative by combined capillary and syphon action for lifting and returning excess lubricant from the sump to the reservoir. The last specified means includes a hollow conduit communicating at an inlet end thereof with the sump and at an outlet end thereof with the reservoir, means for priming the conduit and a porous plug provided in the inlet end of the conduit and extending into the sump to draw lubricant therefrom into the conduit and for retaining the prime of the conduit when the lubricant level in the sump falls below the level of the porous plug.

In accordance with a further feature of the invention, the conduit is divided into two sections, one extending from the sump to one connection of a T fitting, and the other extending from a second connection of the T-fitting to the reservoir. The third connection of the T-fitting is provided with a cap or other air tight means which is removable for filling the conduit with lubricant to prime the same when necessary.

The invention will now be described in greater detail with reference to the appended drawings in which:

Fig. 1 is a view, partly in front elevational but largely in vertical section, of a flat bed sewing machine embodying the invention;

Fig. 1a is an enlarged vertical sectional view of the oil return conduit T junction shown in Fig. 1;

Fig. 2 is an enlarged end elevational view of the machine as observed from the left of Fig. 1, the needle head cover plate being omitted for better illustration of parts within the needle head;

Fig. 3 is an enlarged vertical sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is a top plan view, of the machine of Fig. 1 with a cover element and a part of the cloth plate removed and other parts broken away for better illustration of the oil return conduit in the upper arm and of certain of the operative parts;

Fig. 5 is a longitudinal vertical section through the needle head and a portion of the overhanging arm of a machine such as shown in Fig. 1 and illustrates a modified form of construction; and

Fig. 6 is an enlarged top plan view of the portion of the machine shown in Fig. 5, with parts broken away, and illustrating the modified form of construction shown in Fig. 5.

Referring now to the drawings, and more particularly to Fig. 1, there is shown a flat bed sewing machine comprising a base 10, a vertical standard 11, mounted at one end of and extending upwardly from base 10, and a horizontally extending overhanging arm 12. Arm 12 is parallel with base 10 and terminates in a needle head 13. The vertical standard, overhanging arm and needle head are preferably of one-piece hollow construction and the lower end of the standard is adapted to be removably secured to the base 10 by means of screws or the like. The vertical standard is provided at the upper end thereof with a removable cover plate 14 for ready access into its interior. Needle head 13 is similarly provided with a removable cover plate 15. A partition 16 extends across the interior

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of the overhanging arm 12 at its juncture with needle head 13. At the opposite end of the arm 12 a boss 17 defines with cover plate 14, a channel 18 forming the upper end of a lubricant delivery passage.

Base 10 has a bottom wall 19, a front wall 20, a rear wall 20' (Fig. 3), a pair of intermediate, transverse walls 21 and 22 and an end wall 23. Walls 19, 20, 20', 21 and 22 define a lubricant reservoir or chamber 24 which is filled to an appropriate level with a suitable lubricant, such as oil, indicated at 25. The base is covered with a cloth plate 26.

Extending through the base is a rotary driving shaft 30 which is supported for rotation in a series of bearing sleeves including a sleeve 31 carried by base end wall 23 and a sleeve 32 carried by intermediate wall 22. A combined handwheel and pulley 33 is attached to the projecting end of shaft 30 external to the end wall 23. A driving pulley 34 is coaxial with and secured to shaft 30 intermediate walls 22 and 23 by means of a set screw 35.

A driven rotary shaft 36, which extends through overhanging arm 12 in parallel relation to driving shaft 30, is rotatably supported in a bearing sleeve 37 carried by boss 17 and in a bearing sleeve 38 carried by partition 16. A driven pulley 39 is secured by means of a set screw 40 to the end portion of shaft 36 which projects into vertical standard 11. Pulley 39 is disposed directly above pulley 34 and is operatively connected thereto by a belt 41.

A crank 45, partially broken away in Fig. 1, is positioned within the needle head 13 and is secured to the left end of shaft 36 for rotation therewith. Crank 45 is connected by suitable devices, including a link 46, to a vertically reciprocable needle bar 47. The machine parts are so arranged that rotation of shaft 30 imparts, through the medium of pulleys 34 and 39 and belt 41, like rotation to shaft 36 and corresponding reciprocation to needle bar 47. The lower portion of needle bar 47 is broken away in Fig. 1, but it is arranged to carry one or more needles (not shown) for cooperating with devices contained within the machine base in the formation of stitches, as is well known in the art.

A thread tensioning and guiding unit 50 (Fig. 2) is mounted at the front of the vertical standard 11. A vertically reciprocable presser bar 51 is carried by needle head 13 adjacent and parallel to needle bar 47. Presser bar 51 is adapted to carry a presser foot (not shown) of any suitable form for holding down the work. The presser bar is normally urged downwardly by compression spring 52 that bears at its opposite ends against an adjustable screw threaded bearing sleeve 53, turnable for adjustment from the exterior of the needle head, and a collar 54 which is secured to the presser bar. Suitable apparatus under the control of the operator and including a lever 55 may be provided for raising the presser bar 51 against the action of spring 52 and for releasing the thread tension provided by unit 50.

One or more oscillatable loopers 60 are provided beneath cloth plate 26, at the left (Fig. 1) of the enclosed lubricant chambers in the base, to cooperate with the needles affixed to needle bar 47 in the formation of stitches. As shown in Fig. 1, two loopers are shown adapted to cooperate with two needles affixed to needle bar 47, to provide two closely spaced lines of stitches in the work. Suitable loop-seizing and shedding movements and suitable needle-avoid movements are imparted to loopers 60 through appropriate linkage connections with shaft 30.

For the purpose of imparting the loop-seizing and shedding movements to loopers 60, the latter are affixed to a looper carrier 61 having a ball stud 61a projecting therefrom and cooperating with a strap 62 provided at one end of a connecting rod 63. The other end of connecting rod 63 carries a similar strap 64 cooperating with a hall stud 65 at the upper end of an arm 66. Arm 66

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is secured to a rock shaft 67 which is suitably journaled in the front and back walls of base 10 and which receives rocking movements by means of an arm 68 secured at one end thereof to shaft 67. Arm 68 carries at the other end thereof a ball pin 69 which is received by a strap 70 provided at the lower end of a connecting rod or pitman 71. Connecting rod 71 is provided at the other end thereof with a strap 72 which cooperates with an eccentric secured to driving shaft 30.

The mechanisms for imparting needle avoid movements to the loopers, for feeding the work, for raising presser bar 51 and for releasing tension device 50 are not fully illustrated in the drawings but may correspond generally to like mechanisms disclosed in the copending patent application of Albert C. Peterson, Serial No. 228,487, filed May 26, 1951.

The oil or lubricant 25 contained in chamber or reservoir 24 is utilized for the purpose of thoroughly and automatically lubricating various bearing surfaces of the driven parts of the machine. Lubricant is delivered to various wear receiving parts in overhanging arm 12 and head 13 through a passageway 80 (Figs. 1 and 3) provided in vertical standard 11 and formed by a wall 80', U-shaped in horizontal section, extending downwardly from boss 17 and inwardly from rear wall 11' of vertical standard 11. An oil slinging disc 81, having a hub 82, is affixed to driving shaft 30 by a set screw 83. The lower portion of disc 81 extends into the body of lubricant 25 in chamber 24. Upon rotation of driving shaft 30 and disc 81, the latter picks up lubricant and throws the same upwardly through passageway 80 in the form of a spray or mist. The lubricant thus dispersed enters the channel 18 and is delivered to the open end of a lubricant delivery conduit 84 which extends into channel 18. Lubricant is also delivered from channel 18 to bearing 37 through wicking 85 provided in a bore 86 in boss 17. While the lubricant will be referred to hereinafter as oil, it should be understood that other liquid lubricants may be employed.

Conduit 84, which extends through overhanging arm 12 at a slight downward slope toward the needle head and is supported in boss 17 and in partition 16, transmits oil that is collected in the upwardly facing opening in the end thereof within the channel 18 to the wear receiving parts of the sewing machine contained within the head 13. A wick filled, downwardly curved extension 90 of conduit 84 directs oil onto the needle bar 47. The wicking may extend as far as desired into the conduit 84 to insure delivery of the lubricant at a desired rate. Because of the quantity of oil delivered to the needle bar 47 and because of the reciprocating motion of the needle bar, oil is thrown therefrom to the other mechanisms in the needle head. If desired, multiple wicks may be provided in the head for delivering oil from conduit 84 directly to vital wear receiving parts in the head in addition to the needle bar.

A vertical oil hole 91 (Figs. 1 and 4) is provided in partition 16. This hole extends through the conduit 84 and communicates with bearing 38 to provide lubrication for the latter. Hole 91 extends completely through partition 16 from the bearing 38 to the exterior surface of the arm 12. Oil may thus be added to the conduit 84 as well as being supplied to the bearing 38 from outside of the machine. This is particularly desirable when the machine is started up after a long idle period since it insures prompt delivery of lubricant to the parts in the head.

In order to insure adequate lubrication of all wear receiving parts in the head 13, it is desirable that somewhat more oil than is absolutely necessary for lubrication under normal running conditions be supplied to the head 13 through conduit 84. The amount of oil delivered through conduit 84 is dependent primarily on the size of the conduit, the character and extent of the wicking employed therein, the size and configuration of oil slinging

disc 81, the speed of shaft 30 and the oil level in reservoir 24.

Excess oil in head 13 collects in a sump 95 provided in the bottom of the head. As shown most clearly in Figs. 1a and 2, one end of an oil return conduit section 96 extends into the sump 95. The inlet end of the conduit section 96 is enlarged by means of a bell member or cap 97 secured thereto by welding or the like; this serves to increase the flow of oil through the conduit. A plug 98, which may be made of felt or other suitable porous material, is inserted in the lower, open end of the cap 97. Plug 98 extends slightly below the lower extremity of cap 97 and into the oil in sump 95. A small chamber 99 is provided within the cap above the plug.

Conduit section 96 extends upwardly into a T fitting 100 provided in the head 13. This T fitting is fastened to a side wall of the head by means of a bracket 101 (Fig. 2) integral with or welded to the fitting, and a screw 102. The bracket 101 may be made adjustable horizontally by providing an elongated slot for the screw 102. Outer end of T 100 is provided with a screw cap 103, while the other end thereof has a universal coupling 104 from which an oil return conduit section 105 extends through the partition 16, through the overhanging arm 12, down the vertical standard 11 and into the chamber 24 above the level of the oil 25. At its outlet end, conduit section 105 is fastened to the top or upper wall of chamber 24 by a suitable bracket 106, which fits into an opening 106a in the top of the chamber aligned with a corresponding opening in the bottom of the vertical standard. An arm 106b of the bracket is adjustably secured to the top of the chamber by a screw 106c. Bracket 106 holds conduit section 105 against movement which might result from vibration of the machine. As shown in Fig. 4, bracket 106 may be provided with an oil resistant plastic insert 107 having vent holes 108 for the oil reservoir. The bracket preferably has a split collar portion, as shown, adapted to clamp the insert about the lower end of conduit section 105.

The oil return system comprising conduit sections 96 and 105 must be primed initially. This may be accomplished by removing the needle head cover plate 15 and the screw cap 103 and filling the conduit sections 96 and 105 with oil. The cap 103 and plate 15 are then replaced and the system is ready to function. Once the system is primed, oil collected in sump 95 will be drawn upward through conduit section 96, through T 100 and through conduit section 105 to reservoir 24 by a combination of syphon and capillary action. Porous plug 98, provided at the inlet end of conduit section 96, in addition to acting by capillary action to lift oil from the sump 95 into the conduit section 96, whenever oil is present in the sump up to the level of the plug, also acts as an air lock which retains oil in the conduit sections 96 and 105 even when there is no flow of oil therethrough. In the absence of plug 98, loss of liquid head, which would occur when the level of oil in sump 95 fell below the inlet end of conduit section 96, would cause the liquid in the conduit sections 96 and 105 to run out of both ends, thus destroying the prime. Since it is highly undesirable to frequently reprime the oil return system, provision of plug 98 is very important. With plug 98 in place, excess oil in sump 95 will be delivered to the reservoir 24, through combined syphon and capillary action, whenever such excess oil accumulates. When the excess oil level falls below the lower end of plug 98, delivery of oil to the reservoir 24 will cease. However, oil will remain in the conduit sections 96 and 105 so that, as soon as the oil level in sump 95 rises to a suitable level, syphon and capillary action will automatically commence to draw the excess oil from the sump and deliver it into reservoir 24. Plug 98, by causing the retention of oil in conduit sections 96 and 105 during intervals when there is no syphon action, enables the system to retain its prime indefinitely. It should be observed in this connection that the inside di-

ameter of the conduit sections 96 and 105 is such that the oil will not fall out of the conduit at the discharge end under the low gravity head existing there. Surface tension, frictional resistance and capillary action at this end will be sufficient to overcome the head of about 4 or 5 inches of oil that is present. In fact, a substantially higher head may be effectively overcome.

The flow of oil from the sump 95 and through the porous plug 98 into the conduit section 96 is primarily capillary in nature. There are various factors which affect this flow. The flow through plug 98 is directly proportional to the plug area, i. e., area normal to the direction of flow, and inversely proportional to plug length, i. e., length in the conduit. It has been found that a plug diameter about six times the conduit internal diameter and a plug length within the conduit, i. e., above the base of cap 97, of about four times the conduit internal diameter provides satisfactory capillary action. These plug dimensions are not, however, sharply critical, and are given only as an illustration of one suitable plug size. Other sizes could be employed with good results.

A second factor which influences oil flow through the plug 98 is plug density. The rate of flow tends to decrease as the plug density is increased. It has been found desirable to use a plug just dense enough so as to provide sufficient surface tension to prevent air being sucked in by the available suction head. This suction head is about four or five inches in most flat bed sewing machines in operating position. However, it is desirable that the plug be dense enough to provide a surface tension sufficient to resist the suction head encountered when the machine is rested on its handwheel end. In flat bed sewing machines, this latter suction head will usually be about 12 inches. The surface tension is controlled by the density of the plug because the size of the interstices in the plug is decreased as the density is increased and the surface tension is greater with smaller interstices.

The flow of oil through the plug is, of course, dependent on the viscosity of the oil. However, it is desirable to choose the viscosity primarily for lubricating characteristics rather than flow characteristics.

System performance is greatly affected by the diameter of the oil return conduits. It has been determined that an oil return conduit having an internal diameter lying within the range of about $\frac{1}{16}$ inch to $\frac{3}{32}$ inch gives the best results. If the internal diameter is too large, oil will fall out of the outlet end, while if it is too small, the flow of oil will be unduly restricted by friction. Since it is desirable to have as high a flow as possible, the oil return conduit preferably has an internal diameter lying with the aforementioned range.

If a still larger flow is required or desirable, a conduit of somewhat greater internal diameter may be used. However, the outlet internal diameter should still be kept within the range of about $\frac{1}{16}$ inch to $\frac{3}{32}$ inch so that the oil will not fall out of the conduit. Increasing the internal diameter throughout most of the conduit length will decrease frictional resistance and hence increase flow, although flow due to capillary action will decrease somewhat. Instead of reducing the cross sectional area at the outlet end, a porous plug similar to the one used at the inlet end may be provided at the outlet end to create a surface tension sufficient to hold back the oil in the oil return capillary when the oil level in sump 95 falls below the plug 98. However, if air were to get into the oil return system, a condition comparable to that generally termed "vapor lock" would occur and free passage of oil in the conduit would be prevented.

The rate of removal of oil from sump 95 is limited by the factors mentioned above so that, under some conditions of machine operation, oil may collect in sump 95 at a greater rate than it is drawn off. However, since operation of the oil return system is not dependent on machine operation, this excess oil will automatically be returned to the reservoir when the machine is not being

operated and surplus oil in the head sump 95 will be kept at a minimum.

As has been explained, the oil return system, shown in Figs. 1 through 4 is provided with a T fitting in the needle head whereby the system may be primed by removing the cover plate from the head and unscrewing the cap on the dead end of the T so that the oil return conduit may be filled with oil. A modified construction, in which priming may be effected more easily, is shown in Figs. 5 and 6.

Referring now to Figs. 5 and 6, it will be observed that the inlet end of a conduit section 96', which corresponds to conduit section 96, is provided with porous plug 98 and extends into the sump 95 in the same manner as described in connection with Figs. 1 through 4. Conduit section 96' extends upwardly into a universal coupling 115 provided at the end of a fitting 116. Fitting 116 is mounted in partition wall 16. The inlet end of conduit section 105', which corresponds to conduit section 105, fits into the opposite end of fitting 116. A tube 117 provided in partition wall 16 extends from the top or upper surface of arm 12 to the center of fitting 116 and is threaded into the latter. Tube 117 and fitting 116 form a T connection. Conduit section 105' is provided with an opening through its wall aligned with the bore of tube 117. The outer end of tube 117 is normally closed by means of a screw plug 118 which provides an air tight seal.

When the system needs to be primed, plug 118 may be removed and oil poured into tube 117 until conduit sections 96' and 105' are filled. Sufficient oil is preferably poured in so that tube 117 is filled to the level of plug 118. When this is done, tube 117 acts as an oil reservoir which may supply oil to the conduit sections in the event the system tends to lose its prime.

The operation of the oil return system of Figs. 5 and 6 is the same as that of Figs. 1 through 4, i. e., oil is drawn from sump 95 and delivered to reservoir 24 through combined capillary and syphon action.

If fitting 116 is rigidly mounted in partition 16, tube 117 could conveniently be replaced with a passageway or hole provided in partition 16. Such a hole would have an opening communicating with the center of the fitting 116 and with the conduit sections 96' and 105'.

While the invention has been described in relation to certain specific embodiments thereof and in relation to a specific use, it should be understood that the invention is not limited thereto since various modifications of the construction and other uses of it will occur to those skilled in the art within the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. In a sewing machine having operating parts to be lubricated, a lubricant reservoir, means for delivering lubricant from said reservoir to said parts and a sump disposed above the highest level of lubricant in said reservoir arranged to collect excess lubricant delivered to said parts, the combination of automatically operable means for returning lubricant from said sump to said reservoir which comprises a conduit extending upwardly from said sump, laterally therefrom and downwardly to said reservoir, the inlet end of said conduit at said sump having a porous plug therein with the lower end of said plug positioned adjacent the bottom of the sump, said plug filling the inlet end of the conduit and being of such density as to provide capillary passages therethrough adapted to lift lubricant from said sump by capillary action into the interior of said conduit and to provide a surface tension sufficient to resist the suction head created by the lubricant in said conduit, and the outlet end of said conduit at said reservoir having a discharge passage of smaller cross sectional area than that of said plug, the lower end of said discharge passage being at a lower level than the lower end of said plug.

2. In a sewing machine having operating parts to be lubricated, a lubricant reservoir, means for delivering lubricant from said reservoir to said parts and a sump disposed above the highest level of lubricant in said reservoir arranged to collect excess lubricant delivered to said parts, the combination of automatically operable means for returning lubricant from said sump to said reservoir which comprises a conduit extending upwardly from said sump, laterally therefrom and downwardly to said reservoir, the inlet end of said conduit at said sump having a porous plug therein with the lower end of said plug positioned adjacent the bottom of the sump, said plug filling the inlet end of the conduit and being of such density as to provide capillary passages therethrough adapted to lift lubricant from said sump by capillary action into the interior of said conduit and to provide a surface tension sufficient to resist the suction head created by the lubricant in said conduit, and the outlet end of said conduit at said reservoir having a discharge passage of smaller cross sectional area than that of said plug, the lower end of said discharge passage being at a lower level than the lower end of said plug, and readily accessible means connected with said conduit for enabling the introduction of lubricant into said conduit to prime the same.

3. In a sewing machine having operating parts to be lubricated, a lubricant reservoir, means for delivering lubricant from said reservoir to said parts and a sump disposed above the highest level of lubricant in said reservoir arranged to collect excess lubricant delivered to said parts, the combination of automatically operable means for returning lubricant from said sump to said reservoir which comprises a conduit extending upwardly from said sump, laterally therefrom and downwardly to said reservoir, the inlet end of said conduit at said sump having a porous plug therein with the lower end of said plug positioned adjacent the bottom of the sump, and the outlet end of said conduit at said reservoir having a discharge passage of smaller cross sectional area than that of said plug, the lower end of said discharge passage being at a lower level than the lower end of said plug, and readily accessible means comprising a T fitting included in said conduit, said T fitting having a removable sealing member in one of the entrances thereof for enabling the introduction of lubricant into said conduit to prime the same.

4. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last mentioned means including a hollow conduit having an opening adjacent one end thereof in communication with said sump and having the other end thereof in communication with said reservoir, means enabling the introduction of lubricant for priming said conduit, and a short porous element carried by said one end of said conduit and extending into said sump, said element completely closing the opening adjacent said one end of said conduit but being of such density as to provide capillary passages therethrough adapted to draw lubricant from said sump by capillary action and deliver the same into said conduit, said element also being adapted to retain the prime of said conduit when the lubricant level in said sump falls below the level of the porous element, the other end of said conduit which communicates with said reservoir having a sufficiently restricted outlet to retain the lubricant in said conduit by surface tension and frictional resistance to flow when

the level of lubricant in said sump drops below said porous element.

5. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and automatic means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last mentioned means including a hollow conduit having an opening adjacent one end thereof communicating with said sump, said conduit communicating at the other end thereof with said reservoir, means enabling the introduction of lubricant for priming said conduit, and means carried by said conduit adjacent said one end thereof for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said one end of said conduit, said prime retaining means comprising a porous element completely closing the opening adjacent said one end of said conduit and having only capillary passages therethrough sufficiently fine to resist the suction head of the lubricant in said conduit, said element extending to a point adjacent the bottom of said sump, the other end of said conduit which communicates with said reservoir having a sufficiently restricted outlet to retain the lubricant in said conduit by surface tension and frictional resistance to flow when the level of lubricant in said sump drops below said porous element.

6. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an opening adjacent one end thereof in communication with said sump and having the other end thereof in communication with said reservoir, means enabling the introduction of lubricant for priming said conduit, and a short porous element carried by said one end of said conduit to completely close said opening and extending into said sump to draw lubricant therefrom into said conduit, said porous element having interstices therein sufficiently small to provide a surface tension of lubricant within said porous element that will suppress flow of air from said sump into said conduit when the lubricant level in said sump falls below the level of said porous element thereby preventing loss of prime of said conduit, and the outlet of said conduit at the end thereof which communicates with said reservoir being sufficiently restricted to prevent discharge of lubricant therefrom under the lubricant head at said end of the conduit.

7. A sewing machine, comprising a frame having a base that defines a lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements con-

tained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an opening at one end thereof in communication with said sump and having the other end thereof in communication with said reservoir, means enabling the introduction of lubricant for priming said conduit, and a short porous element carried by said one end of said conduit to completely close said opening and extending into said sump to draw lubricant therefrom into said conduit, said porous element being of sufficient length and having interstices therein sufficiently small to provide a surface tension of lubricant within said porous element that will suppress flow of air from said sump into said conduit and flow of lubricant from said conduit into said sump, when the lubricant level in said sump falls below the level of said porous element, and the outlet of said conduit at the end thereof which communicates with said reservoir being sufficiently restricted to prevent discharge of lubricant therefrom under the lubricant head at said end of the conduit.

8. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an internal diameter lying within the range of about one-sixteenth inch to three thirty-secondths inch and an opening at one end thereof in communication with said sump and having the other end thereof in communication with said reservoir, means enabling the introduction of lubricant for priming said conduit, and a short porous element carried by said one end of said conduit to completely close the opening therein and extending into said sump, said element being of such density as to provide capillary passages therethrough adapted to draw lubricant from said sump into said conduit and to retain the prime of said conduit when the lubricant level in said sump falls below the level of said porous element.

9. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an enlarged inlet opening at one end communicating with said sump and having a smaller outlet opening at its other end at a level below the level of said opening at the inlet end and communicating with said reservoir, means enabling introduction of lubricant for priming said conduit, and a porous element carried by said inlet

end of said conduit to completely close the opening therein and extending into said sump, said element being of such density as to provide capillary passages therethrough adapted to draw lubricant from said sump into said conduit and to retain the prime of said conduit when the lubricant level in said sump falls below the level of said porous element, said enlarged inlet opening being of sufficient size to enable the delivery of a predetermined amount of lubricant to said conduit by the capillary action of said porous element, and said smaller outlet opening being adapted to prevent the discharge of lubricant therefrom under the lubricant head at the outlet end of said conduit.

10. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an enlarged inlet end communicating with said sump, a main portion of smaller cross-sectional area than said inlet end extending from said sump through said needle head, said overhanging arm and said vertical standard and an outlet end extending below the level of said inlet end and communicating with said reservoir, means enabling the introduction of lubricant for priming said conduit, and a porous plug provided in said inlet end of said conduit and extending into said sump, said plug being of such density as to provide capillary passages therethrough adapted to draw lubricant from said sump into said conduit and to retain the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug, the cross-sectional area of said plug being sufficient to enable return of lubricant from said sump at a predetermined rate.

11. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having an enlarged inlet end communicating with said sump, a main portion of smaller cross-sectional area than said inlet end extending from said sump through said needle head, said overhanging arm and said vertical standard and an outlet end extending below the level of said inlet end and communicating with said reservoir, said conduit having an internal diameter lying within the range of about one-sixteenth inch to three thirty-secondths inch throughout most of said main portion thereof, means enabling introduction of lubricant for priming said conduit, and a porous plug provided in said inlet end of said conduit and extending into said sump, said plug being of such density as to provide capillary passages therethrough adapted to draw lubricant from said sump into said conduit and to retain the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug, the cross-sectional area of said plug being sufficient

to enable return of lubricant from said sump at a predetermined rate.

12. A sewing machine, comprising a frame having a base that defines a lubricant oil reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering oil from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess oil and located above the highest oil level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess oil from said sump to said reservoir, said last recited means including a hollow conduit communicating at one end thereof with said sump and at the other end thereof with said reservoir, means for priming said conduit and a felt plug provided in said one end of said conduit and extending into said sump to draw oil therefrom into said conduit and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said felt plug.

13. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having a first section extending through said needle head and communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level of the inlet end of said first section and communicating with said reservoir and having an inlet end, a T fitting having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection having a removable closing member adapted to provide an air tight seal for said third connection, means enabling access to said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

14. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having a first section communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level

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of the inlet end of said first section and communicating with said reservoir, said second section having an inlet end, adjacent the outlet end of said first section, a T fitting mounted within said needle head and having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection having a removable cap adapted to provide an air tight seal for said third connection, means including a removable cover plate for said needle head for enabling access to said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

15. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having first and second sections, said first section communicating at an enlarged inlet end thereof with said sump and having an outlet end, said second section having an inlet end adjacent the outlet end of said first section and extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level of the inlet end of said first section and communicating with said reservoir, said first and second sections of said conduit having internal diameters lying within the range of about one-sixteenth inch to three thirty-secondths inch, a T fitting mounted within said needle head and having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection having a removable closing member adapted to provide an air tight seal for said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

16. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, a partition separating said needle head and said overhanging arm and having a channel therein communicating with the exterior of said machine, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having a first section communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end there-

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of arranged below the level of the inlet end of said first section and communicating with said reservoir, said second section having an inlet end adjacent the outlet end of said first section, a fitting mounted in said partition and having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection communicating with said channel, means including a removable plug provided in said channel for securing access to said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

17. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, a partition separating said needle head and said overhanging arm, a hollow tube provided in said partition and communicating with the outside of said machine, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having a first section communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level of the inlet end of said first section and communicating with said reservoir and having an inlet end, a T fitting mounted in said partition and having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection being adapted to receive one end of said hollow tube, means including a removable plug provided in said tube for securing access to said third connection for priming said conduit, and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

18. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, a partition separating said needle head and said overhanging arm, a hollow tube provided in said partition and communicating with the outside of said machine, needle actuating elements contained within said needle head, means for delivering lubricant from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir, said last recited means including a hollow conduit having a first section communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level of the inlet

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end of said first section and communicating with said reservoir and having an inlet end, said first and second sections of said conduit having internal diameters lying within the range of about one-sixteenth inch to three-sixteenths inch, a T fitting mounted in said partition and having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection being adapted to receive one end of said hollow tube, means including a removable plug provided in said tube for securing access to said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

19. A sewing machine, comprising a frame having a base that defines a liquid lubricant reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, a first rotary shaft extending longitudinally of the overhanging arm and terminating at one end at the needle head, a reciprocating needle-carrying bar in the needle head, means responsive to rotation of the first shaft for imparting reciprocation to the needle-carrying bar, a secondary rotary shaft extending longitudinally of the base, means for imparting simultaneous rotation to the shafts, devices in the base responsive to rotation of the second shaft for cooperating with the needle in the formation of stitches in a piece of work, means for delivering lubricant from the reservoir to said needle bar, said latter means including a disc carried by the second shaft and being arranged to project into the lubricant in the reservoir and to sling lubricant upwardly in response to rotation of the second shaft, a sump within the needle head for collecting excess lubricant and located above the highest lubricant level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess lubricant from said sump to said reservoir including a hollow conduit having a first section communicating at an inlet end thereof with said sump and having an outlet end and a second section extending through said overhanging arm and said vertical standard and having an outlet end thereof arranged below the level of the inlet end of said first section and communicating with said reservoir and having an inlet end, a T fitting having three connections, one of said connections being adapted to receive the outlet end of said first section, another of said connections being adapted to receive the inlet end of said second section and said third connection having a removable closing member adapted to provide an air tight seal for said third connection, means for securing access to said third connection for priming said conduit and a porous plug provided in the inlet end of said first section and extending into said sump to draw lubricant therefrom into said first section and for retaining the prime of said conduit when the lubricant level in said sump falls below the level of said porous plug.

20. In a sewing machine having operating parts to be lubricated, a lubricant reservoir, means for delivering lubricant from said reservoir to said parts and a sump disposed above the highest level of lubricant in said reservoir and arranged to collect excess lubricant delivered to said parts, the combination of automatically operable means for returning lubricant from said sump to said reservoir which comprises a conduit having a first portion extending generally upwardly from said sump and a second portion communicating with said first portion and extend-

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ing generally downwardly to a point communicating with said reservoir and below the inlet end of said conduit at said sump, said first portion having an opening adjacent its inlet end for the delivery of lubricant into said conduit, the inlet end of said conduit at said sump having a porous element applied thereto completely to close said opening, said porous element being of sufficient length and having interstices sufficiently small to prevent the entrance of air into said opening adjacent the inlet end of said conduit under the difference in pressure produced by the difference in height between the inlet and outlet ends of said conduit, and the outlet end of said conduit at said reservoir being sufficiently restricted to prevent entrance of air into said outlet end of said conduit.

21. In a sewing machine having operating parts to be lubricated, a lubricant reservoir, means for delivering lubricant from said reservoir to said parts and a sump disposed above the highest level of lubricant in said reservoir and arranged to collect excess lubricant delivered to said parts, the combination of automatically operable means for returning lubricant from said sump to said reservoir which comprises a conduit having a first portion extending generally upwardly from said sump and a second portion communicating with said first portion and extending generally downwardly to a point communicating with said reservoir and below the inlet end of said conduit at said pump, said first portion having an opening adjacent its inlet end for the delivery of lubricant into said conduit, the inlet end of said conduit at said sump having a porous element applied thereto completely to close said opening, said porous element being of sufficient length and having interstices sufficiently small to prevent the entrance of air into said opening adjacent the inlet end of said conduit under the difference in pressure produced by the difference in height between the inlet and outlet ends of said conduit, and the outlet end of said conduit at said reservoir having a discharge passage sufficiently small that surface tension prevents entrance of air into said outlet end of said conduit.

22. A sewing machine, comprising a frame having a base that defines a lubricant oil reservoir, a vertical standard rising from one end of the base, an overhanging arm projecting laterally from the standard over the base, a needle head at the end of the overhanging arm remote from the standard, said standard, overhanging arm and needle head being hollow, needle actuating elements contained within said needle head, means for delivering oil from the reservoir to said needle actuating elements, a sump within said needle head for collecting excess oil and located above the highest oil level in said reservoir, and means operative by capillary and syphon action for lifting and returning excess oil from said sump to said reservoir, said last recited means including a hollow conduit having an inlet opening adjacent one end thereof in communication with said sump and having the other end thereof in communication with said reservoir, means enabling introduction of lubricant for priming said conduit and an element formed of felt carried by said conduit adjacent said one end and completely closing said opening, said element extending into said sump to draw oil therefrom and deliver the same to said conduit through said opening and serving to retain the prime of said conduit when the lubricant level in said sump falls below the level of said felt element.

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