March 14, 1961 B. N. PIERCE 2,974,604

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Original Filed Nov. 21, 1951 3 Sheets-Sheet 1

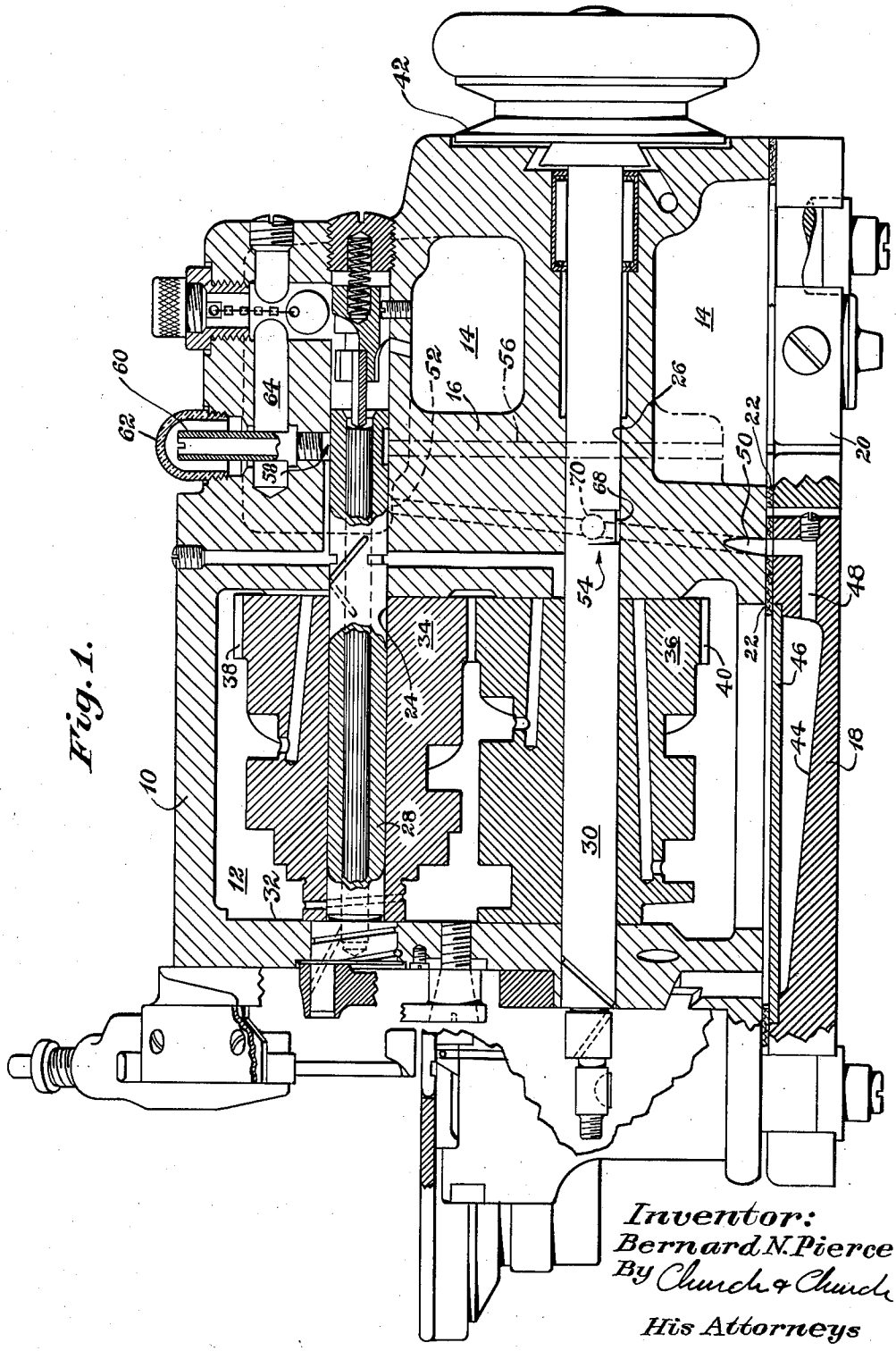


Fig. 1.

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Original Filed Nov. 21, 1951 3 Sheets-Sheet 2

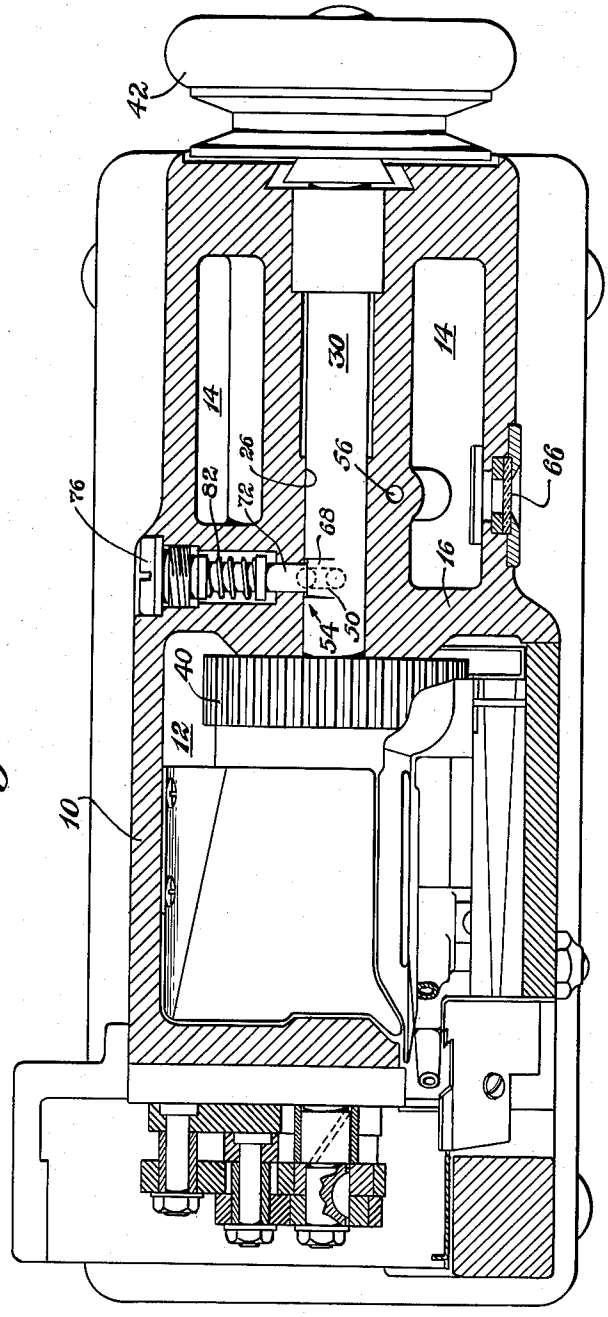


Fig. 2.

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Original Filed Nov. 21, 1951 3 Sheets-Sheet 3

Fig. 4.

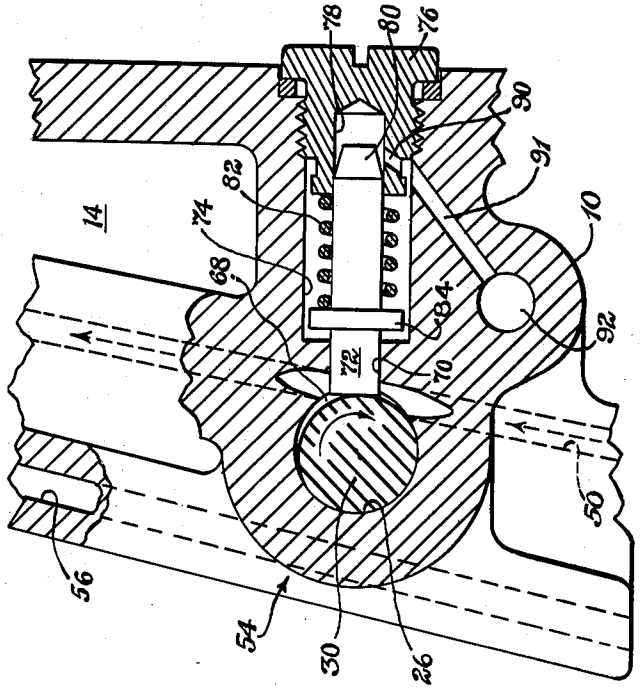
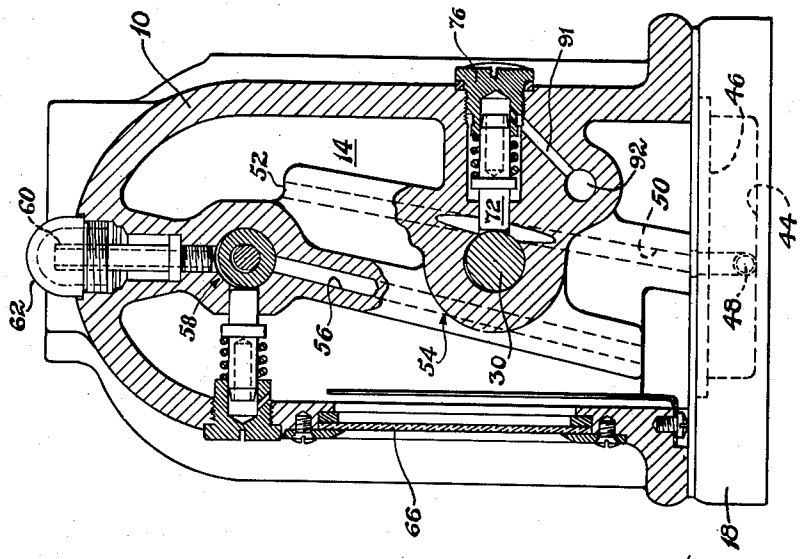


Fig. 3.



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2,974,604

Patented Mar. 14, 1961

2,974,604

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Original application Nov. 21, 1951, Ser. No. 257,620, now Patent No. 2,879,733, dated Mar. 31, 1959. Divided and this application Aug. 18, 1958, Ser. No. 755,551

1 Claim. (Cl. 103—123)

This invention relates to pumps, and more particularly to a pump construction especially adapted to perform an auxiliary function in an existing machine, as for example the circulation of lubricant in a sewing machine lubrication system.

This application is a division of my copending application Serial No. 257,620, filed November 21, 1951, now Patent No. 2,879,733, granted March 31, 1959.

While the invention will be described in one specific environment, that of circulating oil or lubricant in a sewing machine lubrication system, it is to be understood that the pump of the present invention may be adapted for use in other environments.

A primary object of the invention is to provide a pump for the lubrication system of a sewing machine or the like which requires the addition of a minimum number of parts to the machine.

Another object of the invention is to provide a lubricant pump forming an integral part of a machine with only minor modification of existing parts of the machine and operating without interfering with the function of the machine or its component part.

Still another object of the invention is to provide a lubricant pump of simplified construction for transferring lubricant under pressure from one part of the machine to another part.

These and other objects are achieved in a pump employed in a sewing machine having a rotatable shaft journaled in a bore formed in the machine frame with a lubricant transfer passage or duct located within the frame to intersect the bore in which the shaft is journaled. An arcuate slot is cut or formed in the shaft to axially overlap the intersection of the lubricant transfer passage and the bore, and a plunger slideably mounted in the frame is biased into a wiping sealing engagement with the slot in the shaft to seal one section of the lubricant passage from the other.

Upon rotation of the shaft during normal operation of the machine, the arcuate slot defines, with the wall of the bore, an arcuate chamber which transfers lubricant from one section of the passage to the other during each revolution of the shaft.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings.

In the drawings:

Fig. 1 is a longitudinal vertical cross sectional view of a sewing machine employing pumps embodying the present invention;

Fig. 2 is a horizontal cross sectional view of the machine of Fig. 1 taken on a plane passing approximately through the center of the lower shaft of Fig. 1;

Fig. 3 is a transverse vertical cross sectional view of the machine of Fig. 1; and

Fig. 4 is an enlarged transverse cross sectional view of one of the pumps shown in Fig. 3.

In the drawings, pumps constructed according to the invention are employed to pump lubricant in a sewing machine lubrication system. While the pumps are especially adapted for this purpose, it will become apparent from the following description that they are capable of more general application.

The sewing machine shown in the drawings includes a main frame casting **10** which is formed with a mechanism compartment **12** and an oil reservoir compartment **14** separated from each other by a central partition **16**. Both compartments are closed at the bottom by base plates **18** and **20** respectively. Gaskets **22** are employed to seal the joint between main frame **10** and the respective base plates, the base plates being secured to main casting **10** as by bolts (not shown).

Central partition **16** is constructed with an upper bore **24** and a lower bore **26** within which are respectively journaled upper and lower shafts **28** and **30**. Shafts **28** and **30** both extend entirely across mechanism compartment **12** and are supported for rotation by suitable means in the end wall **32** of main frame **10**. Mechanism for operating the sewing machine includes upper and lower cam cylinders **34** and **36** which are respectively secured to upper and lower shafts **28** and **30** by suitable means, not shown. Cam cylinders **34** and **36** are coupled by meshing gear teeth **38** and **40** which are formed on the respective cylinders adjacent central partition **16**. Lower shaft **30** is driven in rotation by pulley and hand wheel assembly **42** which is fixed to shaft **30** at the exterior of frame **10**.

Base plate **18**, which underlies mechanism compartment **12**, is formed with a lubricant collecting sump **44** over which is disposed an oil filter plate **46** of porous metal or other suitable material. A passage **48** is formed in base plate **18** to connect sump **44** to a duct or passage **50** which passes upwardly through central partition **16** and opens into oil reservoir compartment **14** at an elevated location as at **52** (Fig. 3). As best seen in Fig. 3, duct **50** intersects bore **26** in a tangential fashion, and at this location one pump, designated generally **54**, is located to pump lubricant from sump **44** into oil reservoir **14**.

Oil is transferred from reservoir **14** to various parts of the sewing machine mechanism through a second duct or passage **56** which extends upwardly through central partition **16** to intersect upper bore **24**. A second pump, designated generally **58** is located at the upper end of duct **56** to pump oil from passage **56** upwardly through a discharge tube **60** which discharges oil into the interior of a transparent dome **62** located at the top of main frame **10**. From dome **62**, oil flows downwardly into a chamber **64** from which it flows by suitable paths described more fully in parent application Serial No. 257,620, to various parts of the mechanism. Oil discharged from the lubricated parts of the mechanism is collected in sump **44** and re-cycled around the path described above.

Reservoir **14** normally maintains a substantial supply of oil, the amount being such that the normal level of oil contained within the reservoir is somewhere between upper shaft **28** and lower shaft **30**. In order that the supply of oil may be checked, main frame **10** is formed with an opening sealed by a transparent window **66** through which the level of oil within the reservoir may be observed. It is believed apparent that in order to supply oil to chamber **64** and hence to the mechanism, the level of oil within reservoir **14** must be maintained above the lower end of passage **56**.

Pumps **54** and **58** are of similar construction, and hence only pump **54** will be described in detail.

Since bore **26** serves as a bearing for shaft **30**, the shaft is received within the bore quite closely. An arcuate slot **68** is formed in shaft **30** at a location which axially overlaps the intersection of duct **50** and bore

26. The bottom of slot 68 is an eccentric or cam surface extending outwardly at both ends to merge with the full shaft diameter. In one sense, slot 68 may be said to cooperate with the wall of bore 26 to define an arcuate chamber which is rotated about the axis of bore 26 when shaft 30 is rotated.

A bore 70 extends through main frame 10 to intersect bore 26 at the point of intersection between bore 26 and duct 50. Bore 70 slideably receives one end of a plunger 72 which extends through bore 70 to project into an enlarged diameter section 74 of bore 70. A screw-plug 76 is threaded into frame 10 to close the outer end of bore 74. A bore 78 in the shank of plug 76 slideably receives the outer end of plunger 72 to assist in guiding plunger 72 in reciprocation within bore 70. Preferably, the end of plunger 72 which is received within bore 78 is chamfered as at 80. A compression spring 82 is mounted to act between the inner end of plug 76 and an enlarged collar 84 on plunger 72 whereby plunger 72 is resiliently maintained in contact with the surface of shaft 30.

The peripheral surface of shaft 30 which axially includes arcuate slot 68 may be described as a cam against which the inner end of plunger 72 is maintained in sealing engagement by compression spring 82. The line of contact between the plunger 72 and cam or eccentric surface 68 constitutes a straight line parallel to the axis of shaft 30.

Operation of pump 54 is as follows. Shaft 30 is driven to rotate in a clockwise direction when viewed in Figs. 3 and 4. When arcuate slot 68 is located out of engagement with plunger 72, as is the case in Fig. 3, plunger 72 engages the surface of shaft 30 in line contact to act as a seal between that portion of duct 50 which is below plunger 72 and the portion of duct 50 which is above plunger 72. As best seen in Fig. 2, the width of plunger 72 is greater than the diameter of duct 50.

As shaft 30 rotates in a clockwise direction from the position of Fig. 3 into the position of Fig. 4, arcuate slot 68 is advanced beneath the line along which plunger 72 seals with the surface of the shaft. As the leading end of slot 68 advances past plunger 72, the volume of the chamber located below the line of sealing engagement between plunger 72 and shaft 30 continuously increases. The chamber continues to increase in volume as the leading end of slot 68 passes into bore 26. Because of the increased volume of the chamber, a partial vacuum is exerted within the chamber and oil is drawn upwardly through passages 48 and 50 to fill the chamber. As slot 68 continues to advance in a clockwise direction, oil thus flows into the arcuate chamber defined between the bottom of slot 68 and the wall of bore 26.

Continued rotation of shaft 30 eventually brings the trailing end of slot 68 beyond the intersection of the lower portion of duct 50 and bore 26, thus trapping a charge of oil within the arcuate chamber formed between slot 68 and the wall of bore 26. Continued rotation of shaft 30 transports the trapped oil upwardly and discharges the oil into duct 50 at a location above the line of sealing engagement between plunger 72 and shaft 30. Since spring 82 maintains the end of plunger 72 in sealing engagement with either the outer surface of shaft 30 or the bottom surface of arcuate slot 68, the oil which is discharged into the upper or outlet section of duct 50 cannot return to the lower or inlet section of the duct.

The peripheral extent of slot 68 is selected to be less than the circumferential distance measured in the direction of rotation between the lower and upper sections of duct 50. By varying the depth of slot 68, the volume of the chamber defined by the slot and the wall of bore 26 may be varied to thereby regulate the capacity of the pump for a given speed of rotation of shaft 30. The chamber thus formed is filled with oil during each rotation of slot 68 successively past plunger 72, the lower portion of duct 50 and the upper portion of duct 50 and hence a known volume of oil is discharged into the upper section of duct 50 during each revolution of shaft 30.

The chamber formed between the outer end of plunger 72 and screw plug 76 is vented by hole 90 in screw plug 76 which communicates with hole 91 in frame 10. Hole 91 communicates with hole 92 which leads to the intake side of the pump 54. It will be understood that the inner end of screw plug 76 is not in sealing engagement with bore 74. Thus holes 91 and 92 also serve to drain leakage oil from bore 74 to the intake side of pump 54. It will be noted that the arrangement described entirely seals pump 54 from oil reservoir 14 which surround it, thus making it impossible for the contents of oil reservoir 14 to leak back to the intake side of the pump when the device is not being operated.

Pump 58 is substantially identical to pump 54 except that, since pump 58 is above the highest level of reservoir 14, it is not necessary to provide sealed passages for the purposes of venting and draining leakage oil.

While I have described but one embodiment of my invention, it will be apparent to those skilled in the art that the disclosed embodiment may be modified. Therefore, the foregoing description is to be considered exemplary rather than limiting and the true scope of my invention is that defined in the following claim.

I claim:

A pump comprising a frame having a first bore therein and a second bore intersecting and extending radially from one side of said first bore, said second bore having a reduced diameter section extending from its intersection with said first bore to an enlarged diameter section spaced from said first bore, a shaft rotatably journaled in said first bore, a plunger slideably supported in the reduced diameter section of said second bore and having a flat inner end engaging said shaft along a line parallel to the axis of said shaft, the circumferential portion of said shaft engaged by the inner end of said plunger during rotation of said shaft having a depressed eccentric portion adapted to receive the inner end of said plunger, said depressed eccentric portion extending only partially around the circumference of said shaft, means in the end of said enlarged diameter section remote from said reduced diameter section slideably supporting said plunger adjacent its other end, means engaged between said means in said enlarged diameter section and said plunger biasing said plunger against said shaft, an inlet duct in said frame intersecting said first bore and said second bore at one side of the line of engagement between said inner end of said plunger and said shaft, an outlet duct intersecting said first bore and said second bore on the opposite side of said line of engagement, means for rotating said shaft to successively advance said depressed portion past said outlet duct, said plunger and said inlet duct, and means defining a vent communicating with said enlarged diameter section for venting said enlarged diameter section and for returning leakage fluid to said inlet duct.

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