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AUTOMATIC LUBRICATOR FOR POWER DRIVEN CHAIN SAW

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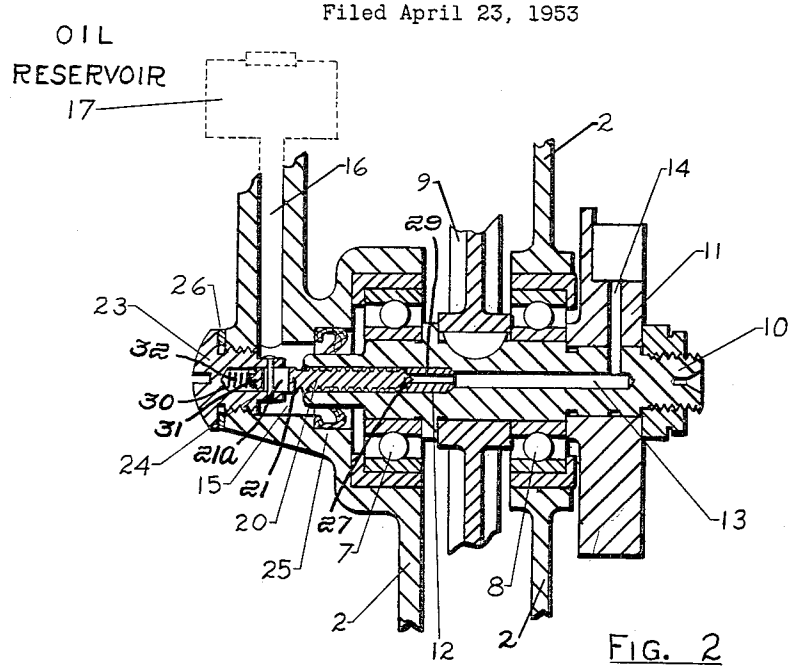


FIG. 2

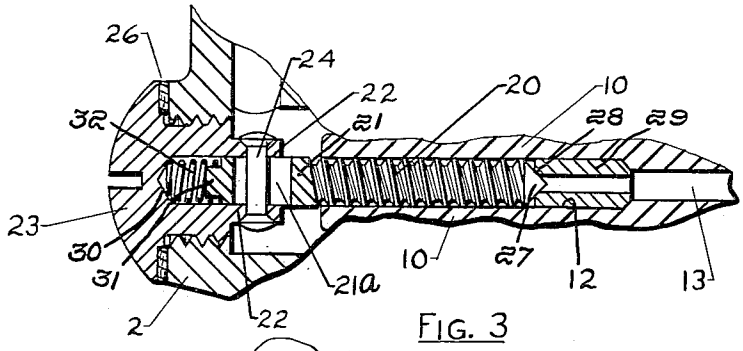


FIG. 3

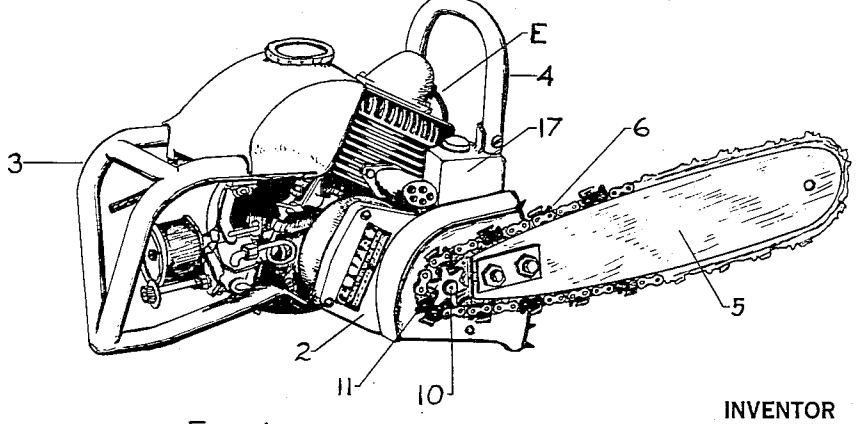


FIG. 1

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AUTOMATIC LUBRICATOR FOR POWER DRIVEN CHAIN SAW

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My present invention relates to power driven chain saws, particularly those of the portable type. It aims to extend the life and improve the operating efficiency of such saws by equipping them with built-in means whereby adequate lubrication may be constantly afforded automatically especially for the saw chain and operatively associated elements.

In the drawings illustrating by way of example one embodiment of the invention:

Fig. 1 is a perspective view of a typical portable chain saw unit incorporating the invention;

Fig. 2 is a sectional view in a plane through the axis of the saw chain drive sprocket and shaft, upon a larger scale; and

Fig. 3 is a sectional view corresponding to a portion of Fig. 2 upon a still larger scale.

The invention is applicable generally to power driven chain saws whether of the type having an electric motor or that having an internal combustion engine as the prime mover or power source. The saw unit selected for purposes of illustration in Fig. 1 comprises an internal combustion engine indicated generally at E integrated into a supporting frame including a transmission housing **2** and handle bars and positioners **3**, **4**. Adjustably fixed to the frame or housing is the cutter bar **5** presenting along its margin a continuous track for the endless saw chain **6**. At the supported end of the cutter bar **5** the chain passes in driven engagement about the drive sprocket **11** fixed at the outer end of the drive shaft **10**.

As seen in Fig. 2 the drive shaft **10** is rotatably mounted in suitable bearings **7**, **8** in the transmission housing **2** and has mounted on and keyed to it a rotary element **9** of the transmission whereby it is driven from the prime mover such as the rotor or crank shaft of the power source.

The saw chain drive shaft **10** is formed with a central bore extending from the inner or engine end, at the left in the views, the bore including an oil intake and driving or pumping portion **12** of calculated diameter and an oil conducting portion or duct **13**, generally of somewhat less diameter. The oil-receiving bore **12** extends from the inner or entering end of the drive shaft to the location of the drive sprocket **11**. The other or outer end of the shaft **10** is closed. One or more radial oil delivery ducts **14** extend from the outer bore portion **13** of the shaft and through the hub of and to the periphery of the sprocket **11**, opening for egress of the oil between the sprocket teeth, preferably at the bottom of an inter-tooth space substantially as shown; Fig. 2.

The inner end of the shaft **10** terminates at and is enclosed by an oil chamber **15** in the saw frame or housing **2** and which communicates by a passage **16** with a frame-supported oil reservoir **17** shown partly diagrammatically in Fig. 2; see also Fig. 1.

The inner and herein somewhat larger oil-driving portion **12** of the shaft bore receives and closely encompasses a relatively stationary helical stud or feed screw element **20**. This non-rotary oil-director member **20** in cooperation with the rotary hollow shaft **10** serves to effect oil

flow to the running saw chain and to restrain the oil at other times. Said oil conveyor and controller **20** has a shallow spiral thread of determined pitch for cooperation with the rotary shaft **10** in a manner to restrain the oil when the shaft is at rest, and to drive or pump the oil with a conveying action when the shaft is driving the saw chain. The outer diameter of the feed screw **20** loosely conforms to the cylindrical wall of the shaft bore portion **12** so that the spiral thread is in close proximity to or substantially in contact with it. The screw and bore diameters and the depth and pitch of the thread are calculated with reference to the designed speed of the shaft **10** and the rate of oil flow desired for the particular chain saw assembly.

The screw element **20** is held in operative position within the drive shaft **10** and is prevented from revolving with it by suitable mounting means which herein also affords ready access to and removability for the screw. In the illustrated example a squared portion **21** at the inner end of the screw **20** is set into a recess between lugs **22** on a threaded closure plug **23** in the housing **2**, opposite the oil-chamber end of the drive shaft **10**. The screw **20** is fixedly but demountably secured to the plug **23** as by a pin **24** passed through it and the ears **22** of the plug. Leakage of the oil to the outside of the drive shaft **10** is prevented by suitable packing **25** at the inner end thereof. The screw-supporting plug **23** also desirably is furnished with a neoprene or other oil-resistant washer **26**.

The size of the feed screw **20** and of the shaft bore **12** in which it is received, and the depth and pitch of the screw thread also are selected with reference to the viscosity of the oil and the attendant temperature conditions. With the drive shaft **10** at rest the viscosity of the oil is an important factor in preventing flow of the oil. During operation of the chain saw the same oil viscosity aids in promoting the forward travel of the oil along through the spiral passageway formed between the conveying screw thread and the surrounding bore wall of the revolving drive shaft **10**. The hand of the screw threading and the direction of rotation of the shaft **10** are matched so that with the shaft in motion the oil is driven forward toward and delivered to the sprocket wheel and thence to the saw chain and associated parts by the pumping or conveying action. In the illustrated example the screw **20** is of right hand, the oil advance is in a clockwise direction around it as viewed from the entering inner or left end of the screw in Figs. 1 and 2, and the rotation of the shaft **10** also is clockwise, as similarly viewed. The described relative dimensioning of the screw **20** and the shaft bore portion **12** and the depth and pitch of the screw thread are calculated with respect to the drive shaft speed, the oil viscosity and other expected circumstances of use so that a constant slow but adequate feed of oil to the sprocket wheel, the saw chain and its guide track about the cutter bar **5** is insured.

For the purposes of cleaning, the stationary oil feed screw **20** can readily be removed merely by backing out the mounting plug **23** which carries the feed screw **20** with it. Also by reason of the construction and arrangement of the illustrating example the rate of lubricant feed may be modified in accordance with seasonal or other operating conditions by similarly demounting and substituting another selectively available screw **20** with greater or less pitch and depth for the spiral passageway.

For some installations and operating conditions it is desirable to provide valve means for shutting off flow of lubricant when the chain saw or other machine equipped in accordance with the invention is at rest, and for opening the oil delivery duct at the start of and during operation. This applies more particularly with lubricants of relatively low viscosity or under high speed operation of the drive shaft such as the saw chain shaft **10** and

attendant building up of ssubstantial pressures effective on the lubricant. In the illustrated embodiment of the invention such valving provision is shown, in this instance automatic and through the medium of the spiral feed screw element **20** itself. While the valving may be variously accomplished a simple and efficient structure for the purpose is had by utilizing the screw element **20** for the additional valving function.

Accordingly, as best seen in Fig. 2, the inner end of the screw element **20** is tapered to present a conical valve **27** and the bore **12** of the shaft **10** is provided with a like-formed valve seat **28**. The latter may be on an adapter sleeve **29** inserted in the shaft bore subject to removal when the valve feature is not desired.

To afford the valving action the combined feed screw and valve element **20** is given capacity for bodily shifting movement in the axial direction. Accordingly the outer squared portion **21** of the screw and valve element **20** adjacent the retaining pin **24** has the opening through which the pin passes somewhat elongated to provide a guide slot **21***a*, of sufficient extent axially to permit the element **20** to move to and from closing position at the valve seat **28**. The outer end of the feed screw and valve element **20** is reduced or otherwise formed as at **31** for seating the inner end of a coil spring **32** positioned in a central recess **30** formed in the closure plug **23**, in prolongation of the bore **12** of the rotary shaft **10**. Thus the feed screw-valve **20** is urged into the valve closing seated position as shown in Fig. 3, also Fig. 2.

When the machine or apparatus such as the chain saw of the drawings is started up for use the rotation of the shaft **10** in its encompassing relation to the non rotative feed screw and valve element **20** develops a pressure upon the lubricant within the shaft bore **12** and effective on the feed-screw valve element **20** to shift it lengthwise against the loading of the spring **32**. Thus the valve **27** is opened automatically and releases the lubricant for advance under the continuing influence of the feed screw within the rotating shaft **10**, through the passages **13**, **14** to the drive sprocket and saw chain or other parts to be lubricated. The spring **32** generally is relatively light and is selected to permit valve opening by the lubricant pressure available under the given operating circumstances. When the power is shut off and the drive shaft **10** comes to rest the valve member **27** automatically reseats under action of the valve spring **32** and counteracts any tendency of further flow of lubricant.

As apparent from the foregoing, the lubricant feeding feature as afforded by the spiral formation of the non-rotary element **20** in conjunction with the accompanying rotary shaft **10** may be utilized either with or without the provision for automatic shut-off and opening with respect to the lubricant supply.

My invention is not limited to the particular embodiment thereof illustrated and described herein, and I set forth its scope in my following claims:

1. In a portable powered chain saw having a frame, a rotary drive shaft thereon carrying a drive sprocket for the saw chain, a central bore in the drive shaft from one end to the sprocket with a communicating passage to the periphery of the latter, an oil chamber on the frame and enclosing the bore entrance end of the shaft, a stud having a longitudinally advancing circumferential spiral formation extending into the shaft bore and proportioned relative thereto for flowing oil from said chamber during rotation of the shaft relative to the stud, a threaded plug on the frame at the oil-chamber end of the shaft and having a central bore supporting the stud non-rotatably but with capacity for axial shifting, a valve on the stud forward of the spiral formation, a seat for the valve in the shaft bore, and spring means in the plug bore urging the stud axially into valve closing position subject to automatic opening against the spring by oil pressure attendant on rotation of the shaft.

2. In a portable power-driven chain saw of the type comprising a frame supporting a prime mover, a cutter bar on the frame, a saw chain running on the cutter bar, and a rotary drive shaft on the frame operable by the prime mover and carrying a drive sprocket for the saw chain, automatic lubricating mechanism for the sprocket and the chain passing about it, said mechanism including a central bore in the drive shaft from one end to the sprocket and having a connecting radial passage opening to the sprocket periphery, an oil chamber enclosing said shaft end and supplied from a reservoir, a stud having an oil-feeding spiral thereon in and closely encompassed by the shaft bore and projecting at the oil-chamber end, the frame presenting a stationary wall opposite the oil-chamber end of the drive shaft, a removable plug on said wall, means on the plug supporting the spiral-carrying stud non-rotatably in line with the axis of the shaft bore and also guiding the stud for limited bodily movement axially, said stud having the shaft-encompassed end formed as a valve and the shaft bore being formed with a seat therefor, and spring means on the plug loading the stud in valve-closing direction.

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