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[33] **Great Britain**

[31] **33,256/65**
Continuation-in-part of application Ser. No. 569,324, Aug. 1, 1966, now abandoned.

[56]		References Cited	
UNITED STATES PATENTS			
1,298,465	3/1919	Dean	310/156
1,914,900	6/1933	Tarboy	184/7(C-1)
1,945,596	2/1934	Chryst	184/7(C)
2,453,636	11/1948	McKay	310/156(UX)
2,838,669	6/1958	Horsch	331/148X
3,040,185	6/1962	Horton	307/275
3,108,198	10/1963	Lentz	307/225
3,121,803	2/1964	Watters	307/225
3,165,171	1/1965	Baeriswyl	184/3

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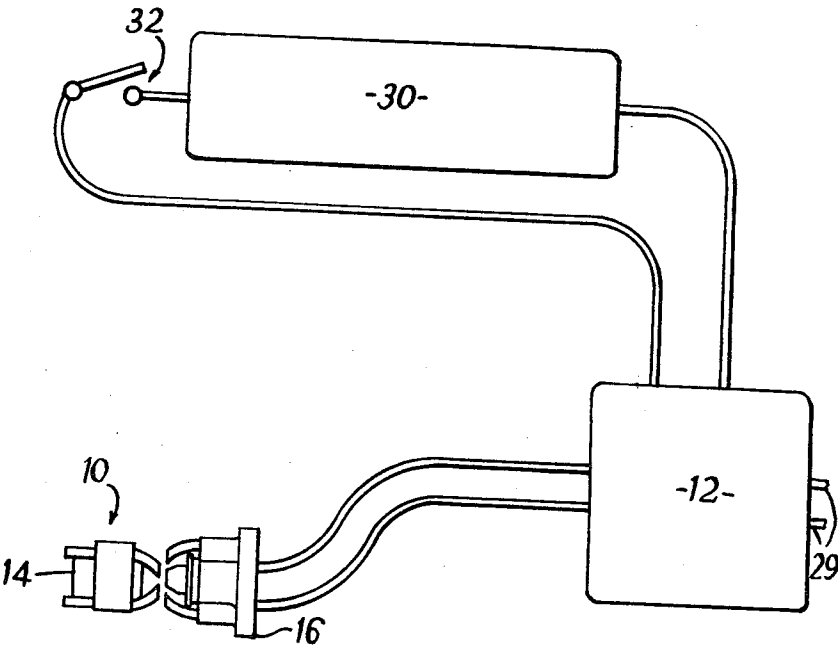
[54] **PULSE-ACTUATED LUBRICATION SYSTEM**
9 Claims, 7 Drawing Figs.

[52] U.S. Cl. **184/7,**
123/196, 307/225, 310/156, 331/148

[51] Int. Cl. **F16n 7/14,**
H03k 21/00, H02k 21/12

[50] Field of Search. 123/196;
184/7, 6, 7C, 7C-1; 307/225, 275; 331/148;
310/156

ABSTRACT: A lubricating system supplies lubricant to various parts of an apparatus. An electrical pulse generator provides a signal so as to actuate the lubricating means. A blocking oscillator stores a specific number of pulses from the generator to provide a counting cycle from which the signal is produced.



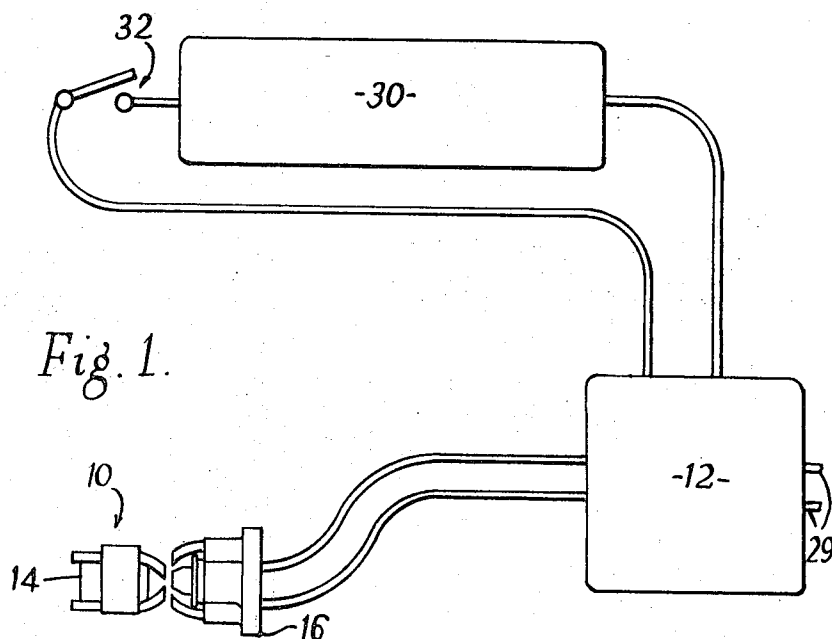


Fig. 1.

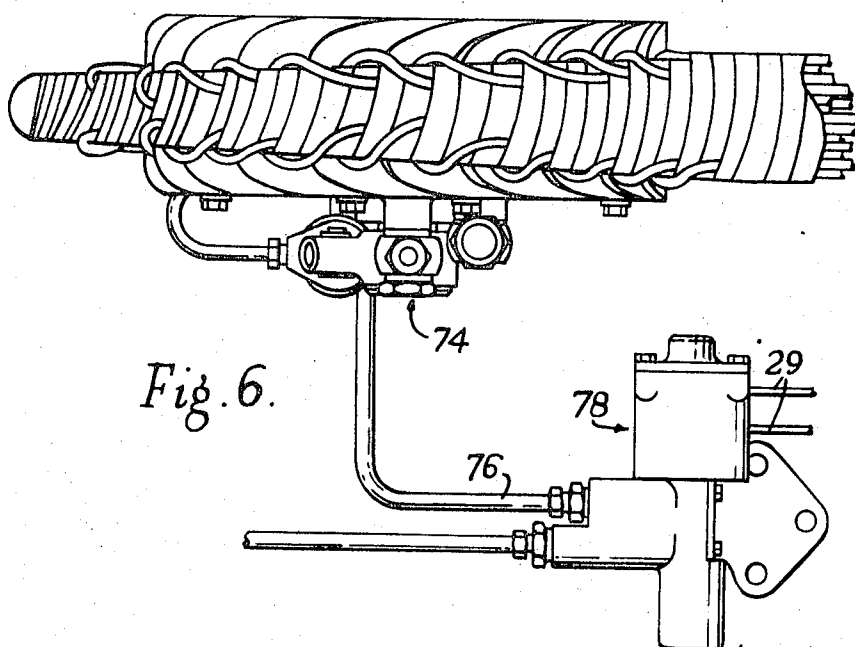


Fig. 6.

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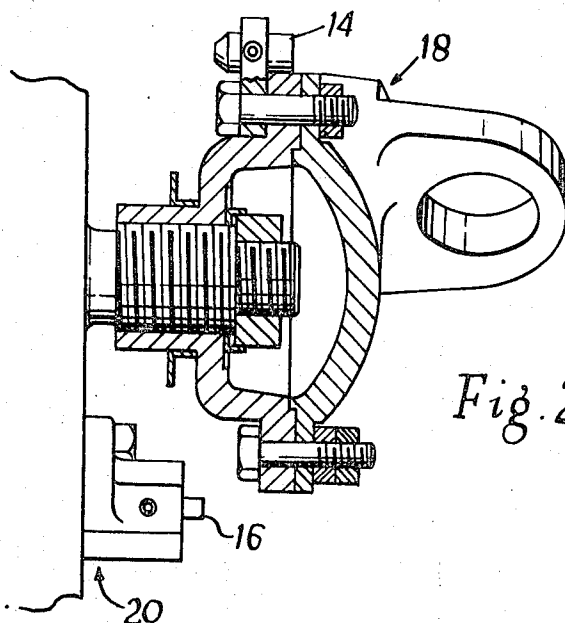


Fig. 2.

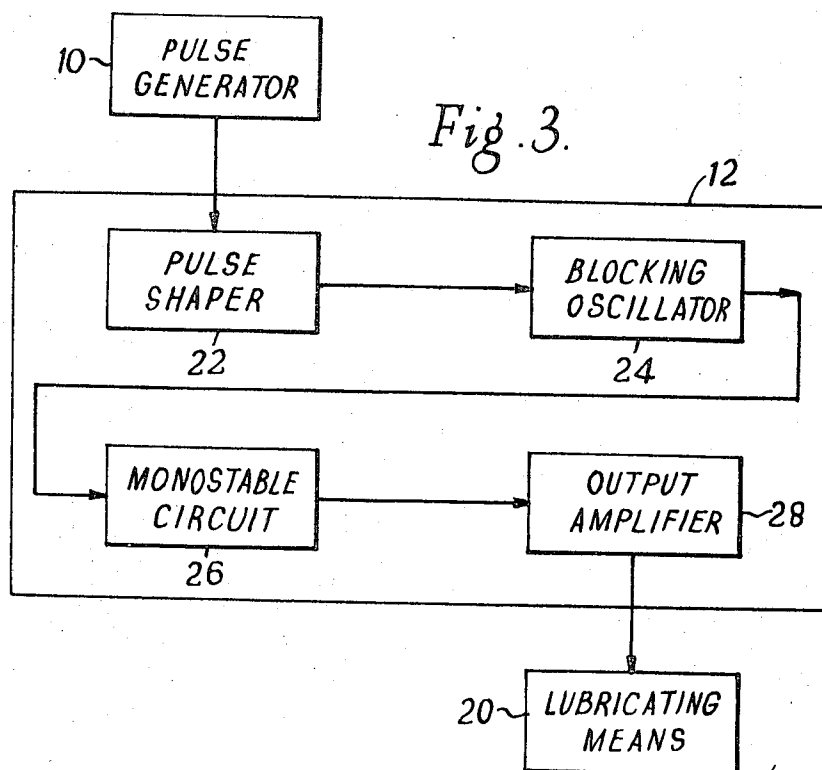


Fig. 3.

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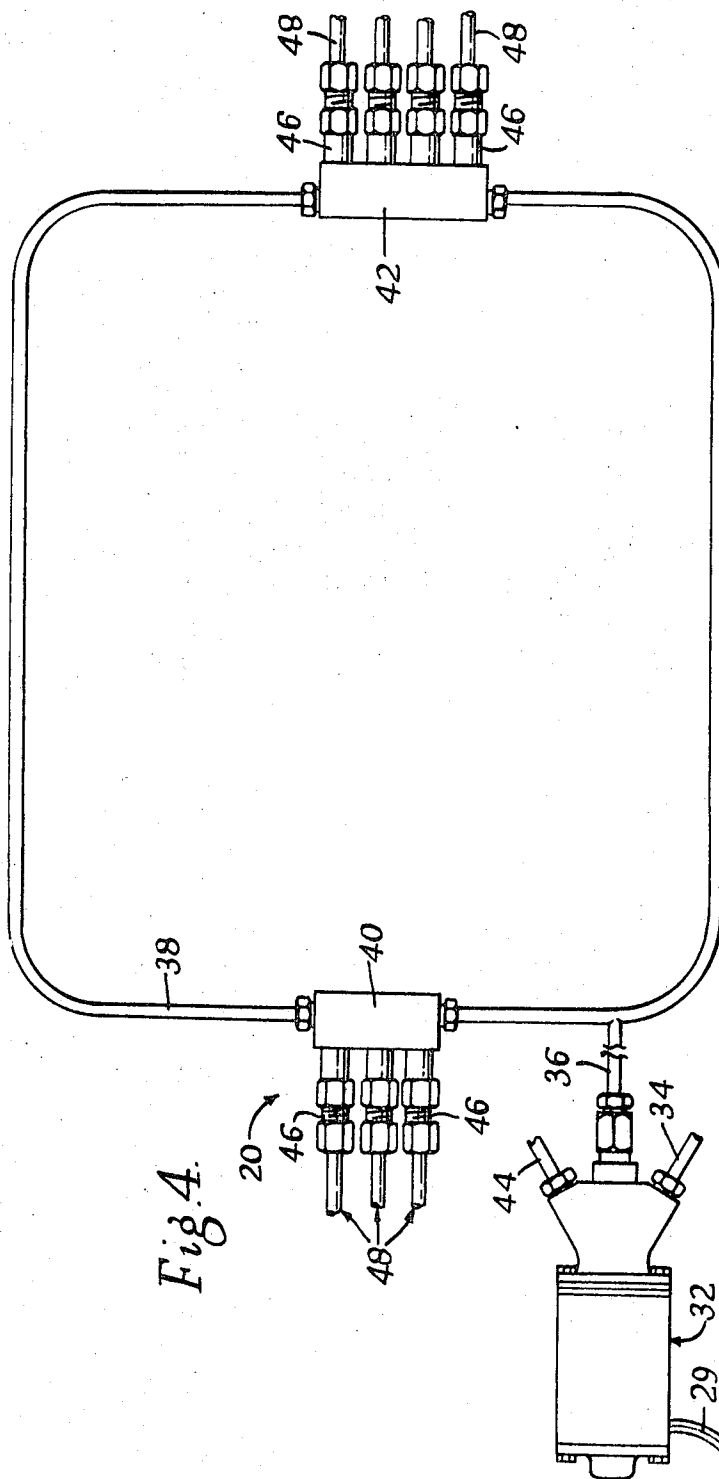
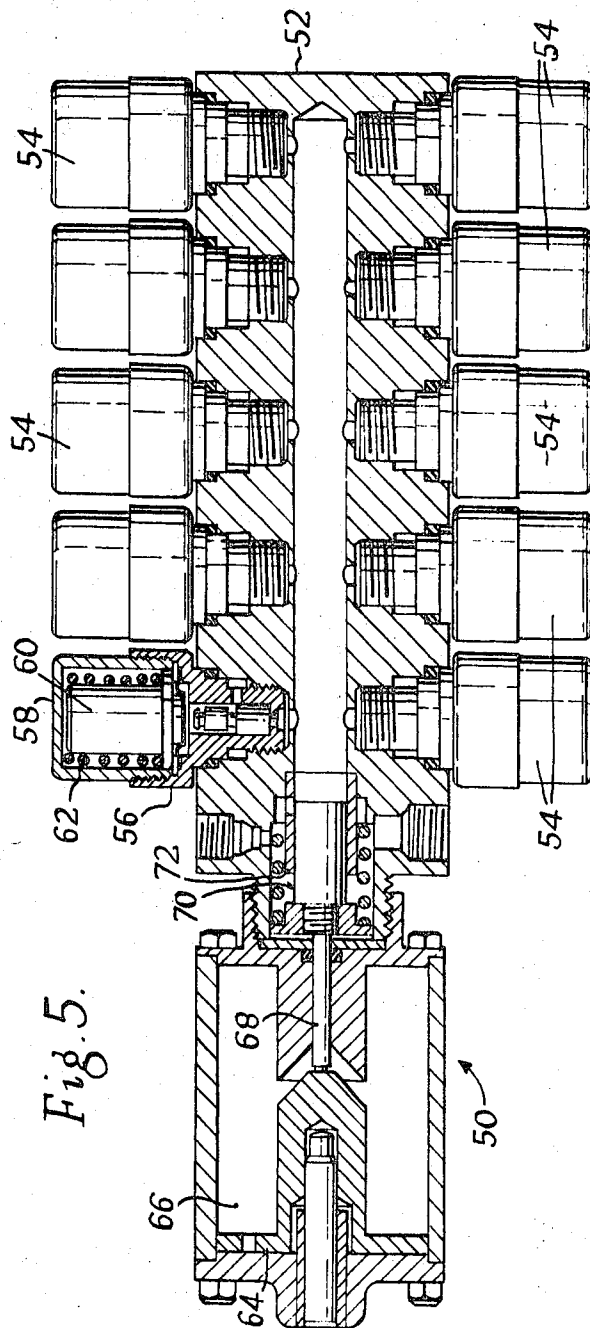


Fig. 4.

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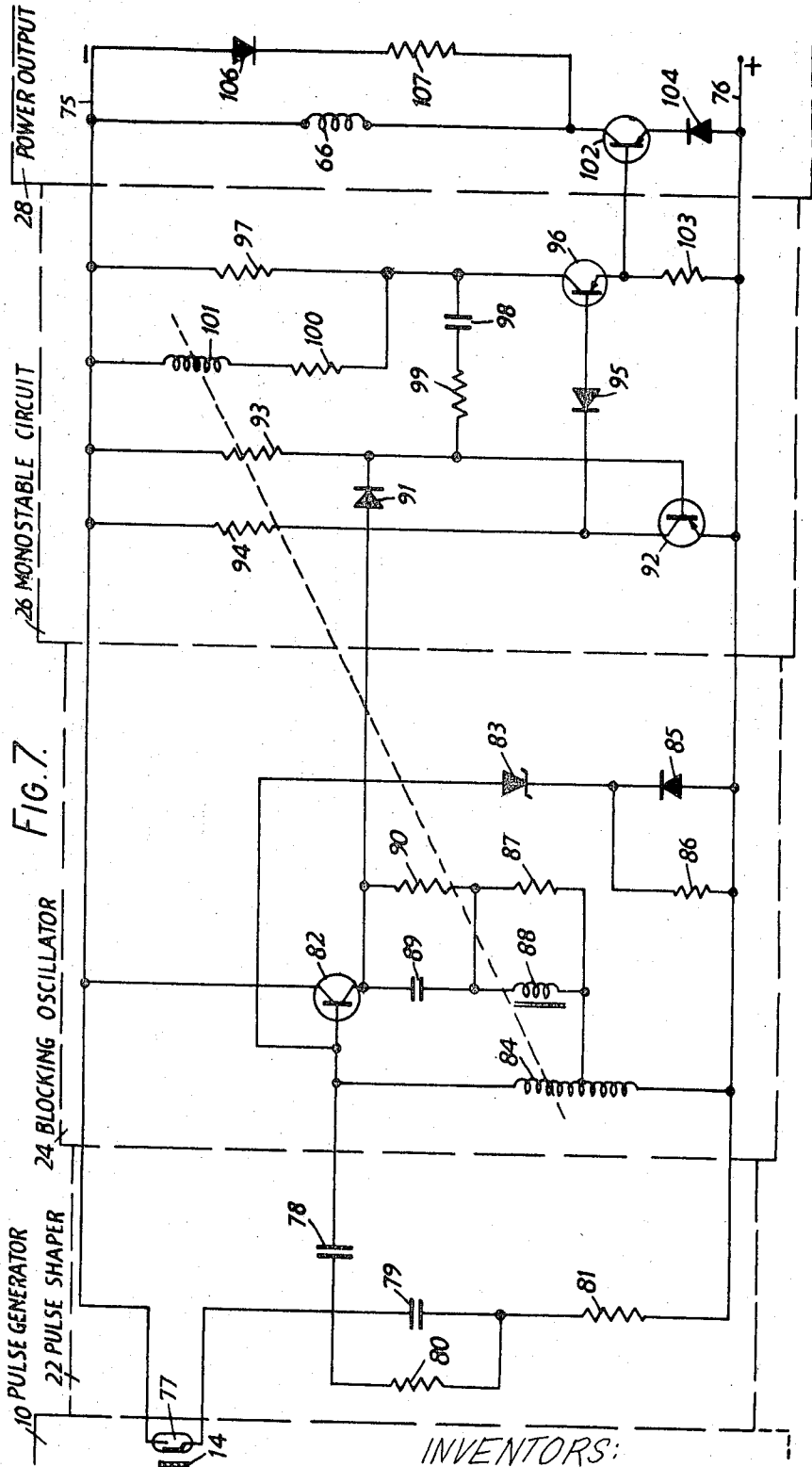


FIG. 7.

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PULSE-ACTUATED LUBRICATION SYSTEM

The present application is a continuation-in-part of application Ser. No. 569,324, filed Aug. 1, 1966, and now abandoned.

The present invention relates to a system and apparatus for lubricating which is particularly, although not exclusively, suitable for lubricating vehicles.

It is an object of the invention to provide means for lubricating a vehicle or machinery, which means may be independent of other systems in the vehicle or machinery.

It is a further object to provide a lubricating system by means of which predetermined quantities of lubricant can be supplied to appropriate parts of the vehicle or other apparatus to be lubricated, at appropriate intervals, for example intervals dependent on the rate of operation of the apparatus to be lubricated. By means of the system of the invention, a vehicle can be lubricated in accordance with the mileage covered by the vehicle.

It is an advantage of the invention that the supply of lubricant can be regulated in accordance with the requirements of the apparatus to be lubricated, and thereby wastage of lubricant due to excessive rate of supply can be avoided, while at the same time proper lubrication is ensured by the regular supply of lubricant.

A particular feature of the invention is the control of the supply of lubricant by electrical means.

According to this invention, a system for lubricating apparatus includes control means for delivering electrical signals at a rate dependent on the rate of operation of the apparatus to be lubricated, and lubricating means responsive to the electrical signals delivered by the control means for delivering lubricant to parts of the apparatus to be lubricated.

Preferred forms of the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a schematic diagram of a control means forming part of the invention;

FIG. 2 shows one way of arranging parts of the control means on a vehicle;

FIG. 3 is a schematic block diagram illustrating features of a preferred control means;

FIG. 4 is a diagrammatic representation of one form of lubricating means;

FIG. 5 is a longitudinal sectional view showing another form of lubricating means;

FIG. 6 is a schematic diagram showing another form of lubricating means; and

FIG. 7 shows the control means of FIG. 3 in more detail.

In each of the embodiments of the invention to be described, the control means comprises a pulse generator 10 and an electric signalling device 12.

The pulse generator 10 comprises a magnet 14 and a pickup device 16. The pickup device 16 is adapted to deliver an electric pulse each time the magnet passes it, and the magnet and pickup are each mounted on parts of the vehicle or other apparatus to be lubricated, which are movable relative to each other so as to cause the magnet to pass towards and away from the pickup periodically in accordance with the rate of operation of the vehicle. Conveniently, the pickup 16 is mounted on a fixed part of the apparatus and the magnet is mounted on a rotating part, so that it is carried with a circular motion and passes adjacent to the pickup once in each revolution of the rotating part. In a motor vehicle, the magnet can, for example, be mounted on the propeller shaft near the differential gear, and the pickup is mounted on another part of the vehicle, e.g. the chassis, in a position adjacent to the path of the magnet during rotation of the propeller shaft. As shown in FIG. 2 the magnet 14 is mounted on a transmission yoke 18 which rotates with the propeller shaft and the pickup 16 is mounted on the engine mounting 20.

Rotation of the propeller shaft causes the magnet to move in a circle, and, once in each revolution, the magnet passes close to the pickup and causes the pickup to generate an electric pulse which is passed by conducting leads to the electrical signalling device.

The signalling device 12 is adapted to deliver electric output pulses or signals to the lubricating means via conducting leads after receiving pulses from the pulse generator.

The signalling device is adjustable so that a predetermined number of pulses delivered by the pulse generator at the rate of revolution of the propeller shaft are absorbed before an output signal is delivered. Each output pulse or signal delivered by the signalling device is passed to lubricating means 21 which responds by delivering lubricant to desired lubrication points.

In one form of the invention illustrated in FIG. 3 the signalling device 12 comprises a pulse shaper 22 which receives pulses from the pulse generator and shapes them to a constant amplitude and duration. The shaped pulses are passed to a blocking oscillator 24 comprising a feedback transformer which is magnetized increasingly in discrete steps by the successive pulses until eventually the core of the transformer becomes saturated whereupon the oscillator is triggered to pass an output pulse of predetermined "overshoot" amplitude to a monostable circuit 26. The monostable circuit is triggered by the output pulse to produce a pulse of short duration which is then amplified by an amplifier 28 to produce output signals which are passed over conducting leads 29 to control the lubricating means 20.

At the instant the amplifier produces an output pulse, it also sends a reset pulse back to the feed back transformer in the blocking oscillator 24 to reset the saturated core of the transformer back to its original state, whereupon further pulses from the pulse generator progressively magnetize the transformer core in a new cycle similar to that just described.

The ratio of the number of output signals to the number of pulses delivered by the pulse generator can be varied by adjustment of the steady state magnetization of the core of the feedback transformer in the blocking oscillator.

The signalling device may be supplied over conducting leads with electric current from the vehicle battery 30 to which it is connected through the ignition switch 32 as shown schematically in FIG. 1.

The lubricating means 20 may take various forms but in all cases it includes at least one pump the operation of which is controlled by the output signals delivered by the control means.

The or each pump delivers lubricant from a reservoir to a distribution system which distributes lubricant to each of the lubrication points on the vehicle or other apparatus.

In order to supply lubricant from a single pump to a number of lubrication points, the distribution system may comprise one or more manifolds from each of which lubricant is supplied to individual lubrication points in quantities regulated by metering devices.

Referring now to FIG. 4 one form of lubricating means 20 comprises a solenoid-operated pump 32 which is formed as single unit, the pump being operated by energization of the solenoid by the output signals from the control means. Lubricant is fed to the pump through an inlet 34 by gravity from a reservoir (not shown) and is forced by the pump through a feed outlet 36 into a closed-circuit ring main 38 which feeds manifolds 40, 42.

The pump is also provided with a vent 44 leading to the lubricant reservoir.

Each of the manifolds 40, 42 is provided with capillary-type metering units 46 which are adjustable to permit a regulated feed of lubricant from the ring main through outlets 48 to individual points to be lubricated.

In this embodiment, all the capillary-type metering units 46 in the ring main 38 share the lubricant delivered to the ring main by the pump, and each metering unit delivers a proportion of the lubricant according to the setting of the individual metering unit.

The capillary-type metering units 46 are of conventional construction and may be made of metal or injection-molded plastics material and are adapted to be held in screw-fit or press-fit engagement in the manifolds in the ring main.

In a modified form of this embodiment shown in FIG. 5, the output signals from the control means energize a solenoid-operated pump 50 which is similar to the pump 32 but instead of the oil delivered by the pump being shared by a number of capillary metering devices and distributed in proportion to the settings of the individual metering devices, the oil is delivered by the pump to a manifold block 52 which comprises a number of displacement metering devices 54. If desired a number of such manifold blocks can either be arranged around a ring main or individually supplied by the pump.

Each of the displacement metering devices 54 is adjustable to regulate the quantity of oil delivered to a number of lubrication points and comprises a body 56 into which is screwed a housing which defines a chamber 58 in which is a spring-loaded piston 60 of adjustable stroke. A valve in the body of the metering device controls an oil inlet and an oil outlet. Oil delivered under pressure by the pump via the manifold lifts the valve so that the outlet is closed and oil enters the chamber 58 through the inlet, displacing the piston upwardly against the resilient action of the spring until the piston reaches the end of its permitted stroke. Immediately the pump 50 ceases to deliver oil under pressure on the return stroke of its piston, the spring-loaded piston 60 in the metering device begins to return downwardly under the action of the spring 62, immediately forcing oil downwardly on to the valve which moves downwardly to close the inlet and open the outlet. The continued descent of the spring-loaded piston 60 feeds oil at a pressure determined by the strength and compression of the spring 62 from the chamber, through the outlet, into a pipe which conveys the oil to the points to be lubricated.

As shown in FIG. 5, the pump 40 has a movable core 64 surrounded by a solenoid coil 66. When the solenoid is actuated by an output pulse from the control means, the core displaces a floating pin 68 which in turn displaces a spring loaded piston 70 in a pump cylinder 72 to eject lubricant from the cylinder to the distributing system. When the solenoid is deenergized the spring-loaded piston 70 returns to its former position to admit more lubricant to the cylinder 72.

In another embodiment shown in FIG. 6 the lubricating means comprises a pump 74 for delivering lubricant from a supply to the required lubrication points, the pump being operated by compressed air which is conveniently drawn from the vehicle braking system through a pipeline 76. The supply of air to the pump 74 is regulated by an air control unit 78 in the pipeline. The air control unit is an electrically controlled valve of conventional construction having a solenoid which is energized by the output signals of the control means described above.

In a further embodiment instead of the lubricant pump being operated by compressed air or an integral solenoid the pump is driven through a ratchet gear which maybe operated either by means of a solenoid energized by the output signals of the control means or by a single-acting pneumatic piston-cylinder arrangement operated by compressed air, the supply of which is controlled by an air control valve in accordance with the receipt of output signals from the control means. For a better understanding of this embodiment reference may be made to our copending application Ser. No. 540,445 filed Mar. 8, 1966.

Referring now to FIG. 7, lead 75 is the negative supply line and lead 76 is the positive supply line. The stages shown in FIG. 3 are indicated as enclosed in chain lines. The pulse generator 10 comprises a permanent magnet 14 which is movable as shown in FIG. 2 so as to actuate a reed switch 77 which is substituted at the station occupied by coil 16 for this latter coil. The reed switch 77 is placed across lead 75 and the pulse shaper 22 being connected to capacitor 78 and to the parallel combination of capacitor 79 and resistor 80. Capacitor 79 and resistor 80 are joined, through resistor 81, to positive rail 76.

The base terminal of transistor 82 is joined to the anode of zener diode 83, one end of saturable reactor 84 and capacitor 78. The cathode of zener diode 83 is connected in series with

the parallel combination of resistor 86 and forward biased diode 85 to the positive lead 76. A tapping made in the windings of reactor 84 is connected to the junction of inductance 88 and resistor 87. Inductance 88 is joined in series with capacitor 89 to the emitter of transistor 82 and in parallel with resistor 87. Resistor 90 is connected to the junction of inductance 88 and capacitor 89 and in parallel with capacitor 89.

The emitter of transistor 82 is also connected to the anode of diode 91, the collector of transistor 82 being connected to the negative lead 75. The cathode of diode 91 is connected to the base of transistor 92 and, through resistor 93, to the negative lead 75. The collector of transistor 92 is connected through resistor 94 to the negative lead 75. The emitter of transistor 92 is connected to the positive rail 76. The collector of transistor 92 is connected to the cathode of diode 95, the anode of diode 95 being connected to the base of transistor 96. The collector of this transistor 96 is taken through resistor 97 to the negative lead 75. Capacitor 98 joined in series with resistor 99 are between the base of transistor 92 and the collector of the transistor 96. Connected to the collector of transistor 96 is resistor 100 which is joined in series with inductance 101 to the negative lead 75. Inductance 101 is a feedback winding wound on the same core as inductance 84. The emitter of transistor 96 is connected to the base of transistor 102 and through resistor 103 to the positive lead 76. The emitter of transistor 102 is connected in series with forward biased diode 104 to the positive lead 76. The collector of transistor 102 is connected through lead 105 and actuating coil 66 (see FIG. 5) to the negative lead 75. The anode of diode 106 is connected to the negative lead 75 and the cathode of this diode is connected in series with resistor 107 to the collector of transistor 102.

Magnet 14 may be attached to a rotating member in the vehicle. When it travels past the reed switch 77, the switch contacts close and the pulse shaping network of resistors 80, 81 and capacitors 78, 79 produce a voltage pulse of constant amplitude and duration to trigger the blocking oscillator transistor 82. Then flux density is built up in the core of reactor 84 in discrete steps by successive pulses. When the reactor 84 saturates, the oscillator produces a pulse with sufficiently long overshoot to trigger a monostable circuit. The monostable circuit comprising transistors 92 and 96 and associated networks reshapes this pulse so that it is suitable to drive power transistor 102 and thus energize the actuating solenoid coil 66. At the same time that actuating coil 66 is energized a reset coil 101 in the monostable is energized to reset the now saturated core to its original state.

The scaling factor of the counter can be varied by changing the steady state magnetization of the reactor 84 by varying the position of the core in the coil or alternatively by varying the tapping point.

Voltage pulses generated in a fixed coil by a rotating magnet can be used instead of a reed switch.

The components used in the circuit of FIG. 7 are as follows.

Resistors (in ohms):

80	220k
81	1k
86	1k
87	150
90	5.6k
93	27k
94	1k
97 (3 watts wirewound)	22
99	6.8k
100	180
103	47k
107	10

Capacitors (in farads):

78	1 kp
79	0.022μ
89	0.47μ
98 (40 volts)	16μ

Inductances:

88	700μH
84—Teleon core HCR 1c, 0.002 Tape, 0-50 turns, 0-150-300 turns 38 SWG. of EnCu.	

Active components

Transistors:

82	-----	ACY 22
92	-----	ACY 22
96	-----	ACY 41
102	-----	OC 35

Diodes:

83 (Zener)	-----	BZY 88 C9V1
85	-----	OA 47
91	-----	OA 81
95	-----	BYX 36
104	-----	BYZ 19
106	-----	BYX 36

We claim:

1. A system for lubricating apparatus having lubricating means operatively responsive to an operating signal, said system comprising: electrical pulse generator means including magnet means and magnetic flux detector means movable by an apparatus relative to each other in pulse generating relation for generating electrical pulses, and signal means for sending an operating signal to actuate said lubricating means, including a blocking oscillator which stores a specific number of pulses from said generator means to provide a counting cycle and then produces said operating signal, the signal means being resettable for the next counting cycle upon actuation of said lubricating means.
2. A system as claimed in claim 1 including a pulse shaper positioned between the pulse generator means and the signal means for shaping the generated pulses to constant amplitude and duration.
3. A system as claimed in claim 1 in which the magnetic means and flux detector means are mutually rotatable with one positioned adjacent the circular path of the other.
4. A system as claimed in claim 3 wherein the blocking oscillator comprises a feed back transformer which is stepwise magnetized by the electrical pulses and produces an output

pulses on core saturation.

5. A system as claimed in claim 4 wherein the specific number of electrical pulses stored by the feed back transformer is adjustable by variation of the steady state magnetization of the core.
6. A system as claimed in claim 4 including a monostable circuit which is triggered by the output pulse from the feed back transformer to produce an operating signal.
7. A system as claimed in claim 6 in which the feed back transformer is reset to perform another counting cycle by a reset pulse produced by an amplifier following the monostable circuit.
8. A system as claimed in claim 7 wherein the magnetic means and flux detector means are relatively movable by the transmission system of the apparatus.
9. A vehicle lubrication system comprising:
 - a magnet attached to a moving part of the vehicle;
 - a magnetic pickup attached to a nonmoving part of the vehicle;
 - a pulse shaper operatively connected with said pickup for shaping the pulses produced by the pickup;
 - a feed back transformer operatively associated with said pulse shaper and which is stepwise magnetized by pulses from the pulse shaper to give an output pulse for a specific number of input pulses;
 - a monostable circuit operatively connected to said transformer and triggered by an output pulse from the transformer;
 - an output amplifier connected to amplify pulses received from the monostable circuit and to supply an operating signal; and
 - a signal response lubricating means connected to said output amplifier, the feedback transformer being reset by a reset pulse emitted by the amplifier.

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