

Nov. 12, 1940.

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2,221,585

PUMPING APPARATUS

Filed Dec. 2, 1938

4 Sheets-Sheet 1

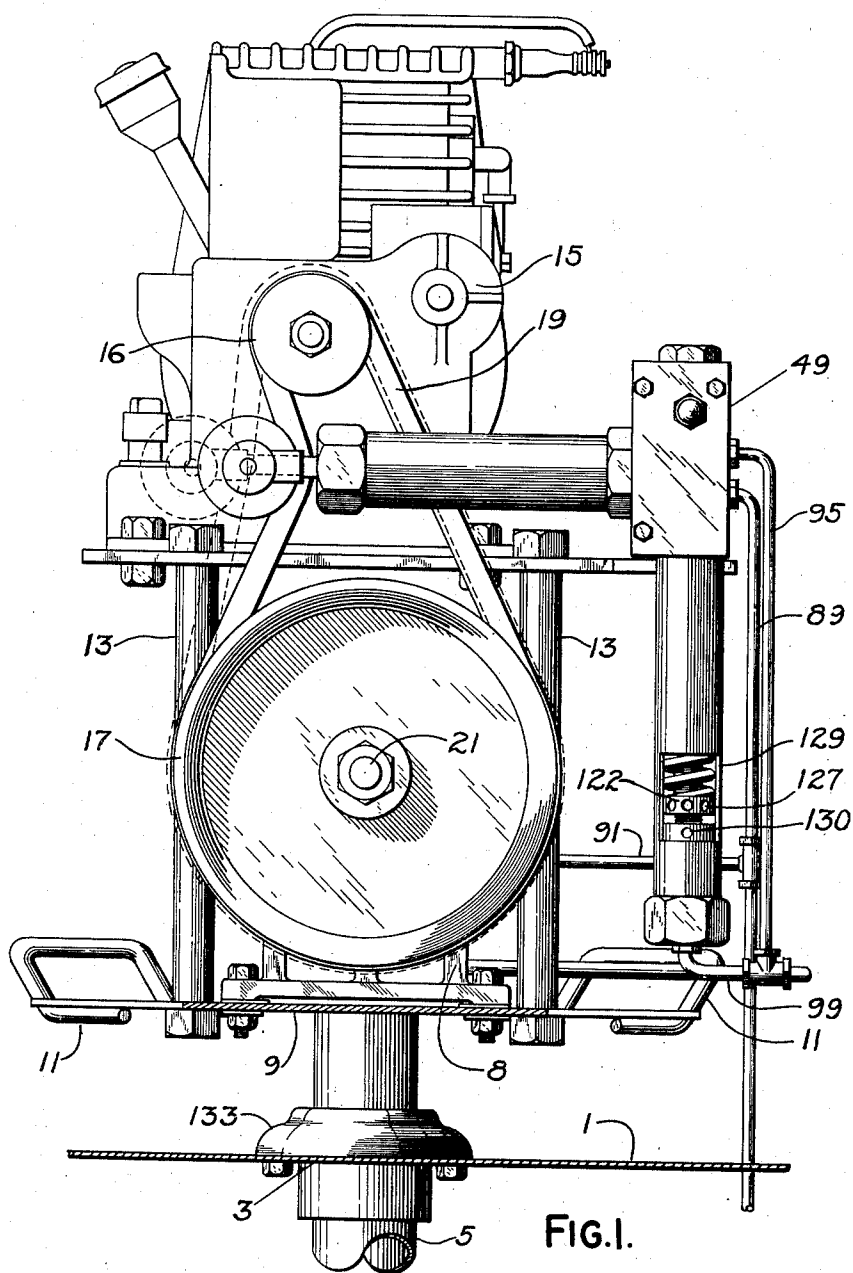


FIG. 1.

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4 Sheets-Sheet 2

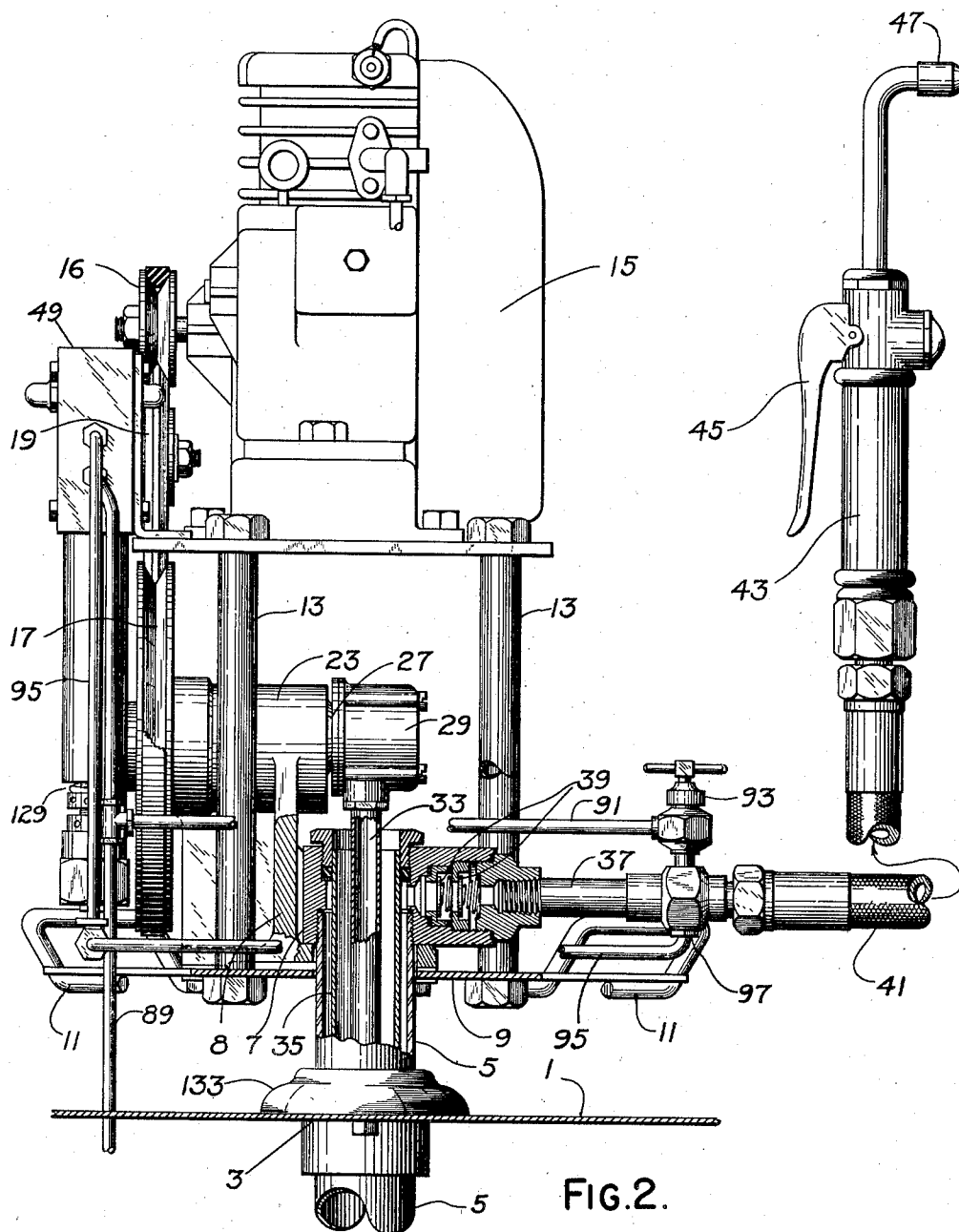


FIG.2.

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4 Sheets-Sheet 3

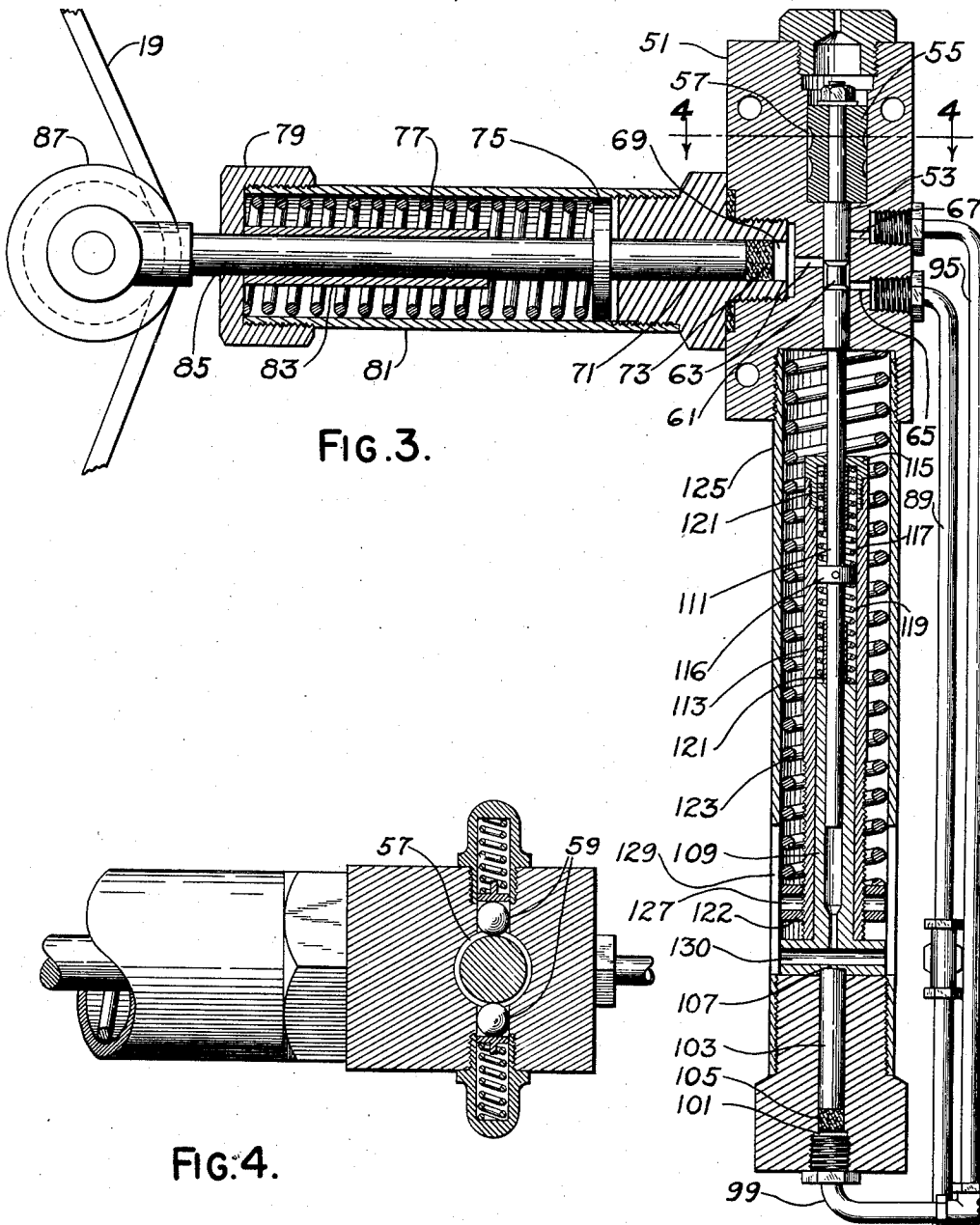


FIG. 4.

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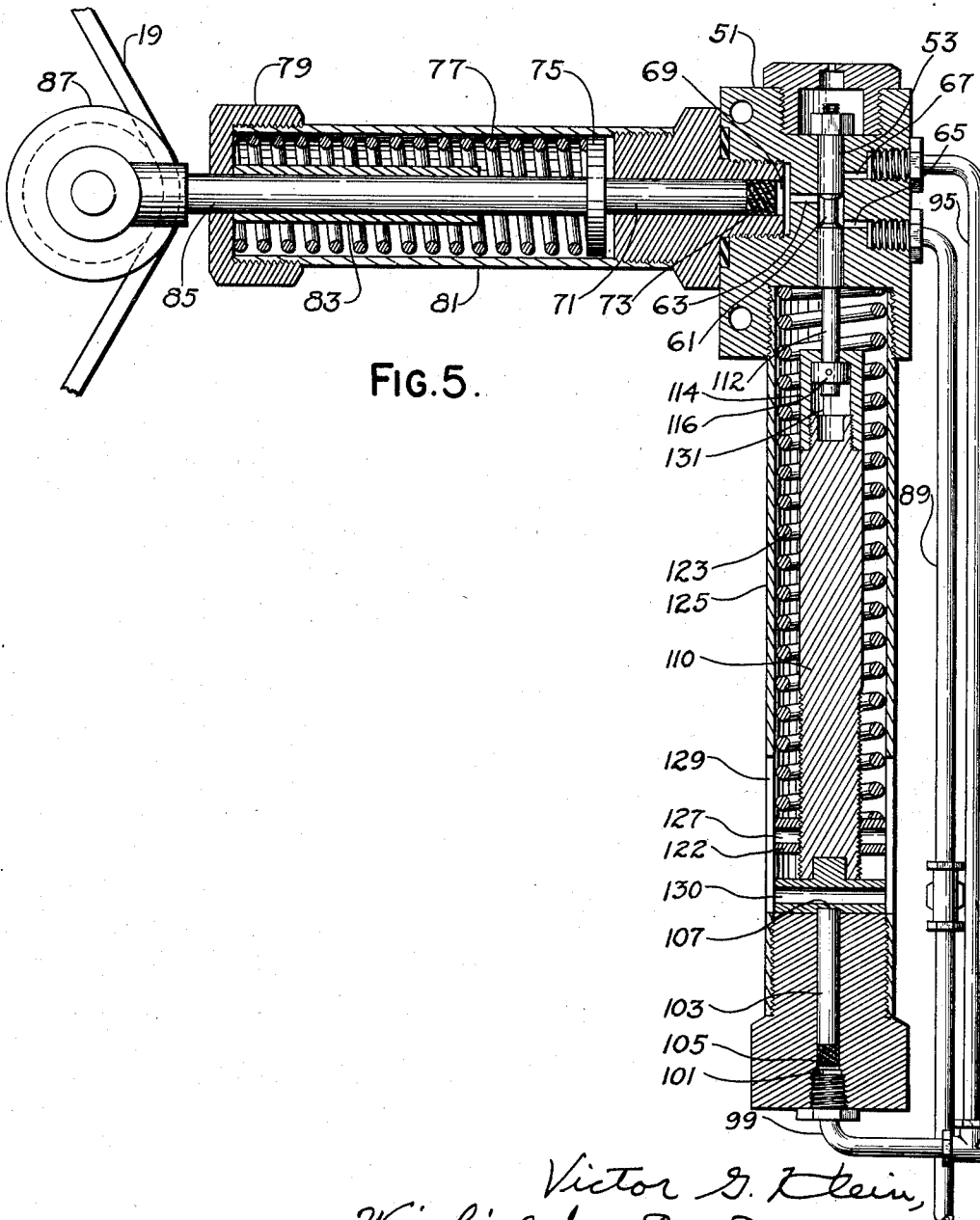


FIG. 5.

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UNITED STATES PATENT OFFICE

2,221,585

PUMPING APPARATUS

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Application December 2, 1938, Serial No. 243,540

16 Claims. (Cl. 74-242.11)

This invention relates to pumping apparatus, and with regard to certain more specific features, to high-pressure lubricant pumps adapted to be driven from continuously operating motors such as internal combustion engines.

Among the several objects of the invention may be noted the provision of a high-pressure lubricating apparatus having a lubricant pump driven from an internal combustion engine in which, when a line control valve is moved to open position, there is automatically effected operation of the pump to maintain an instantaneously available line pressure; the provision of a drive between the pump and the operating engine in which, when said valve is closed, there is effected automatic disconnection or de-clutching of the pump from the continuously running engine; the provision of de-clutching apparatus comprising a simple form of belt drive with means for maintaining constant belt tension over a range of lubricant pressure conditions; and the provision of apparatus of this class in which the clutching and de-clutching means functions with a quick action in order to avoid excessive belt wear. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention:

Fig. 1 is an end elevation of the apparatus;

Fig. 2 is a side elevation, parts being broken away;

Fig. 3 is an enlarged vertical section of a clutch control valve;

Fig. 4 is a cross section taken on line 4-4 of Fig. 3; and,

Fig. 5 is a view similar to Fig. 3 showing another form of valve.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

At many locations, such as at the sites of building contractor's operations and at some rural filling stations, neither pneumatic engines nor electric motors are available for driving lubricant pumps, and even where they are available, it is sometimes desirable, for purposes of portability, to drive the lubricant pump by means of an engine which is independent of air and

electric lines. However, such independent engines (internal combustion or gasoline engines) differ from electric and pneumatic motors in that the gasoline engine cannot be started under any substantial load. That is to say, when the load is applied to an internal combustion or gasoline engine, the engine must be in motion. The present invention provides means for adapting the internal combustion engine to lance-like pumps such as shown, for example, in the United States patent of Alexander P. Fox and Victor G. Klein, No. 2,187,684 dated January 16, 1940, for Lubricating apparatus.

Referring now more particularly to Figs. 1 and 2, there is shown fragmentarily at numeral 1 the top of a barrel which has an upper opening at 3 through which the lift cylinder 5 of the pump is adapted to be thrust so as to place the latter within the barrel so that its intake is at the bottom of the barrel.

At its upper end, the cylinder 5 is threaded into a body 7 (Fig. 2), the latter being attached to a frame 8 which in turn is carried upon a supporting plate 9 having handles 11. A fastening flange 13 provides temporary fastening means on the barrel.

Pillars 13 extending upwardly from the plate 9 support a gasoline engine or motor 15. The engine 15 has a power pulley 16 which is belted to a pulley 17. A V-belt is preferable with V-shaped pulley grooves, but other belt forms may be used.

The pulley 17 is attached to a shaft 21 which is carried in a bearing in the frame 8. Attached to the shaft 21 is a crank pin 27 which is articulated at a bearing 29 with the upper end of a hollow connecting rod 33.

At the lower end of the connecting rod 33 and in the cylinder 5 are the pumping elements such as those shown in said patent of Fox and Klein, or other suitable and known pumping elements may be used. These form no part of the novel inventive features herein, and are therefore not described in detail. The rod 33 is surrounded by an inner cylinder 35 between which and the cylinder 5 compressed lubricant passes upwardly to the hollow body 7.

The hollow body 7 is connected to an outlet manifold 37 by way of double check valves 39 which open outwardly with pressure from the body 7 and in close with back pressure from the manifold 37.

The outlet of the manifold 37 has attached thereto a flexible pressure hose 41 for carrying lubricant to a control valve 43 at the end of said hose. The control valve is opened and closed

from a manually controlled handle 45 and has an outlet 47 for directing lubricant into proper channels.

It is desired that, when the handle 45 of the valve 43 is pressed to open the valve, the pressure available in the hose 41 should not fall off substantially, although a slight or incipient reduction is inconsequential. Furthermore, pressure should be available at the instant that the valve 43 is opened, that is, the hose 41 should remain under pressure between valve operations.

One object of the invention is to use the driving belt 19 for the purpose of clutching and de-clutching the constantly running engine 15. This connection numeral 49 indicates generically a pressure-responsive control valve. This valve (Fig. 3) includes a body portion 51 into which slidably extends a valve stem 53, the latter carrying a plug 55. The plug has spaced grooves 57 with which cooperate spring-pressed detent balls 59 (see Fig. 4). It is clear that this construction provides a full-throw snap-action for the stem 53 when initially moved slightly over one-half of its throw. The valve stem 53 is provided with a grooved passage 61 which is movable from the position shown in Fig. 3, in which a port 63 is exclusively connected with a relief port 65 to a position in which the port 63 is exclusively connected with a pressure inlet port 67.

The port 63 communicates with a pressure cylinder 69 in which is a piston 71 packed as shown at 73. This piston has behind it a shoulder 75 against which presses a spring 77, the latter reacting against a cap 79. The cap is threaded to a cylinder 81 which contains the spring 77 and collar 75. A sleeve 83 limits the outward motion of the collar 75.

Reaching outwardly from the collar 75 is a stem 85 which carries an idler pulley 87. This pulley cooperates with the relatively flat outside of the V-belt 19 to tighten the latter and force it into the pulley grooves when the collar 75 is under influence of the spring 77. To remove the influence of the spring 77, pressure is admitted to the cylinder 69 by placing the valve 53 in the position alternative to that shown in Fig. 3.

The relief port 65 is connected with a relief line 89 which leads back to the lubricant supply in the barrel 1. This relief line also is connected with a line 91 from a manually operable relief valve 93, the latter being in the manifold 37. The valve 93 may be opened and closed manually and at will.

The pressure port 67 is connected to a pressure line 95 which also passes to a connection 97 in the manifold 37. This pressure line 95 has a branch 99 which communicates with a cylinder 101. In the cylinder 101 is a piston 103 packed as shown at 105. This piston 103 is attached at 107 to a bearing member 109 which slidably supports the outer end of a stem 111 extending from the valve 53. To the outside of the bearing member 109 is permanently fastened an extension sleeve 113 having a cap 115 which also forms a bearing for the extension 111.

Within the sleeve 113 and fastened midway to the extension 111 is a collar 116, on opposite sides of which are located springs 117 and 119. The spring 117 abuts the cap 115 and the spring 119 abuts the upper end of the bearing 109. Inner sleeves 121 serve to limit the motion of the collar 116 within the sleeve 113.

Threaded to the exterior of the sleeve 113 is an adjustable collar 122 against which presses a spring 123. The spring reacts against the body

51 and is contained in a cylinder 125. Spanner holes 127 in the collar 122 permit adjustment through the openings 129 (see Figs. 1 and 2). A spanner hole 130 also permits prevention of rotation of the members 109 and 113, while the collar 122 is being adjusted.

Assuming that the gasoline motor 15 is revolving, that the manifold 37 and the line 41 are filled and under pressure, but that the belt 19 is slack, the slack condition of the belt is explained as follows:

Since the manifold 37 is under pressure but the pump is not operating, the check valves 39 prevent back-flow to the pump. The pressure in the manifold 37 is communicated over the lines 95 and 99 to the cylinder 101 so that the piston 103 is pushed above the position shown in Fig. 3. This pushes up sleeve 113 and bearing member 109 with the collar 122 against the action of the spring 123. Hence the spring 119 under the collar 116 is also compressed. The stem 111 and valve 53 resist this compression without movement for some period of time, due to the detaining action of the balls 59. Finally, when the compression in the spring 119 becomes great enough to overcome the detaining action of the balls 59, then the valve 53 is pushed with a full stroke from the position shown in Fig. 3 to its alternative position, wherein the recess 61 connects the inlet pressure port 67 with the port 63. The piston 71 in cylinder 69 is forced to the left against the action of the spring 77, thus throwing the stem 85 and idler pulley 87 into free position such as shown in dotted lines in Fig. 1, wherein the belt 19 is loose. Hence the gasoline motor 15 is in de-clutched condition and idles. The pump is not being driven but pressure is available from the hose 41 from the preceding period of pump activity.

To obtain lubricant the operator places the nozzle 47 in a desired location, grasps the valve 43 and moves the handle 45 to open the valve. This releases the pressure in the hose 41 and manifold 37. The result is that pressure is incipiently decreased in the pressure line 99 and hence the pressure is reduced on spring 123. This causes the sleeve 113 to descend. Initially, the spring 117 above the collar 116 is compressed while the detaining action of balls 59 resists movement of the valve 53. Finally a predetermined pressure overcomes the detaining action of the balls and the valve 53 moves to the position shown in Fig. 3. This causes the recess 61 to place port 63 into communication with the relief port 65. Lubricant under pressure is released from cylinder 69 and exhausted through line 89 back to the lubricant supply. This is caused by the pressure of the spring 77 which forces the piston 71 back into its cylinder 69, and draws in the stem 85. This forces the idler pulley 87 against the outside of the belt 19, thereby tightening the belt and causing it to function as a driving clutch between the motor 15 and the pulley 17 (see the solid-line belt position in Fig. 1).

It will be noted that the valve action is a so-called snap action, and that therefore pressure application and pressure relief at the piston 71 is substantially instantaneous. This means that the idler pulley 87 is substantially instantaneously moved to either of its positions. Therefore the belt 19 is tightened and loosened in a minimum period and reduces the time that undesirable belt slippage may occur. It should be understood, however, that even without this snap-action the

operation would be successful in view of the short time required for the groove 61 to traverse the relatively narrow ports 65 and 67.

As the pump comes into operation, it supplies lubricant under pressure through the check valves 39, manifold 37, hose 41 to and through the valve 43. Thus it will be seen that, whenever the lever 45 is pressed to open the valve, pressure is immediately available and continues to be available by reason of the instantly automatic connection effected between the constantly running engine 15 with the pump. On the other hand, when the valve 43 is closed, the engine 15 automatically becomes disconnected.

The adjusting collar 122, having the holes in it as shown at 127, and the cylinder 125 being provided with the openings 129 so that a tool may be applied to the opening 127, there is effected means for an adjustment of the compression of the spring 123. The compression of this spring of course determines the pressure at which the sleeve 113 will be moved. By this means the value of outlet pressure in the hose 41 may be adjusted to suit any lubricating requirement. At the same time the snap action belt clutching effect is not changed, nor is belt tension changed, because the pressure of the idler pulley 87 on the belt 19 is determined only by the stiffness of the spring 77 which holds the idler 87 against the belt 19. This pressure is not changed by any changed pressure in the pressure line 95, as determined by the pressure in the manifold 37. This is because such pressure is only effective to hold the pulley 87 clear of the belt 19 and not against it. Thus is obtained a constant action of the resilient spring on the belt during driving conditions. High lubricant pressure may be carried in the manifold 37 and hose 41 without variable and/or excessively high pressures being applied to belt tightening purposes. That is, the even pressure of spring 77 does the belt tightening and not the variable high pressure required for lubrication.

Since pressure in the line 95 is necessary for holding the pulley away from the belt 19, it will be seen that, if during a period of long non-use, the pressure in the manifold 37 drops, the belt-tightening parts will be in the condition of Fig. 3 wherein the engine 15 is clutched to the pulley 17. Under such circumstances, the valve 93 may be manually opened while cranking the motor 15 to start it. Therefore, the motor 15, although it is clutched to and drives the pulley 17 and pump parts, it drives them under substantially no-load conditions; for the pump under these conditions pumps to the manifold 37, through the open valve 93, through the pipe 91 and back to the supply through line 99. After the engine starts, the valve 93 may be closed, whereupon the required pressure builds up in the manifold 37 to throw the parts into their alternative de-clutched positions and hence to de-clutch the engine.

The motor 15 could also be started by holding open the valve 43, but it is desirable to have a valve such as 93 which does not spring shut when released but which, for example, screws open and shut. Furthermore, a valve such as 43 is not always located close to the barrel 1 at which the starting operation occurs, while valve 93 is close.

It will be observed that the springs 117 and 119 provide for lost-motion activity between the sleeve 113 and the stem 111. This lost-motion may be obtained by other means than with the springs, but the springs serve the function primarily of providing more instantaneous action.

In Fig. 5 is shown a modified form of the control valve in which the springs 117 and 119 (of Fig. 3) and the detent mechanism (of Fig. 4) are omitted. Similar reference characters indicate corresponding parts. In this construction, the member 110 (similar to the member 109 in Fig. 3) is made longer and the sleeve 114 (similar to the sleeve 113 in Fig. 3) is made shorter, thus providing a lost-motion socket 131 in which collar 116 has lost-motion to the extent indicated. The collar 116 is located on a shorter stem 112 (which corresponds to the stem 111 in Fig. 3).

Operation of the device shown in Fig. 5 is as follows:

When the hose valve 43 is closed, the pressure in the manifold 37 is communicated to the piston 103 by means of the pressure line 99. This pushes up the piston 103 against the action of the spring 123. After some lost-motion between the member 110 and the collar 116, the collar 116 is pushed upward an amount determined by the available motion for the cap 114. The cap 114 stops when the inside of the body 51 is reached. At this time, the valve groove 61 becomes positioned so as to connect the pressure inlet 67 with the cylinder 69, thus pushing the idler pulley 87 from belt 19 and declutching the engine 15 from the pump.

The expansive action of the lubricant in passing from the port 67 to the cylinder 69 by way of port 63 results in a slight pressure drop in the line 95 and associated lines 99. Hence, the spring 123 re-expands slightly, but at this time the collar 116 is at the lower end of the chamber 131, so that the member 110 may descend this short distance without moving the valve 53.

The relief position of the valve is shown in Fig. 5 wherein it may be assumed that the hose valve 43 has been opened, to reduce the pressure in the manifold 37 and lines 95, 99. This causes substantial descent of the piston 103 and the inner side of the cap 114 to contact the upper side of the collar 116 after lost-motion has taken place. Ultimately, the valve is drawn down to the position shown in Fig. 5 wherein the pressure under piston 71 is relieved by way of the relief line 89. This causes the spring 77 to actuate the rod 85 so that the idler 87 is drawn over to tension the belt 19 and clutch the engine 15 to the pump. This sustains pressure against the incipient pressure drop introduced by opening the valve 43.

One advantage of the construction of Fig. 5 lies in the fact that the springs 117 and 119 may be eliminated, as well as the detent mechanism 55, 59. This form of the device also acts more positively when very high lubricant pressures are used.

It will be understood that the engine 15 carries a suitable governor for maintaining a substantially constant speed under the various load conditions between idling and full load.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. In apparatus of the class described, an outlet manifold associated with and near a pump and adapted to receive material under pressure, driving means comprising releasable driving

portions, and means for automatically connecting the driving means for driving in response to incipient pressure decrease in the manifold and for disconnecting said driving means in response to incipient pressure increase in said manifold, and manual pressure releasing means associated with the manifold for permitting temporary operation of said motor while the driving means is closed.

2. In apparatus of the class described, a pressure manifold, a belt adapted to be tightened by driving and loosened for idling, means for automatically tightening the belt in response to incipient pressure decrease in the manifold and for loosening the belt in response to incipient pressure increase in said manifold, said last-named means comprising a spring for applying pressure for tightening and means for applying said pressure only for belt loosening.

3. In apparatus of the class described, a driving belt of a length adapted to drive when tight but to cease driving when loosened, an idler movable against the belt to tighten it and away from it to loosen it, means normally biasing the idler to tighten the belt, an outlet manifold adapted to receive pressure when the belt drives, and means responsive to incipient increase in pressure in said manifold adapted to apply said pressure to overcoming the action of said biasing means whereby said idler is moved away from the belt.

4. In apparatus of the class described, a pressure manifold on a pump having a belt drive, a line extending from said manifold, a control valve in said line adapted to be moved to a position a substantial distance from the pump, the opening of said valve being adapted incipiently to reduce pressure in said manifold, an idler associated with said belt, spring means normally biasing said idler against the belt, and movable valve means movable under pressure from said manifold and adapted to control pressure therefrom, said valve means being adapted to move to a position to apply pressure against the spring biasing means to move said pulley from the belt when incipient pressure increase occurs in said manifold by reason of a closed condition of the control valve, said movable valve being adapted to move to a position to release pressure from the biasing means when said control valve is opened.

5. In apparatus of the class described, an outlet pressure manifold for a pump having a belt drive, a line extending from said manifold, a control valve in said line adapted to be moved to a position a substantial distance from the pump, the opening of said valve being adapted incipiently to reduce pressure in said manifold, an idler associated with said belt, spring means normally biasing said idler against the belt, and snap-acting valve means movable under pressure from said manifold and adapted to control pressure therefrom, said valve means being adapted to move with snap-action to a position to apply pressure against the spring biasing means to move said pulley from the belt when incipient pressure increase occurs in said manifold by reason of the closed condition of the control valve, said movable valve being adapted to move with snap-action to a position to release pressure from the biasing means when said control valve is open incipiently to reduce pressure in the manifold.

6. In apparatus of the class described, an outlet manifold for a pump having a belt drive in-

cluding a belt of a length adapted to drive when tight but to cease driving when loosened, an idler movable against the belt to tighten it and away from it to loosen it, a spring normally biasing the idler to tighten the belt, valve means responsive to incipient increase in pressure in said manifold adapted to move to one position to direct said pressure to overcoming the action of said spring so that said idler is moved away from the belt, and adapted to move to a second position in response to incipient decrease in manifold pressure to release said overcoming pressure.

7. In apparatus of the class described, an outlet manifold for a pump having a driving belt, an idler for tightening and loosening the belt, control means for the idler comprising a piston adapted to move the idler when pressure is applied to the piston, a spring normally biasing said piston to force the idler to tighten the belt, a valve, said valve including a pressure port connected to the manifold and a relief port, the valve being movable to communicate between either the pressure port or the relief port and said piston, and means for moving said valve to its pressure transmitting position or its relief position by incipient rise or fall respectively in pressure in said manifold.

8. In apparatus of the class described, an outlet manifold for a pump having a driving belt, an idler for tightening and loosening the belt, control means for the idler comprising a first piston associated with the idler, means normally biasing said piston to force the idler to tighten the belt, a full-stroke valve, said valve including a pressure port connected to the manifold and a relief port leading to the supply, the valve being movable with a snap action to communicate either between the pressure port or the relief port and said piston, and means for moving said valve to its pressure transmitting position or its relief position by incipient rise or fall respectively in pressure in said manifold, said last-named means comprising a second piston, means normally biasing the second piston, and means communicating pressure from the manifold to the second piston to move the second piston against its biasing means.

9. In apparatus of the class described, an outlet manifold for a pump having adapted to draw from a supply, a driving belt, an idler for tightening and loosening the belt, control means for the idler comprising a first piston associated with the idler, means normally biasing said piston to force the idler to tighten the belt, a full-stroke valve, said valve including a pressure port connected to the manifold and a relief port leading to the supply, the valve being movable with a snap action to communicate either between the pressure port or the relief port and said piston, and means for moving said valve to its pressure transmitting position or its relief position by incipient rise or fall respectively in pressure in said manifold, said last-named means comprising a second piston, means normally biasing the second piston, means communicating pressure from the manifold to the second piston to move the second piston against its biasing means, and means for adjusting the degree of bias on the second piston whereby the operating pressure for valve operation may be varied independently of the degree of bias on the first piston.

10. In apparatus of the class described, an outlet manifold for a pump having a driving belt, an idler for tightening and loosening the belt, an

outlet manifold associated with the pump, control means for the idler comprising a piston associated with the idler, a spring normally biasing said piston to force the idler to tighten the belt, a full-stroke valve, said valve including a pressure port and a relief port, the valve being movable with a snap action to communicate either the pressure port or the relief port to apply pressure to said piston, and means for moving said valve with a snap action to its pressure position or its relief position by incipient rise or fall respectively in pressure in said manifold, said last-named means comprising a second piston, a spring normally biased against said piston against pressure, and means for communicating pressure from the manifold to said second piston, said spring providing energy for moving the valve toward its pressure relief position, and the pressure from said manifold providing energy to move the valve toward its pressure-transmitting position.

11. In apparatus of the class described, an outlet manifold for a pump having a driving belt, an idler for tightening and loosening the belt, control means for the idler comprising a piston associated therewith, a spring normally biasing said piston to force the idler to tighten the belt, a valve, said valve including a pressure port and a relief port, the valve being movable to communicate either the pressure port or the relief port with said piston, and means for moving said valve to its pressure position or its relief position by incipient rise or fall respectively in pressure in said manifold, said last-named means comprising a second piston, a second spring normally biased against said piston, means for communicating pressure from the manifold to said second piston, said spring providing energy for moving the valve toward its pressure relief position, and the pressure from said manifold providing energy to move the valve toward its pressure-transmitting position, and a lost-motion connection between said second piston and the valve.

12. In apparatus of the class described, an outlet manifold for a pump having a driving belt, an idler for tightening and loosening the belt, control means for the idler comprising a piston associated therewith, a spring normally biasing said piston to force the idler to tighten the belt, a full-stroke valve, said valve including a pressure port and a relief port, the valve being movable with a snap action to communicate either the pressure port or the relief port with said piston, and means for moving said valve with a snap action to its pressure position or its relief position by incipient rise or fall respectively in pressure in said manifold, said last-named means comprising a second piston, a second spring normally biased against said second piston, and means for communicating pressure from the manifold to said second piston, said spring providing energy for moving the valve toward its pressure relief position, and the pressure from said manifold providing energy to move the valve toward its pressure-transmitting position, detent holding means for the valve, and a lost-motion connection between said second piston and the valve.

13. In apparatus of the class described, an idler, a source of pressure, a piston associated with the idler and adapted to move it, the piston being adapted to be moved under pressure to move the idler to idling position, means biasing said piston oppositely to move the idler to a non-idling position, a valve having a pressure port and a relief port, said valve including a stem

adapted to be positioned to transmit pressure from the pressure port to the piston and into a second position to cut off said pressure and to relieve it from the piston, lost-motion means for moving the valve, said lost-motion means including a second piston responsive to pressure from said source, means biasing said second piston against pressure, the lost-motion means being moved under incipient increase in pressure to move toward setting the valve to its position to transmit pressure to the first piston, and under conditions of incipient reduction in pressure to move the valve into its alternative position.

14. In apparatus of the class described, an idler, a source of pressure, a piston associated with the idler and adapted to move it, the piston being adapted to be moved under pressure to move the idler to idling position, means biasing said piston oppositely to move the idler to a non-idling position, a valve having a pressure port and a relief port, said valve including a stem adapted to be positioned to transmit pressure from the pressure port to the piston and into a second position to cut off said pressure and to relieve it from the piston, detent means for resiliently detaining the valve in one or the other of its positions but permitting motion with a snap action, lost-motion means for moving the valve against the detent means, said lost-motion means including a second piston responsive to pressure from said source, a spring biasing said second piston against said pressure, the lost-motion means being moved under incipient increase in pressure to move toward setting the valve to its position to transmit pressure to the first piston, and under conditions of incipient reduction in pressure to move the valve into its alternative position.

15. In apparatus of the class described, an idler pulley, a pressure source, a piston associated with the idler and adapted to move it and adapted to be moved under pressure to move the idler to idling position, means biasing said piston in the opposite direction to move the idler to a non-idling position, a valve having a pressure port and a relief port, said valve including a stem adapted to be positioned to transmit pressure from the pressure port to the piston and into a second position to cut off said pressure and to relieve it from the piston to exhaust, detent means for resiliently detaining the valve in one or the other of its positions but permitting motion with a snap action, lost-motion means for moving the valve in connection with the detent means, said lost-motion means including a second piston responsive to pressure from said source, a spring biasing the second piston against said pressure, the lost-motion means being moved under incipient increase in pressure to move toward setting the valve to its position to transmit pressure to the first piston, and under conditions of incipient reduction in pressure to move the valve into its alternative position, and means for adjusting the tension of the spring associated with the second piston.

16. In apparatus of the class described, an outlet manifold associated with and near a pump and adapted to receive from the pump material under pressure, driving means from an internal combustion engine to the pump comprising releasable driving portions, means for automatically connecting the driving portions for driving in response to incipient pressure decrease in the manifold and for disconnecting said driving portions in response to incipient pressure increase

in said manifold, whereby incidentally a driving connection is effected between the engine and the pump upon leakage of pressure from the manifold, and manual means associated with
5 the manifold for opening it whereby temporary operation of the motor may take place under conditions wherein pressure will not build up

in the manifold while the driving portions remain connected, and whereby upon closing the manifold at said manual means the engine may be loaded while under operating conditions to increase pressure in the manifold.

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