NATHAN MECHANICAL LUBRICATOR

69. Sizes and Types.—An exterior view of a Nathan DV 7, ten-feed mechanical lubricator made by the Nathan Manufacturing Co. is shown in Fig. 31. These lubricators are made in the sizes shown in the accompanying tabulation.

SIZES OF LUBRICATORS

SIZE	CAPACITY PINTS	NO. OF FEEDS
DV-2	8	1 to 6
DV-3	16	1 to 6
DV-4	20	1 to 8
DV-5	26	1 to 14
DV-6	26	1 to 26
DV-7	36	1 to 26

The lubricator comprises a body that is filled with oil through a filling plug in the cover. The cover is locked by a sealing bar and is opened only when the interior of the lubricator is being cleaned or when it is necessary to change the adjusting screws of the pumping units to feed more or less oil. The gear housing *a* and the counter-pawl support *b* are bolted to the body of the lubricator by the studs and nuts shown, and enclose the driving-pawl support *c*, to the outer end of which the drive arm *d* is connected by the clamping bolt *e*. The balance lever *f* is clamped to the end of the ratchet shaft *g* for the hand operation of the pumping units. The waste cock *h* permits the draining of any water that has accumulated in the lubricator. A body plug is also located at the bottom of the heating chamber for completely draining the heater compartment. The pipe *i* connects to the heater pipe in the interior of the lubricator.

70. Ratchet Drive.—The ratchet-drive mechanism and the arrangement for operating the pumping units of the lubricator are shown in the sectional view in Fig. 32. The ratchet-drive mechanism is housed within the gear housing *a* and the counter-

pawl support *b*, these parts being held together against the wall of the lubricator by studs, two shown. The ratchet shaft *g* has a crank disk *k* mounted on one end, a balance lever *f* clamped on the other end, and a ratchet disk *l* keyed on the shaft between the ends. Riveted to the ratchet disk are two

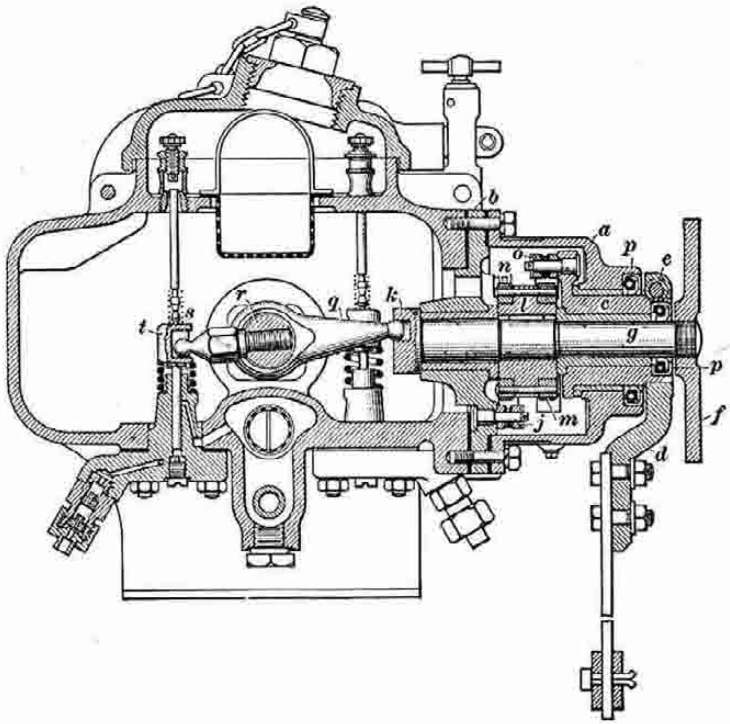

FIG. 32

ratchet wheels *m* and *n*, the driving pawls *o* contacting the teeth of wheel *m*, and the holding pawls *j*, mounted on pins in the counter-pawl support, the teeth of the wheel *n*. The ratchet shaft operates in a bushing in the counter-pawl support and in the driving-pawl support *c*. The ratchet drive is lubricated from the oil well of the lubricator, the oil seals at *p* preventing leakage of oil by the driving pawl support *c* and the ratchet shaft *g*.

71. Sliding Shaft.—The driving ball arm *q*, Fig. 32, of the sliding shaft *r* fits in a circular hole in the crank disk *k* of the ratchet shaft. The sliding shaft is placed in the lubricator at right angles to the ratchet shaft and its ends have a limited sliding movement in the lubricator wall. The ball pin *s* of the sliding shaft fits in an elongated slot in the crosshead *t* of a pumping unit. A view of the sliding shaft used with the DV 5, 6, and 7 mechanical lubricators is shown in Fig. 33, in which the driving ball arm is indicated at *b*, and the fourteen ball pins, one for the crosshead of each pumping unit, are shown at *s*.

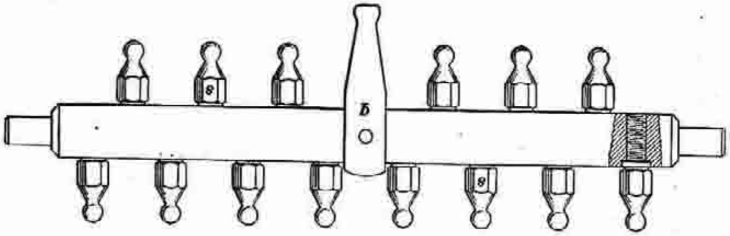

FIG. 33

72. Pumping Unit.—A pumping-unit assembly is shown in section in Fig. 34. It comprises a cylinder *a*, to which the oil pipe is coupled, a piston *b* and a crosshead *c*, made in one piece, a lifting spring *d* and an indicator *e* connected flexibly to the crosshead by a spring *f*, and a regulating cap and screw *g*. The elongated slot *h* in the crosshead is to receive the ball pin of the sliding shaft.

Each pumping unit is inserted into the interior of the lubricator from the outside and is secured to the lubricator body by four studs and nuts.

A view of the cylinder of a pumping unit with the piston in place and partly broken away to show the port arrangement is given in Fig. 35. The position of the piston when near the end of the suction stroke is shown in (*a*) and its position when near the end of the pressure stroke is shown in (*b*).

The passage *a* in the cylinder wall connects the oil well of the lubricator to the bore of the cylinder, whereas passage *b* leads from the cylinder to the oil pipe. The two ports in the cylinder wall are about one-quarter turn apart.

A view of one side of the part of the piston that operates in the cylinder is given in Fig. 36 (*a*), and a view of the other side is shown in (*b*). The piston is hollow as far up as the port *c*, which is drilled through the piston from one side to the other. A groove *d* extends downward from the port *c* on the suction side of the piston, and a groove *e* extends upward from port *c* on the discharge side.

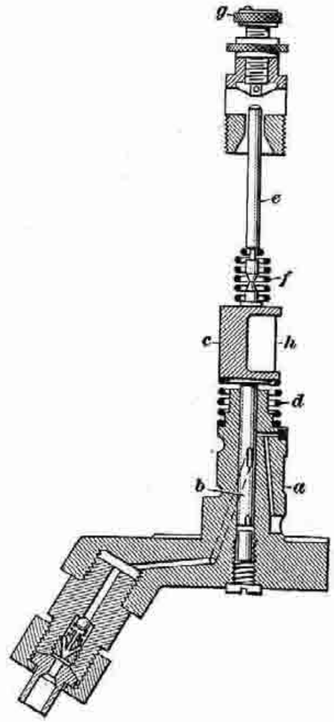

FIG. 34

73. Operation of Ratchet Mechanism and Connected Parts.—The swinging movement of the drive arm *d*, Fig. 32, imparts a partial turning movement, first in one direction and then in the other, to the driving-pawl support *c*. On one swing of the drive arm, the driving pawls *o* engage the teeth of the ratchet wheel *m*, and turn the ratchet shaft *g* and the crank disk *k*. On the other swing of the drive arm, the driving pawls merely slip back over the teeth of the ratchet wheel *m*, the backward movement of the shaft being now prevented by the holding pawls *j*, engaging the teeth of its ratchet wheel *n*. The intermittent turning movement of the shaft *g* and the crank disk *k* causes the driving ball arm *q*, and hence the sliding shaft *r*, to move up and down as well as back and forth. The ball pin *s* has then a similar movement in the elongated slot in the crosshead *t* of the pumping unit. The same movement is imparted to the crosshead except that the upward movement is caused by its spring instead of by the ball pin.

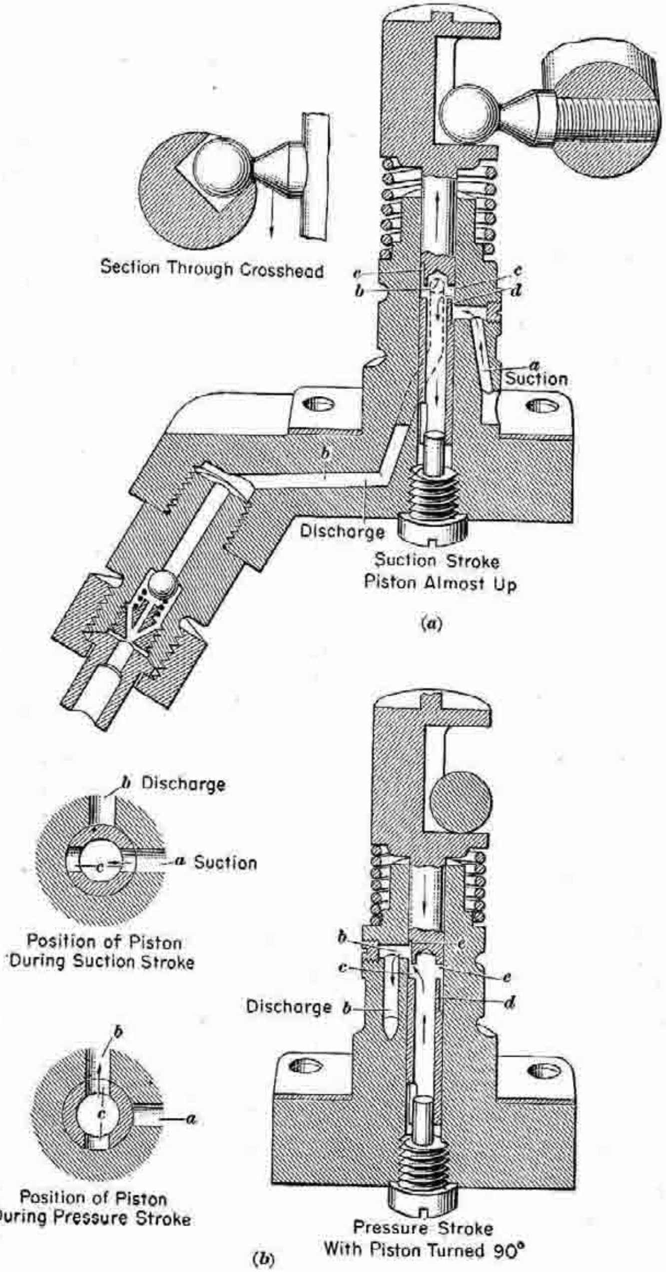

FIG. 35

74. Operation of Pumping Unit.—If the ball pin of the sliding shaft, Fig. 32, were a fit in the crosshead of the pumping unit, the movement of the pin and the crosshead would be identical. But the slot in the crosshead is not only wider than the ball pin, but is also longer, and this changes the movement that the pin would otherwise impart to the crosshead. The shape of the slot causes the sliding shaft through the medium of the ball pin to impart two separate and distinct movements to the crosshead and the piston, one being a downward one transmitted by the turning movement of the sliding shaft, and the other one a partial rotation imparted by the lengthwise movement of the sliding shaft at about the time the piston completes its stroke. The upward movement of the piston and the crosshead is brought about by the crosshead spring.

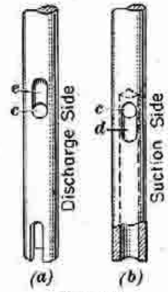

FIG. 36

75. With the crosshead and the piston moved upward in a straight line by the spring, Fig. 35 (*a*), oil is drawn into the interior of the hollow piston through passage *a* in the cylinder wall, and port *c* and groove *d* in the piston. With the crosshead at the end of its upward stroke, the ball pin of the sliding shaft is then in such a position in its slot as to begin to impart a quarter turn to the crosshead, causing port *c* and groove *d* to move out of register with port *a* and bringing port *c* and groove *e* in register with the discharge port *b*, as in view (*b*). The ball pin next begins to move the piston and the crosshead down, and the oil in the interior of the piston is compressed and forced out through port *c*, groove *e*, and passage *b*. When the pressure becomes high enough to unseat the ball check-valve against the pressure of the oil in the oil pipe on the other side, the valve opens, and the oil enters the oil pipe. The additional pressure then imposed on the oil in the oil pipe causes the terminal check to open and permit the oil to mingle with the steam and thus pass to the parts to be lubricated. As the piston and the crosshead complete their stroke, the ball pin is again in the correct position in its slot to give the crosshead

a quarter turn, thereby again bringing port *c* and groove *d* in register with the inlet port. At the completion of this turning movement, the further action of the ball pin on the crosshead stops, and the crosshead spring forces the piston upward on its suction stroke again. On this stroke the pin merely rides on the bottom surface of its seat.

The pumping mechanism places the oil in the oil pipes as far as the terminal checks under a pressure of about 25 pounds more than the boiler pressure.

76. Regulation.—The elongated slot *h*, Fig. 34, in the crosshead in combination with the adjusting screw permits the oil pumped by the lubricator to be regulated to any degree desired. Turning the screw down against the extension rod reduces the lift of the crosshead and hence the quantity of oil drawn into the pumping unit, and turning it up has the reverse effect. Turning the screw all the way down prevents any movement of the crosshead and cuts this pumping unit out of service. The slot is of such a length that the ball pin can now move up and down in it without contacting the ends; however, the turning movement of the crosshead at the end of each stroke will continue as before.

77. Heater.—The lubricator heater unit consists of a straight pipe running through the oil heating chamber, connected at one end to a saturated steam supply and piped at the other end to the exhaust passage in the cylinders. The steam enters the heater pipe through a choke, one with an opening of a different size being used in summer from that used in winter. With one type, the choke is provided with two openings, the change from one to the other being made by moving a lever to the proper position.

78. Double Pumping Unit.—With the double pumping unit the oil is drawn, during the suction stroke, into two separate compartments of the unit at the same time, and discharged through two separate outlets during the pressure stroke. The principle of operation of both the single and the double pumping unit is similar. Double pumping units are recommended

for chassis lubrication or for feeds to Nathan four-feed oil distributors.

The piston *a* of the double pumping unit, Fig. 37, is hollow and slides up and down on the plunger *b*, the upper end of which terminates at *c*. The lower end of the plunger is smaller than the upper portion and is held fixed by the plug *e*.

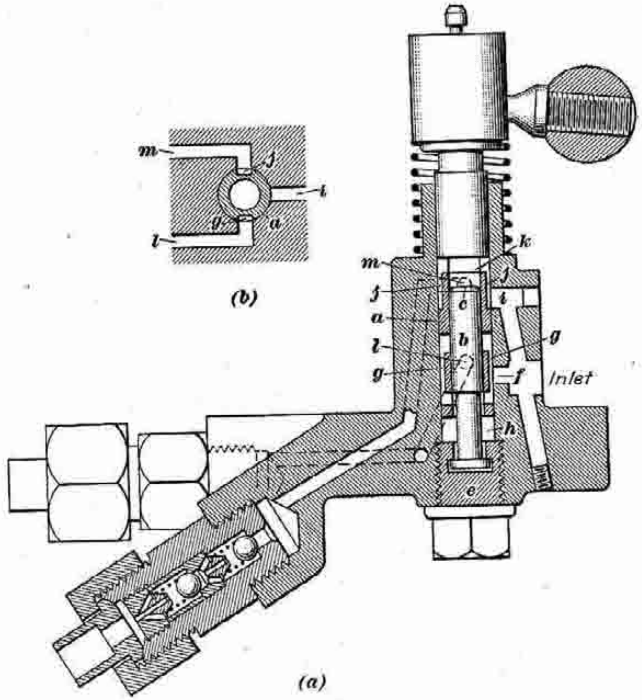

FIG. 37

79. On the upward stroke of the piston *a*, oil is drawn into the lower end of the cylinder through the inlet passage and port *f* and groove *g*, filling the chamber *h* beneath the piston *a*. At the same time, oil is drawn into the upper end of the cylinder through port *i* and the groove *j* and fills chamber *k* between the end of the plunger and the upper end of the bore of the piston. This action continues until the piston is moved upward to the limit of its stroke by the crosshead spring. The ball pin then gives the crosshead about one-quarter turn, thereby turning the inlet ports and grooves in the piston out of register with the main inlet passage and connecting the ports and grooves g and j with the outlet passages l and m as shown in (b). The piston next begins to move down, compressing the oil in both chambers k and h and forcing it out into passages m and l that connect with the oil pipes. The back-flow of oil after the pressure stroke is completed, is prevented by the ball checks shown.

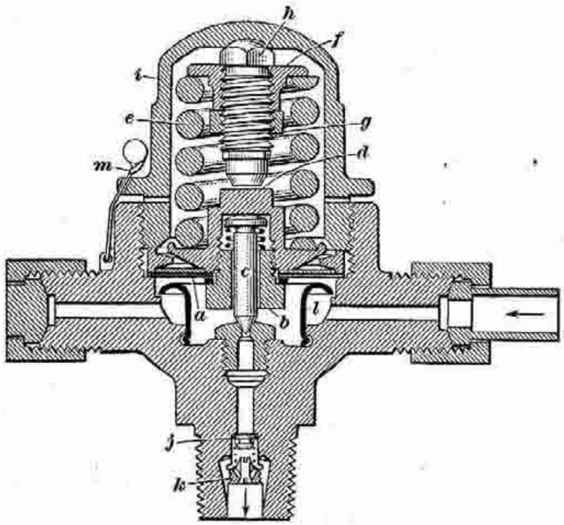

FIG. 38

80. High-Pressure Terminal Check.—The purpose of the Nathan DA terminal check is to maintain a predetermined constant pressure in its oil line somewhat higher than the maximum steam pressure that may be encountered. Hence, regardless of the fluctuations in steam-chest pressure, the oil is always discharged from the check at the same rate as it is being pumped from the lubricator into the other end of the oil pipe.

The principal parts of the terminal check, Fig. 38, are a diaphragm a, a diaphragm nut b, a diaphragm valve c, a spring abutment d, a diaphragm spring e, a regulating nut f, a locknut g, a regulating bolt h, and a cap i. The ball check j with

a spring and a stop k protects the diaphragm valve and its seat from steam and water. The dirt arrester l around the diaphragm valve c forms a dirt well that can be readily removed for cleaning.

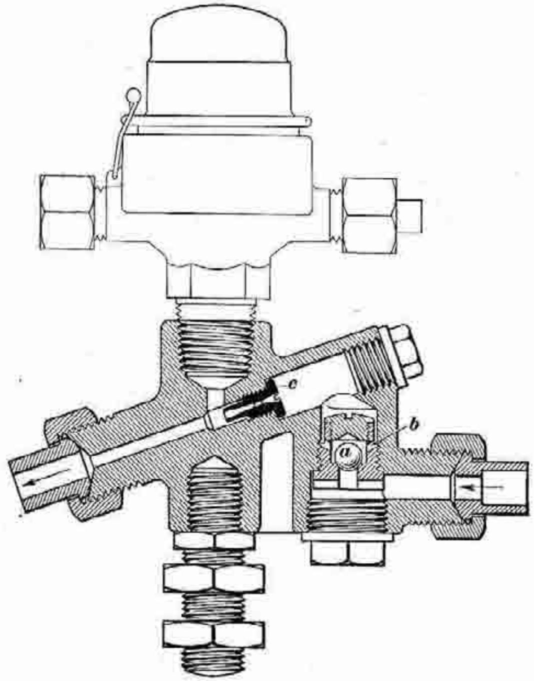

FIG. 39

The terminal check is set for a higher pressure by first breaking the seal m and then screwing down the cap, thus placing more tension on the diaphragm spring through the medium of the regulating bolt and nut. The terminal check should be adjusted to a pressure approximately 25 pounds higher than the working pressure. The blank connection at the left is for the attachment of a test gage.

81. Oil Atomizer.—The purpose of the oil atomizer, Fig. 39, which is screwed on to the shank of the terminal check is to pick up and atomize the oil as it is discharged from this check. The preferred method of application is to locate two atomizers on the top of each steam chest, one for the valve and one for the cylinder.

Saturated steam from the air-compressor steam line or the lubricator heater line is piped to the steam inlet of the atomizer and, lifting the ball check *a*, passes upward through the passage *b* and then flows through the nozzle *c*. This nozzle is designed to impart a high velocity to the steam, thus breaking up the oil into fine particles and carrying the mixture of steam and oil into the main steam supply and thence to the required points.

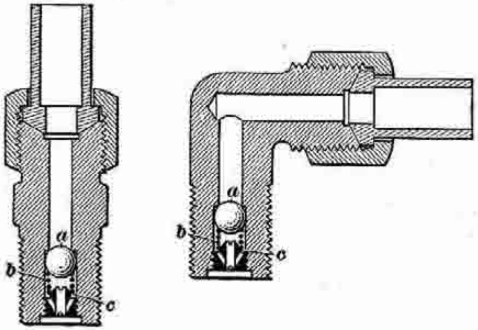

FIG. 40

82. Low-Pressure Terminal Check.—The low-pressure terminal check is located at the oil outlets to the various points where the oil is not fed against steam pressure, such as the guides, the shoes anl wedges, etc. This type of check keeps the oil pipes filled at all times, so that lubrication begins as soon as the engine starts; also, it prevents the oil from draining from the pipes when the engine stops. The arrangement of the device will be evident from Fig. 40, in which a ball check *a* is normally held seated by the spring *b*, the lower end of which seats on the stop *c*.

NATHAN 3515 FOUR-WAY OIL DISTRIBUTOR

83. Purpose.—The purpose of the Nathan four-way oil distributor is to divide the oil from one feed of the mechanical lubricator equally for the lubrication of such parts as the crossheads and guides, wheel hubs, shoes and wedges, etc., where a small quantity of oil is required.

The distributor is connected by a pipe to a feed of the mechanical lubricator, and its pumping mechanism is operated by the pressure of the oil in this pipe.

84. Description and Operation.—An exterior view of the Nathan 3515 four-way oil distributor is given in Fig. 41, the pipe connecting it to the mechanical lubricator being shown at *a*. The ribs through which the oil passes to the ends of the pistons are indicated by *b*. The four pipes shown lead to the points to be lubricated. The other side of the lubricator with the coverplate removed to show the interior mechanism is illustrated in Fig. 42.

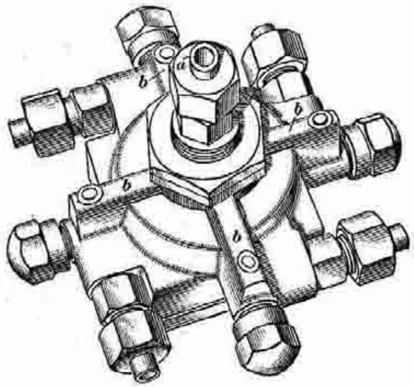

FIG. 41

The assembly comprises four oil-tight pistons, *1*, *3*, *2*, and *4* connected by yokes *5* and *6*. The outer ends of pistons *1* and *3* contact yoke *5* at all times, whereas the ends of pistons *2* and *4* contact yoke *6*. A movement of piston *1* to the right causes the yoke *5* to move piston *3*, the yoke at the same time imparting a partial turning movement to pistons *2* and *4*. Also, piston *3*, when moving to the left, moves piston *1* through the medium of yoke *5*, the yoke at the same time turning pistons *2* and *4* in the direction opposite to that in which they were moved before.