May 21, 1957 R. L. HARTER 2,792,911

DIVISIONAL LUBRICANT FEEDER

Filed July 27, 1956 5 Sheets-Sheet 1

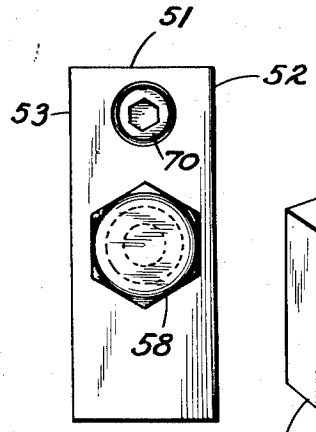


Fig. 2

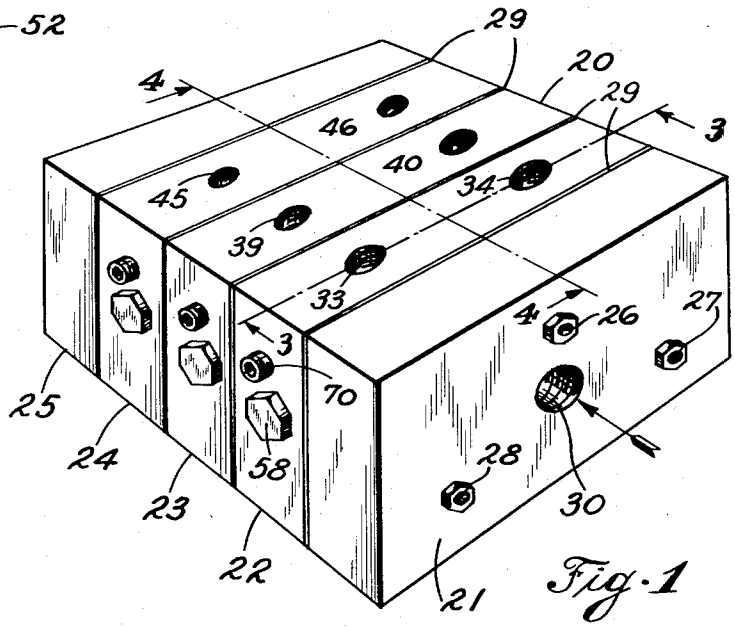


Fig. 1

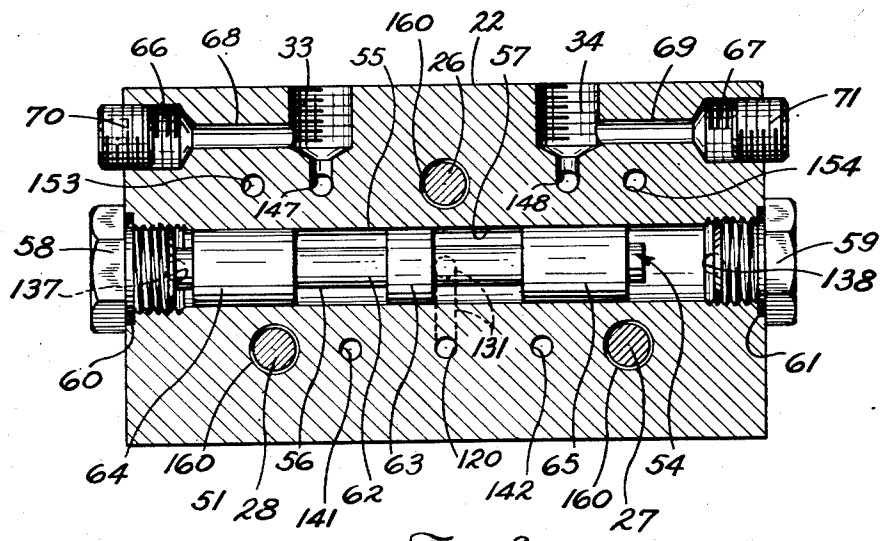


Fig. 3

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DIVISIONAL LUBRICANT FEEDER

Filed July 27, 1956 5 Sheets-Sheet 2

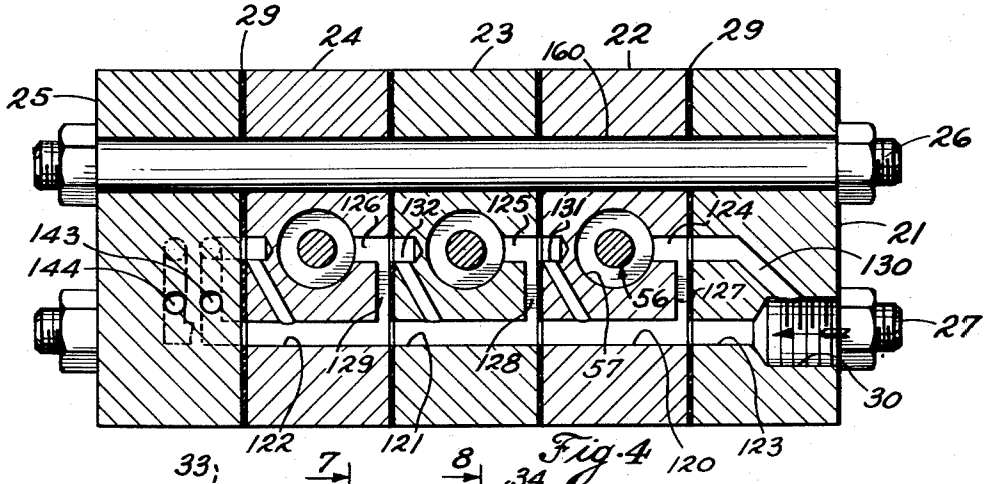


Fig. 4

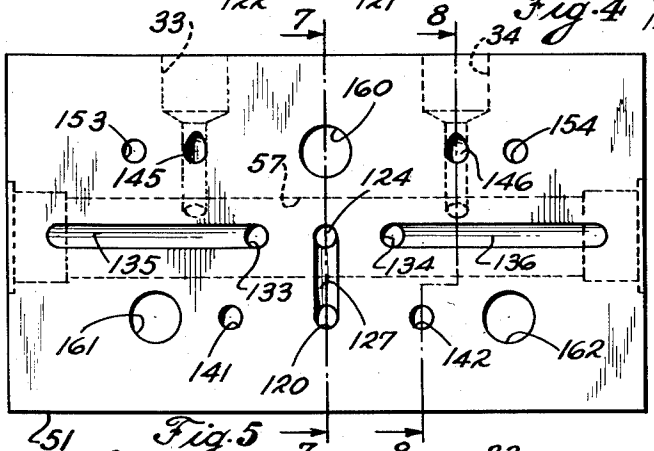


Fig. 5

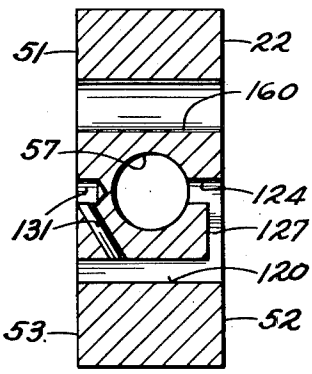


Fig. 7

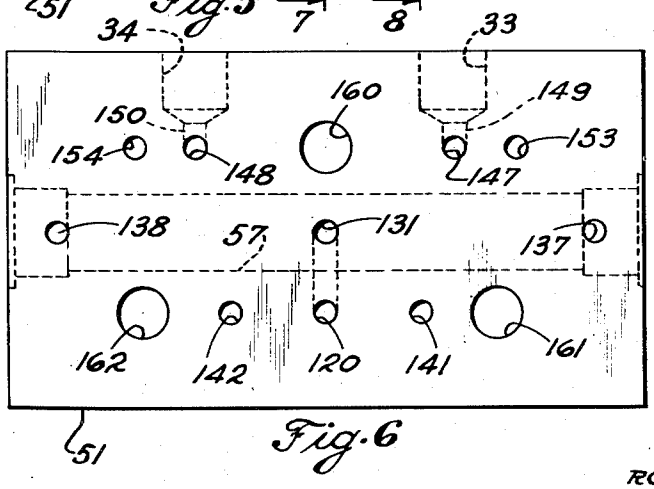


Fig. 6

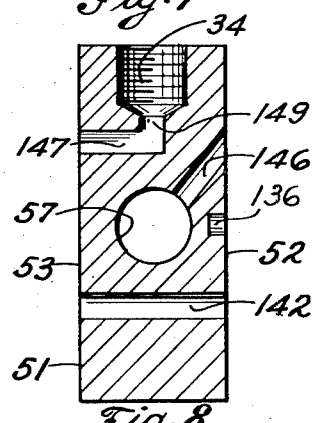


Fig. 8

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DIVISIONAL LUBRICANT FEEDER

Filed July 27, 1956 5 Sheets-Sheet 3

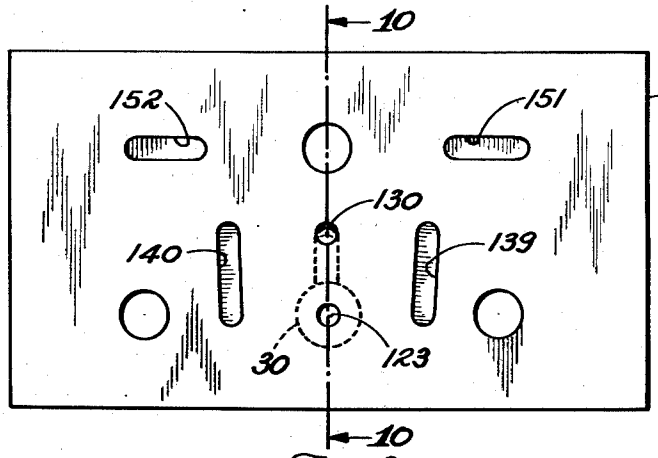


Fig. 9

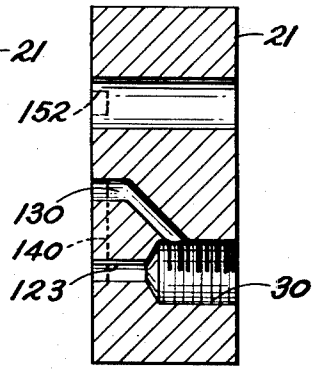


Fig. 10

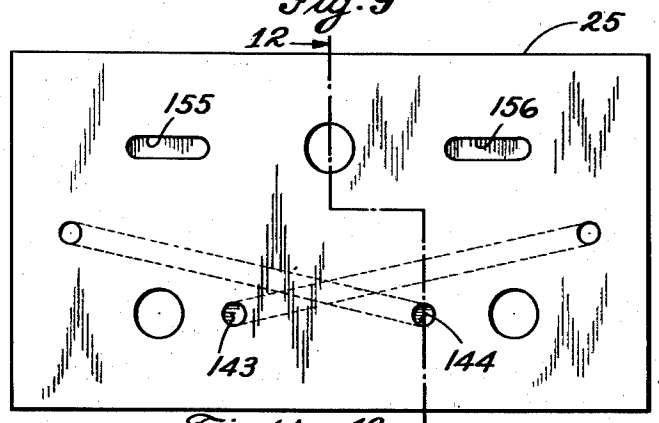


Fig. 11

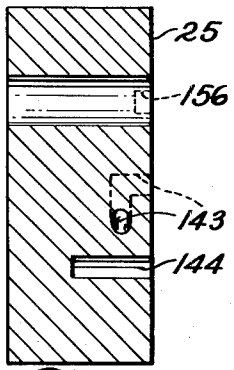


Fig. 12

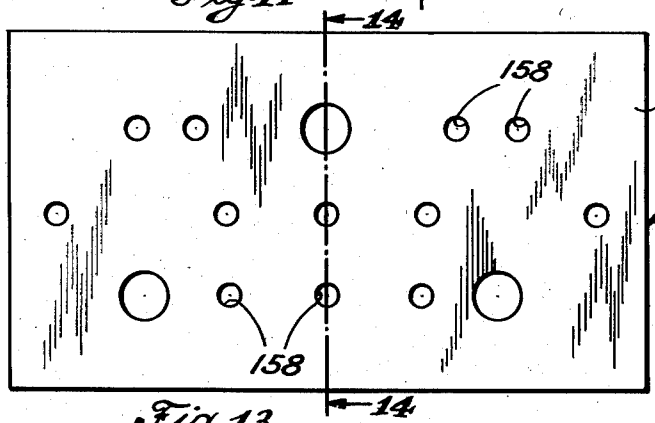


Fig. 13

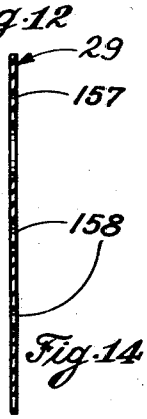


Fig. 14

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May 21, 1957 R. L. HARTER 2,792,911

DIVISIONAL LUBRICANT FEEDER

Filed July 27, 1956 5 Sheets-Sheet 4

Fig. 15

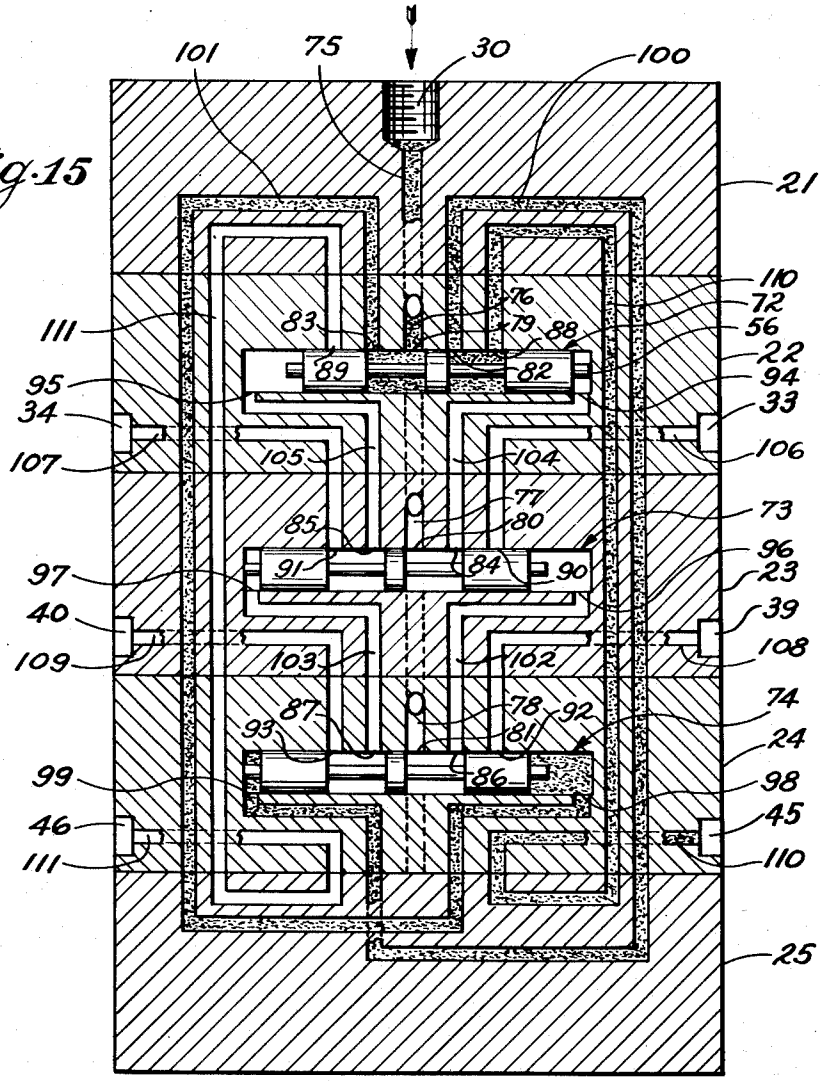
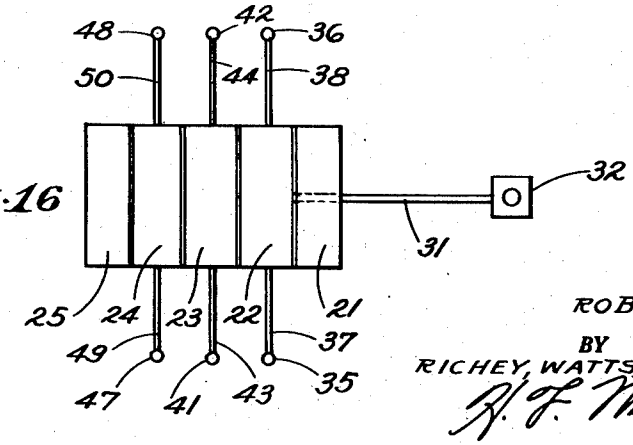


Fig. 16



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DIVISIONAL LUBRICANT FEEDER

Filed July 27, 1956 5 Sheets-Sheet 5

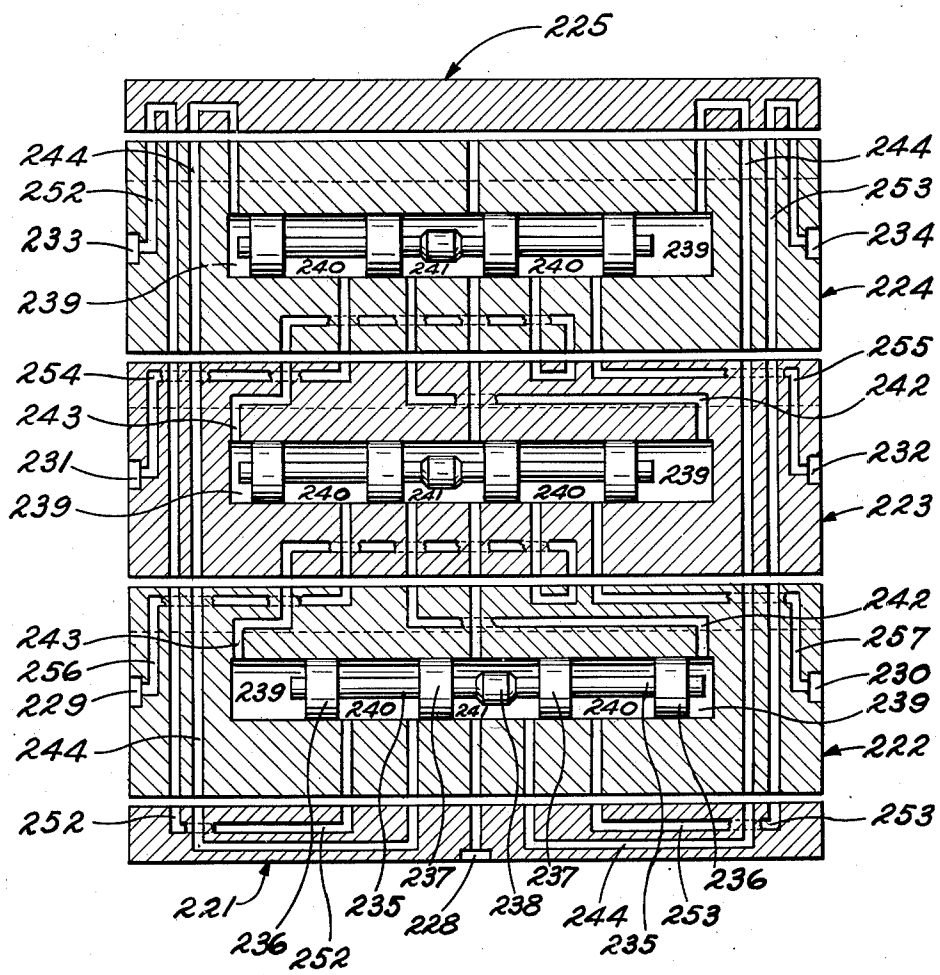


Fig. 17

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United States Patent Office 2,792,911 Patented May 21, 1957

2,792,911

DIVISIONAL LUBRICANT FEEDER

Robert L. Harter, Annapolis, Md., assignor to Trabon Engineering Corporation, Cleveland, Ohio, a corporation of Ohio

Application July 27, 1956, Serial No. 600,538

3 Claims. (Cl. 184—7)

This invention relates to automatic lubricating systems and, more particularly, to a divisional feeder in which a lubricating medium is transmitted from a central station to a plurality of lubricating devices distant therefrom, such as bearings.

This application is a continuation-in-part of my co-pending abandoned applications Serial No. 443,522, filed July 15, 1954 and Serial No. 463,868, filed October 22, 1954.

An object of the invention is to minimize the loss of pressure in centralized lubricating systems of the type to which the invention relates.

Another object of the invention is to provide an improved divisional feeder which may be adapted to service any desired number of lubricating devices or bearings.

Still another object of the invention is to improve the reliability of centralized lubricating systems and to make such systems more adaptable for particular installations.

In my abandoned application, Serial No. 196,921, filed November 21, 1950, and entitled "Divisional Feeder," there is described a distributor for lubricating systems which is adapted to feed a fluid or semi-fluid lubricating medium from a pump to a number of bearings in turn. Such distributors are known in the art as divisional feeders and the feeder referred to comprises a number valve blocks or sections, each incorporating an ejector valve for receiving the lubricating medium from a pump and transmitting the lubricating medium to two bearings associated therewith. A number of the blocks are assembled together with suitable inlet and end blocks, and the several ejector valves cooperate so that each valve is controlled by the operation of another valve which makes the necessary interconnections to the succeeding valve when it operates. Several valves are interconnected so that the operation proceeds in a cyclical fashion, and the valves of the feeder continue to operate to transmit lubricant to the associated bearings so long as the pressure is maintained by the pump associated with the system.

The present invention is concerned with a multiple section divisional feeder of improved construction. In particular, it is very important that the loss of pressure experienced by the lubricating medium in traveling from the lubricant pump through the various conduits and the divisional feeder to the bearings is an important factor in the practical usefulness of such systems. Many factors contribute to produce substantial pressure losses, particularly in the feeder, and it is easily possible that the pressure exerted upon the lubricating medium will drop to the extent of several thousand pounds p. s. i. between the lubricant pump and the bearings. It will easily be seen that, unless great care is taken in the design of the apparatus, the pressure exerted upon the lubricating medium at the bearing will not be sufficient to force the lubricating medium into the bearing.

The feeder of the present invention incorporates a novel ejector valve which accomplishes a dual function, e. g. in that operation of the valve serves to transmit the lubricating medium to the bearings associated with the valve, while simultaneously interconnecting a succeeding valve so that that valve may be operated in its turn. The ejector valve is embodied in a valve block which is associated with a number of similar valve blocks to produce a cyclically operated device of the type referred to above. The particular design of the valves is, however, such that the passages interconnecting the several ejector valves are symmetrically disposed at each side of the feeder and are relatively short, so that the loss in pressure upon the lubricating medium incurred by reason of the passage resistance is minimized.

An important advantage of the present invention is that valve blocks having cylinders of different sizes may be assembled in one feeder and the lubricant which is discharged from the cylinder of one block will pass out through the outlets of that block. This construction makes it possible to use in the feeder several blocks having the same size and shape and arrangement of passages but with cylinders of different sizes which will deliver different amounts of lubricant from their respective blocks, said amounts of lubricant being suitable for the requirements of bearings of different sizes. Thus it is possible to make a feeder consisting of a plurality of valve blocks each adapted to discharge different amounts of lubricant. It is not necessary to alter any of the blocks but only to select blocks having cylinders of the desired capacity. This advantage is traceable primarily to the fact that lubricant discharged from any given block passes through the outlets from that block.

The invention together with further objects, features and advantages thereof will be more fully apparent from a consideration of the following detailed specification and claims taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of the feeder of the invention;

Fig. 2 is an end view of one of the valve blocks of the feeder;

Fig. 3 is a section view taken in the direction 3—3 in Fig. 1;

Fig. 4 is a longitudinal sectional view taken in the direction 4—4 in Fig. 1;

Fig. 5 is a view of the valve block taken on the inlet side thereof;

Fig. 6 is a view of the valve block taken on the outlet side thereof;

Fig. 7 is a section view of the valve block taken in the direction 7—7 of Fig. 5;

Fig. 8 is a section view of the valve block taken in the direction 8—8 of Fig. 5;

Fig. 9 is a view of the inlet block showing the inside face thereof;

Fig. 10 is a section view of the inlet block taken in the direction 10—10 in Fig. 9;

Fig. 11 is a view of the end block showing the inside face thereof;

Fig. 12 is a section view of the end block taken along the line 12—12 in Fig. 11;

Figs. 13 and 14 are views of the gasket;

Fig. 15 is a schematic diagram illustrating particularly the internal passages of the feeder;

Fig. 16 is a schematic diagram illustrating the lubricating system for which the feeder forms a part; and

Fig. 17 is a view similar to Fig. 15 but showing a modified form of the invention.

Referring now to Fig. 1, the divisional feeder **20** of the invention comprises an inlet block **21**, three valve blocks **22**, **23** and **24**, and an end block **25**. The blocks are held together by three tie bolts **26**, **27** and **28**, and four gaskets **29** insure a lubricant-tight seal between the adjoining faces of the several blocks.

Referring also to Fig. 16, a lubricating medium, such as grease, is supplied to a main inlet 30 of the feeder 20 by means of a conduit 31 which is connected to the grease pump 32. The feeder 20 incorporates a number of main outlets, two for each of the valve blocks 22, 23 and 24, respectively, which are connected to the bearings to be lubricated by suitable conduits. Thus, the main outlets 33 and 34 of the valve block 22 are connected to two bearings 35 and 36 by conduits 37 and 38. Correspondingly, main outlets 39 and 40 of valve block 23 are connected to bearings 41 and 42 by conduits 43 and 44, respectively, and main outlets 45 and 46 of valve block 24 are connected to bearings 47 and 48 by conduits 49 and 50, respectively.

The valve blocks 22, 23 and 24 are of identical construction, the feeder 20 being so designed that any number of valve blocks may be combined with the inlet block 21 and the end block 25 so that any desired number of bearings may be serviced. In order that the advantages of continuous operation be insured, it is necessary that a minimum of three valve blocks be utilized. Where less than six lubricating devices are to be serviced by the feeder, the main outlets may be interconnected in accordance with the teachings of my application, Serial No. 220,609, filed April 12, 1951, now Patent Number 2,718,281.

Referring now to Figs. 2 and 3, the valve block 22 comprises a generally rectangular body 51 having two plane parallel side faces 52 and 53. The valve block 22 incorporates an ejector valve 54 comprising a cylinder 55 and a piston 56. Cylinder 55 includes an opening 57 transversely through the body 51 and two cap screws 58 and 59 which are threaded into the body and close the ends of the opening 57. Annular sealing members 60 and 61 are received at appropriate grooves in the body 51.

The piston 56 is formed in a single piece and includes a body 62, a center land 63 and two end lands 64 and 65, respectively. The end lands 64 and 65 are spaced from the center land 63 to form chambers for interconnecting certain ports of the cylinder, while the lands 64 and 65 are employed to close certain ports of the cylinder as will be described hereinafter. It is important that the cylinder opening 57 be perfectly straight and coaxial throughout the length of the opening so that the lands of the piston engage the walls of the cylinder to form a lubricant-tight seal and effectively separate the cylinder into separate parts and to prevent surface broaching or other detrimental wearing effects.

The main outlets 33 and 34 of the valve block 22 open at the top of the body 51. Associated with these outlets are additional main outlets 66 and 67 which open at the ends of the body and are connected to the outlets 33 and 34 by openings 68 and 69, respectively. The feeder may thus be accommodated to any particular installation, and the main outlets which are not used may be closed, as by the plugs 70 and 71 in the main outlets 66 and 67.

The ejector valves of the several blocks are interconnected each with the other and with the main inlet 30 and with the several main outlets by means of openings in the several blocks which extend to the adjoining faces of the several blocks and cooperate from block to block to form passages through which the grease may be transmitted. As shown particularly in Fig. 4, the tie bolts 26, 27 and 28 extend longitudinally through the blocks and hold the blocks and the gaskets 29 in intimate engagement so as to insure that the grease flows from the opening of one block to the openings of the adjacent block, and that none of the grease escapes from the adjacent faces of the blocks.

In order that the arrangement and disposition of the passages in the several blocks may be more clearly understood, reference may be made to Fig. 15, wherein there is shown a schematic diagram of the several ejector valves of the feeder 20 and the passages which interconnect the several ejector valves and the ejector valves with the main inlet and main outlets.

Grease is supplied to the several ejector valves by a main inlet passage 75 which extends from the main inlet 30 longitudinally through the blocks. The grease is transmitted from the passage 75 to the cylinders of the valves 72, 73 and 74 by branch passages 76, 77 and 78. The branch passages 76, 77 and 78 join the cylinder openings to form the inlet ports 79, 80 and 81, respectively, of the several valves.

Two valve ports are provided in each cylinder equidistant from the inlet port and at such a distance therefrom that one valve port communicates with the inlet port when the piston is in one extreme position, and the other valve port communicates with the inlet port when the piston is in the other extreme position. The valve ports of ejector valve 72 are represented at 82 and 83, those of valve 73 at 84 and 85, and those of valve 74 at 86 and 87.

Each ejector valve incorporates two outlet ports, one at each side of the inlet port and outwardly from the associated valve port. Each outlet port is spaced from its associated valve port by a distance such that one valve port communicates with the associated outlet port and the remaining outlet port at the other end of the cylinder is closed by an end land of the piston when the piston is in either extreme position at the ends of the cylinder. The outlet ports of ejector valve 72 are represented at 88 and 89, those of ejector valve 73 at 90 and 91 and those of ejector valve 74 at 92 and 93.

Each ejector valve incorporates two drive ports, one at each end of the cylinder, the drive ports serving to admit the grease into the chamber at the one end of the cylinder for moving the piston to the remaining end of the cylinder, and for transmitting a measured amount of grease from the remaining end of the cylinder to a main outlet associated with that end of the cylinder. The drive ports of ejector valve 72 are represented at 94 and 95, those of ejector valve 73 at 96 and 97 and those of ejector valve 74 at 98 and 99.

The valve ports of each ejector valve are connected to the drive ports of what may be termed the succeeding valve. Thus, the valve ports 82 and 83 of ejector valve 72 are connected to the drive ports 99 and 98 of ejector valve 74 by means of drive passages 100 and 101; valve ports 86 and 87 of ejector valve 74 are connected to drive ports 96 and 97 of ejector valve 73 by means of drive passages 102 and 103; and valve ports 84 and 85 of ejector valve 73 are connected to drive ports 94 and 95 of ejector valve 72 by drive passages 104 and 105. The various ejector valves must be so interconnected that continuity of operation is assured, e. g. that no one of the pistons may reach a dead-center or stalled position, and it is an important feature of the invention that, by reason of the organization of the valves, only one cross-over is required in these passages. Thus, only the passages 100 and 101 are crossed, e. g. in the end block 25, while the remaining drive passages 102 and 103 and 104 and 105 are each disposed entirely at one side of the centerline of the feeder. This same arrangement holds true whatever the number of valve blocks and ejector valves are incorporated in the feeder.

The drive passages 100–105, inclusive, perform a dual function, that is to transmit the grease from the inlet passage to the valve cylinders and, conversely, to transmit the grease from the valve cylinders to the main outlets. From this consideration, the importance of keeping these passages as short as possible in order to reduce the pressure loss in the feeder will be apparent.

The outlet ports of each ejector valve are connected to the main outlets of the succeeding valve block so that in operation, the portion of grease which is ejected from a valve passes through the associated drive passage to the preceding ejector valve and thence through an outlet passage back to the main outlet at the same side of the same valve block. Thus, the main outlets 33 and 34 of

24 communicate at the end face of that block with two horizontal grooves 155 and 156 in the end block 25 which transmit the grease to the openings in valve block 24 corresponding to openings 147 and 148 in valve block 22 and hence to the associated main outlets 45 and 46.

The gaskets 29 are shown in Figs. 13 and 14 and comprise a sheet 157 of suitable material of the same size as the blocks of the feeder. The gaskets include openings 158 which correspond in position to the openings in the valve blocks just described.

The disposition of the several tie bolts 26, 27 and 28 is an important feature of the present feeder inasmuch as the tie bolts are so located as to impart a maximum sealing effort for the benefit of the more extreme longitudinal openings such as openings 153 and 154. Thus, in valve block 22, the opening 160 is above the cylinder opening and between the openings 153 and 154 and the main outlets, while the openings 161 and 162 for the tie bolts 28 and 27 are disposed at the opposite side of the cylinder opening and outside the inlet passage 120 and the drive passage openings 141 and 142. Thus, the portions of the feeder which are subjected to the greatest stresses, e. g. at the inlet of the feeder, are directly held by the tie bolts 27 and 28, yet allowing a substantial distance between the center of the tie bolt and the extremities of the valve block. Thus, the size of the blocks need not be increased to keep the stresses upon the tie bolts and the block bodies within reasonable limits.

The modified form of apparatus shown in Fig. 17 may be used with the pump 32 of Fig. 16 and is quite like the feeder shown in detail in Figs. 1 to 15. Like the feeder of Fig. 15 the feeder of Fig. 17 comprises an inlet block 221, three valve blocks 222, 223 and 224, and an end block 225. These several blocks are held together by two tie bolts like those shown in Fig. 4.

Each of the three valve blocks is generally rectangular and has two plane parallel side surfaces which engage opposed surfaces of blocks on either side thereof. Each valve block incorporates an ejector valve comprising a cylinder and a piston. The cylinders are constructed substantially as shown in Figs. 2 and 3 and as described above in connection with those figures. Each of the pistons is formed with two parts preferably in accordance with the teachings of my copending application Serial No. 178,271, filed August 8, 1950, now Patent Number 2,742,924, but the pistons of the modification shown in Fig. 17 differ from the pistons of Figs. 1 to 15 in that each of the pistons of Fig. 17 is made in two parts, each including two lands with the two parts being coupled together at their adjacent ends. These lands have sufficiently close fitting engagement with the inner surfaces of the cylinders to prevent lubricant under considerable pressure from passing between the lands and the cylinder wall.

It will be understood that the various passages for the flow of lubricant in the apparatus of Fig. 17 may be formed as fully described hereinabove in connection with the description of Figs. 4 to 12 and that gaskets like those shown in Figs. 13 and 14 may likewise be used in the manner above described.

From the foregoing comparisons of the devices of Figs. 15 and 17 and consideration of those figures it will be understood that the main differences between these two devices is in the pistons and the passages for flow of lubricant. Accordingly a more detailed description of these parts will suffice to make plain to those skilled in the art the construction and operation of the apparatus of Fig. 17.

The divisional feeder of Fig. 17 is provided with a main inlet 228 in the end block 221 to be connected to a grease pump and this passage 228 extends through the valve blocks 222, 223 and 224, and communicates with the cylinder of each block.

Each of the valve blocks has two main outlets. These outlets from block 222 are indicated at 229 and 230; those from block 223 are indicated at 231 and 232, while those from block 224 are indicated at 233 and 234.

The ejector valves of the several blocks are connected with each other and with the main inlet 228 and with the several main outlets by means of openings which extend to the adjoining faces of the several blocks and from block to block to form passages through which the lubricant may be transmitted.

The several pistons are substantially identical and hence the description of one will suffice for all three. Each piston consists of a rod 235 having lands 236 and 237 thereon, the latter lands being adjacent to each other. The adjacent ends of rods 235 are connected by a coupling 238. The lands 236 may be called end lands while lands 237 may be called center lands.

The end lands 236 cooperate with the walls of the cylinder to form end chambers 239 in each valve block. Each pair of lands 236 and 237 defines, with the cylinder walls, an intermediate chamber 240. The adjacent center lands 237 define, with the cylinder walls, a central chamber 241 into which inlet passage 228 opens.

The end chambers 239 of each valve block are connected to intermediate chambers 240 of another valve block; that is, the end chambers 239 of block 222 communicate with chambers 240 of block 223 through passages 242 and 243 which, it will be noted cross each other and inlet passage 228 so that the right end chamber of block 222 communicates with the left intermediate chamber of block 223 and the left end chamber of block 222 communicates with the right intermediate chamber of block 223. The end chambers of block 223 similarly communicate with intermediate chambers of block 224 through passages 242 and 243. The end chambers of block 224 communicate with intermediate chambers of block 222 through passages 244 which, it will be noted, do not cross each other but connect together the end chamber and the intermediate chamber on the same side of inlet passage 228.

The intermediate chambers of each block are connected to the main outlets from another block through passages. The left-hand intermediate chamber 240 of block 222 is connected to main outlet 233 of block 224 by passage 252. Similarly the main outlet 234 from block 224 is connected through passage 253 with the right hand intermediate chamber of block 222. The main outlets 231 and 232 of block 223 are connected to the opposite intermediate chambers 240 of block 224 by passages 254 and 255. The main outlets 229 and 230 of block 222 are similarly connected to intermediate chambers 240 of block 223 by passages 256 and 257.

From the foregoing description of the apparatus of Fig. 17 and the description of the operation of Fig. 15, the operation of the apparatus of Fig. 17 will be readily understood but may be succinctly described as follows:

Assuming that the several pistons are in the position shown in Fig. 17, that the several passages and chambers of the apparatus are filled with lubricant, and that lubricant under pressure is being forced into passage 228, it will be seen that there can be no flow of lubricant from the central chamber of block 222 because the passage 244 which leads therefrom opens into the right hand end chamber of block 224 and the piston of that chamber is already at the extreme left end of its stroke. A similar situation exists with respect to block 224 where lubricant cannot flow from inlet passage 228 through passage 242 into the right hand end chamber of block 223 because the piston therein is already at the left end of its stroke.

However, lubricant may flow from inlet passage 228 through the central chamber of block 223 and out through passage 242 to the right hand end chamber 239 of block 222, and will move the piston in that block to the left end of its stroke. As that piston moves it expels lubricant through passage 243 into the right hand intermediate chamber of block 223 and thence through passage 257 to main outlet 230 from that block.

As the piston in block 222 moves to the left it also

valve block 22 are connected to the outlet ports 90 and 91 of ejector valve 73 by passages 106 and 107, respectively, main outlets 39 and 40 of valve block 23 are connected to the outlet ports 92 and 93 of ejector valve 74 by passages 108 and 109, respectively, and main outlets 45 and 46 of valve block 24 are connected to outlet ports 88 and 89 of ejector valve 72 by passages 110 and 111, respectively.

In operation, referring to the position of the pistons in Fig. 15, the grease flows from the main inlet 30 through the main inlet passage 75 and through the several branch passages 76, 77 and 78, respectively, and through the several inlet ports into the cylinders of the ejector valves. In valve 72, the grease flows from the inlet port between the center and left end lands of the piston to the valve outlet 83, thence through the passage 101 to the drive port 98 of valve 74. Since the piston of that valve is already in the extreme left position, the pressure of the grease serves to hold the piston in that position. Similarly, the grease passes through the cylinder of valve 74 between the center and right end lands through the passage 102 and drive port 96 to hold the piston of valve 73 in its extremely left position.

The grease which enters the cylinder of valve 73, however, passes through the cylinder between the center and right end lands of the piston to the valve port 84 and through drive pasage 104 to the drive port 94 of valve 72. The pressure exerted by the grease upon the right end of the piston, e. g. piston 56, moves the piston to the left, thus forcing the grease already in the left end of the cylinder through the passage 105 to the cylinder of valve 73, whence grease passes between the center and left end lands to the outlet port 91 and through the passage 107 to the main outlet 34. With the piston 56 in the left hand position, outlet port 88 is closed by the right end land of piston 56 and the valve outlet 82 is connected to the inlet passage 75 so that grease may be transmitted through pasage 100 to the drive port 99 of valve 74 and shift the piston of that valve; and valve port 83 is connected to outlet port 89 so that when the piston of valve 74 is shifted to the right, grease in the right end of the cylinder may be transmitted through passages 101 and 111 to the main outlet 46.

This mode of operation continues, the piston of each valve being moved to the opposite end of its cylinder in turn to eject a measured amount of the lubricating grease from the main outlet associated with that end of the cylinder of the valve. A consideration of the mode of operation of the several valves will make it clear that none of the pistons may become stalled or dead-centered.

Referring now to Figs. 4–12, inclusive, the various openings in the several valve blocks which form the valve interconnecting passages, described with reference to Fig. 15, are there shown in detail. The separate main inlet passage 75, which, as set forth above, constitutes an important part of the invention, is formed by a number of openings 120, 121 and 122 longitudinally through the valve blocks aligned with each other and with an opening 123 from the main inlet 30 to the inner face of the inlet block 21. The branch passages 76, 77 and 78 comprise a longitudinal opening from the inlet end face of the valve block to the cylinder opening, shown at 124, 125 and 126, for the valve blocks 22, 23 and 24, respectively.

The branch passages also include a groove in the inlet side face of the valve block which interconnects the opening just referred to with the longitudinal opening in that valve block of the main inlet passage 75. Thus, the groove 127 interconnects the openings 120 and 124 in valve block 22, while the grooves 128 and 129 interconnect the corresponding openings in valve blocks 23 and 24.

The branch passages may also include openings in the adjacent blocks which shunt the grooves just referred to as, e. g. the openings 130, 131 and 132 in the inlet block 21 and valve blocks 22 and 23, respectively. The use of such shunt openings is by no means necessary to the practice of the invention.

The drive passages 100—105, inclusive, include certain openings and grooves in the valve blocks which are identical in the several blocks and certain openings and grooves in the inlet and end blocks which cooperate with the openings and grooves in the valve blocks. Referring particularly to Figs. 5 and 6, the valve block 22 incorporates two longitudinal openings 133 and 134 from the inlet face of the body 51 to the cylinder opening 57. These openings form the inlet ports 82 and 83, respectively, with the cylinder opening 57 and at the outer end thereof communicate with two grooves 135 and 136 which are formed in the inlet face of the block 22. The grooves 135 and 136 extend horizontally outward from the inlet port openings 133 and 134 and communicate at the outer end thereof with two openings in the preceding valve block which communicate with the drive ports of the valve of that block. Thus, for the valve block 22, the horizontal grooves corresponding to grooves 135 and 136 of valve block 23 would communicate with two openings 137 and 138 which extend from the end face of the body 51 to the cylinder opening 57 to form drive ports 94 and 95, respectively.

The passages 100 and 101 include openings which extend from the cylinder of ejector valve 72 through the inlet block 21, the several valve blocks 22, 23 and 24 and the end block 25 to the ejector valve 74. Thus, at the inlet end of the feeder, the passages 135 and 136 of valve block 22 communicate with grooves 139 and 140 in inlet block 21 to transmit lubricant from the valve ports of valve 72 to a number of aligned openings, including the openings 141 and 142 in valve block 22, through the valve blocks at the end of the feeder. At the end face of valve block 24, the openings corresponding to openings 141 and 142 communicate with openings 143 and 144 at the inside end of end block 25. These openings transmit the grease to the openings in valve block 24 corresponding to the openings 137 and 138 in valve block 22, and thence to the drive ports 98 and 99 of ejector valve 74. The openings 143 and 144 are crossed as illustratively represented in Fig. 15 and include two diagonal openings parallel to the inside face of the block 25 and at different distances from that face. The disposition of the openings 143 and 144 will be apparent from a consideration of Figs. 11 and 12.

The outlet passages 106—111, inclusive, include openings at opposite sides of each of the valve blocks which cooperate with the associated openings in the adjacent blocks. Thus, as shown in Fig. 5, in valve block 22 two openings 145 and 146 extend diagonally downward from the inlet face of the body 51 and form with the cylinder opening 57 the outlet ports 88 and 89, respectively. Similar openings in the valve block 23 cooperate with two openings 147 and 148 at the end face of block 22 which communicate with the main outlets 33 and 34, respectively. As illustrated particularly in Figs. 6 and 8, the openings 147 and 148 are connected to the main outlet openings by means of short vertical bores 149 and 150 so that the vertical disposition of the openings 147 and 148 is the same as the outer end of the associated openings 145 and 146.

The passages 110 and 111 extend from the ejector valve 72 to the inlet block 21 through the several valve blocks and the end block 25 to the ejector valve 74. To this end, the outlet openings 145 and 146 in the valve block 22 communicate with two horizontal grooves 151 and 152 in the inlet block 21, at the inner end of those grooves. The grooves 151 and 152 communicate at the outer ends thereof with two openings 153 and 154, longitudinally through the body 51, which, in turn, cooperate with similar aligned openings in the valve blocks 23 and 24 to transmit the grease to the end of the feeder. The openings corresponding to openings 153 and 154 in valve block

shifts the central chamber to connect inlet passage 228 with passage 244 whereupon lubricant under pressure may flow into the left end chamber of block 224 with resultant movement of the piston in that block to the right hand end of its stroke and with coincident expulsion of lubricant from the right hand end chamber through the other passage 244 into the right hand intermediate chamber of block 222 and thence through passage 253 to main outlet 234. As the piston in block 224 moves to the right end of its stroke the central chamber in the block is shifted so that the inlet passage 228 is connected with passage 243 leading to the left end chamber of block 223. As lubricant is discharged into that chamber the piston is moved to the right end of its stroke and discharges lubricant from the right end chamber through passage 242, the left hand intermediate chamber of block 224 and passage 254 to main outlet 231 of block 223.

It will be understood that when the piston in block 223 has been moved to the right end of its cylinder, the pistons may be moved to the other ends of their cylinders in the foregoing order and with discharge of lubricant through main outlets 230, 234 and 231. These operations comprise one complete cycle. At the end of one cycle the valves are in position to start another cycle and to discharge lubricant through outlets 229, 233 and 232.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, I state that the subject-matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood equivalents or modifications of, or substitutions for, parts of the above specifically described embodiments of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What is claimed is:

1. A divisional lubricant feeder comprising in combination two spaced apart end blocks and at least three valve blocks between said end blocks, said blocks being connected together and having cooperating grooves in their engaging faces forming passages for lubricant, each valve block having a cylinder and an endwise movable piston therein provided with lands having lubricant tight engagement with the walls of the cylinder and forming end and intermediate chambers in the cylinder, the feeder having an inlet passage opening into the central part of the several cylinders, each block having outlets on opposite sides of said inlet passage, and means for actuating said pistons in succession for sequential and cyclical discharge of lubricant from the end chambers of the several blocks through their respective outlets, said means comprising, for each block, a first passage connecting one end chamber of that block with the inlet passage through an intermediate chamber of another block to admit lubricant under pressure into said end chamber and thereby to move the piston endwise in the cylinder and a second passage connecting the other end chamber of that block with an outlet from that block through another intermediate chamber of said another block, when said piston has been so moved, to conduct lubricant from said other end chamber to said outlet, each of said passages being formed in part by certain of said cooperating grooves, said first and second passages of at least one block crossing one another and also the inlet passage to connect the end chambers of said one block on one side of the inlet passage with intermediate chambers of another block on the opposite side of the inlet passage, and the corresponding passages of at least one other block connecting the end chambers thereof with intermediate chambers of a block on the same side of the inlet.

2. A divisional lubricant feeder comprising in combination two spaced apart end blocks and at least three valve blocks between said end blocks, said blocks being connected together and having cooperating grooves in their engaging faces forming passages for lubricant, each valve block having a cylinder and an endwise movable piston therein provided with three lands having lubricant tight engagement with the walls of the cylinder and forming two end and two intermediate chambers in the cylinder, the feeder having an inlet passage opening into the central part of the several cylinders, each block having outlets on opposite sides of said inlet passage, and means for actuating said pistons in succession for sequential and cyclical discharge of lubricant from the end chambers of the several blocks through their respective outlets, said means comprising, for each block, a first passage connecting one end chamber of that block with the inlet passage through one intermediate chamber of another block to admit lubricant under pressure into said end chamber and to move the piston endwise in the cylinder and a second passage connecting the other end chamber of that block with an outlet from that block through the other intermediate chamber of said another block, when said piston has so moved, to conduct lubricant from said other end chamber to said outlet, each of said passages being formed in part by certain of said cooperating grooves, said first and second passages of all but one block crossing one another and also the inlet passage to connect each of the end chambers of said one block with intermediate chambers of another block on the opposite side of the inlet passage, and the corresponding passages of the remaining blocks connecting each of the end chambers thereof with intermediate chambers of a block on the same side of the inlet.

3. A divisional lubricant feeder comprising in combination two spaced apart end blocks and at least three valve blocks between said end blocks, said blocks being connected together and having cooperating grooves in their engaging faces forming passages for lubricant, each valve block having a cylinder and an endwise movable piston therein provided with four lands having lubricant tight engagement with the walls of the cylinder and forming two end and two intermediate chambers in the cylinder, the feeder having an inlet passage opening into the central part of the several cylinders, each block having outlets on opposite sides of said inlet passage, and means for actuating said pistons in succession for sequential and cyclical discharge of lubricant from the end chambers of the several blocks through their respective outlets, said means comprising, for each block, a first passage connecting one end chamber of that block with the inlet passage through one intermediate chamber of another block to admit lubricant under pressure into said end chamber and to move the piston endwise in the cylinder and a second passage connecting the other end chamber of that block with an outlet from that block through the other intermediate chamber of said another block, when said piston has so moved, to conduct lubricant from said other end chamber to said outlet, each of said passages being formed in part by certain of said cooperating grooves, said first and second passages of all but one block crossing one another and also the inlet passage to connect each of the end chambers of each of said blocks with intermediate chambers of other blocks on the opposite side of the inlet passage, and the corresponding passages of the remaining block connecting each of the end chambers thereof with intermediate chambers of a block on the same side of the inlet.

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