June 20, 1944. E. H. KOCHER 2,351,620

HYDRAULICALLY OPERATED MACHINE TOOL

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Fig. 1.

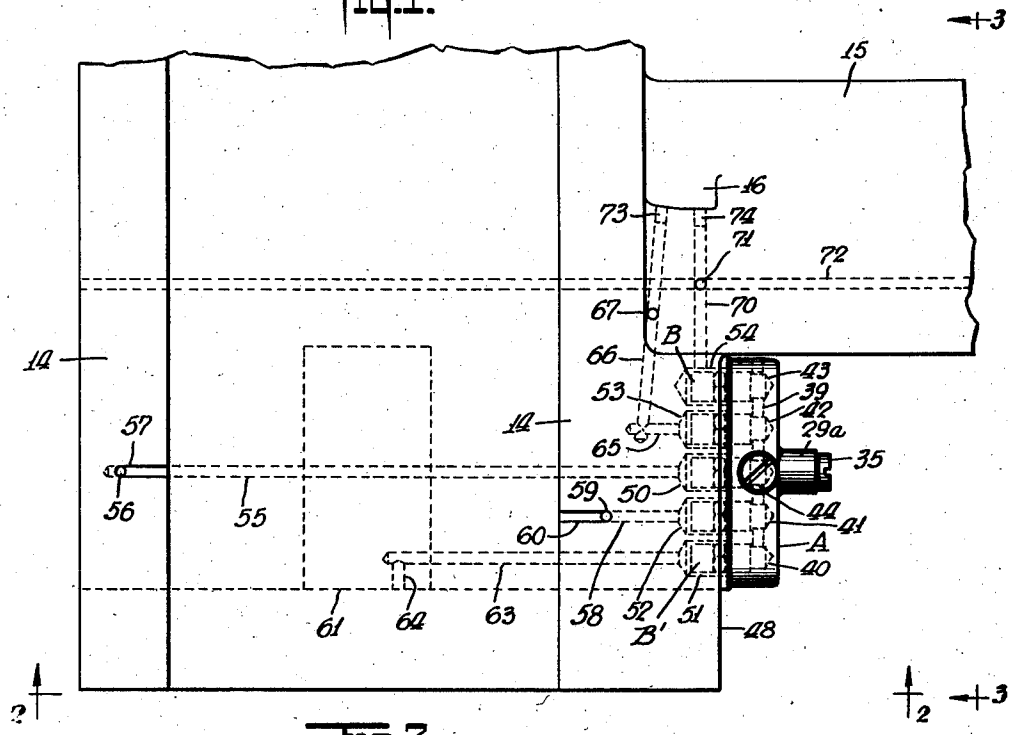


Fig. 2.

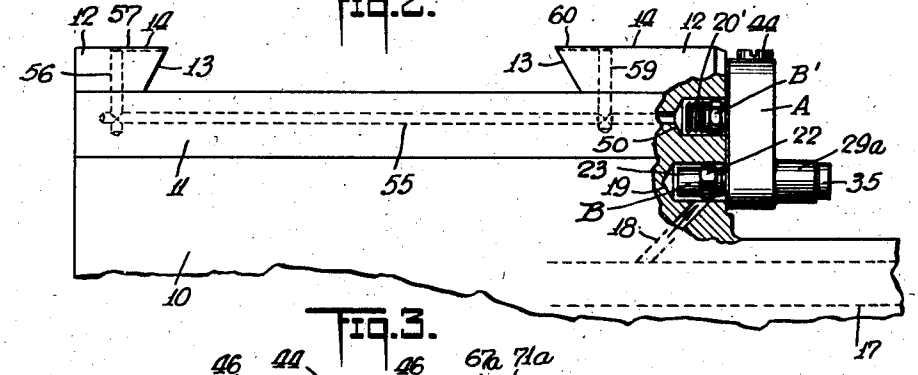
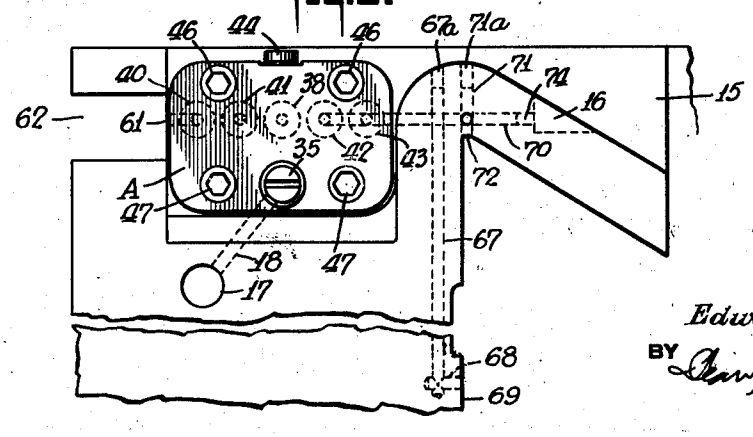


Fig. 3.



INVENTOR
Edward H. Kocher
BY
ATTORNEYS

June 20, 1944. E. H. KOCHER 2,351,620

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FIG. 4.

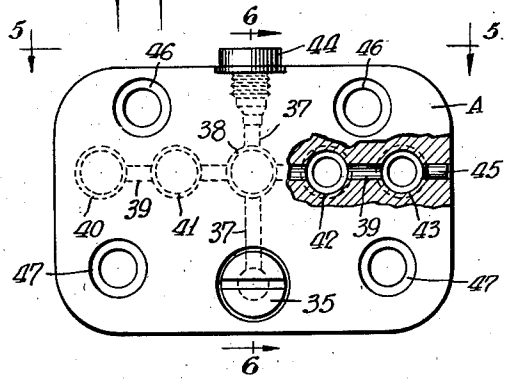


FIG. 5.

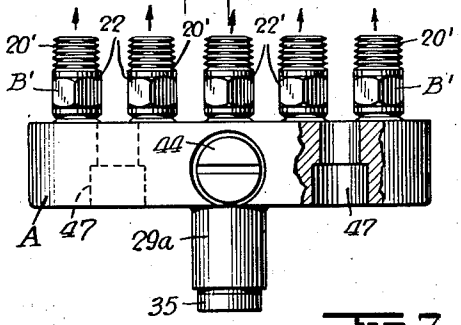


FIG. 6.

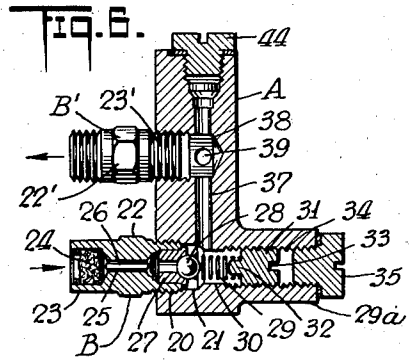


FIG. 7.

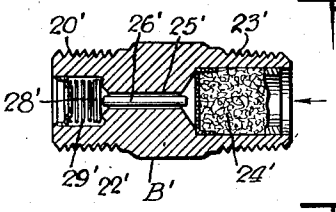


FIG. 8.

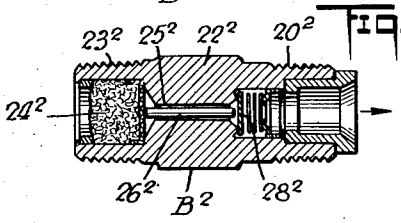
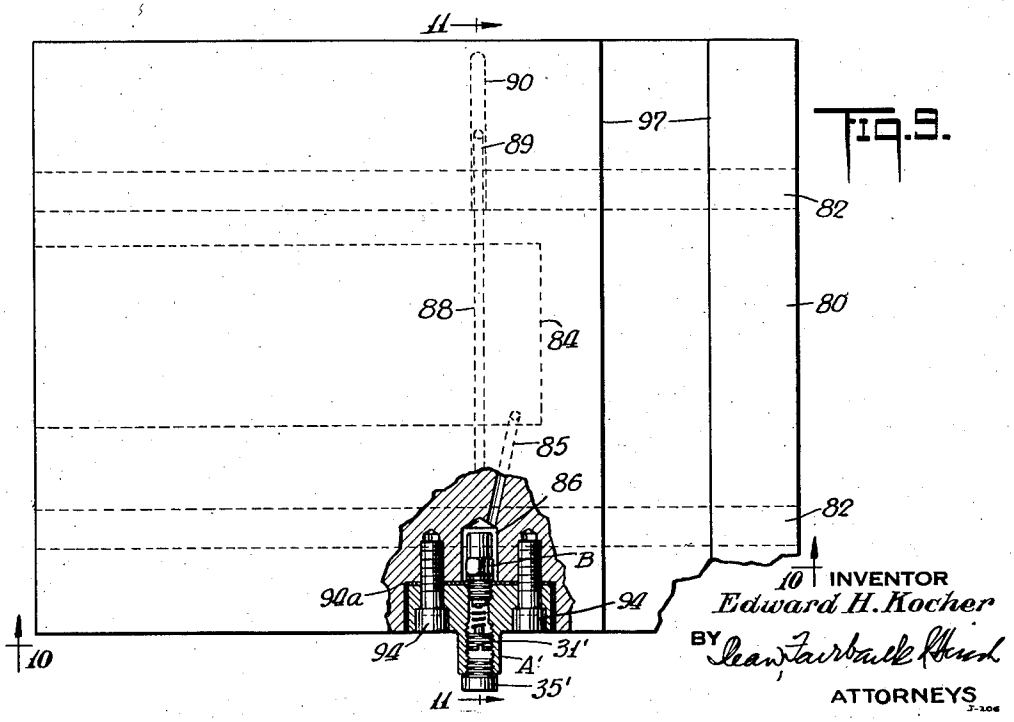


FIG. 9.



INVENTOR
Edward H. Kocher
BY Dean, Fairbank & Hurd
ATTORNEYS

June 20, 1944. E. H. KOCHER 2,351,620

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Fig. 10.

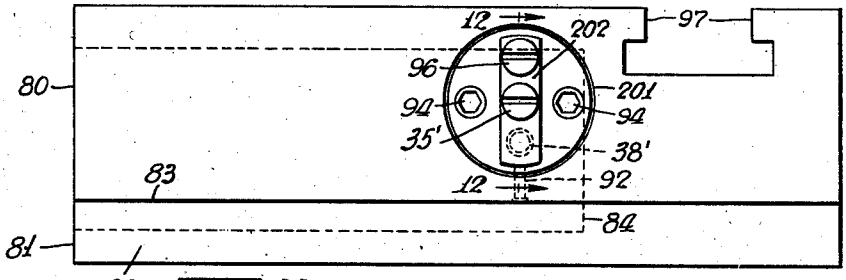


Fig. 11.

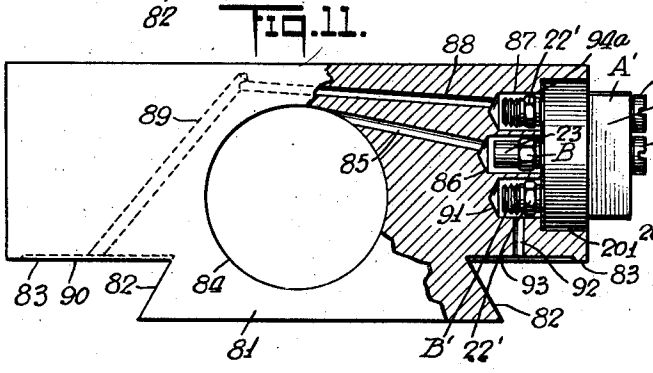
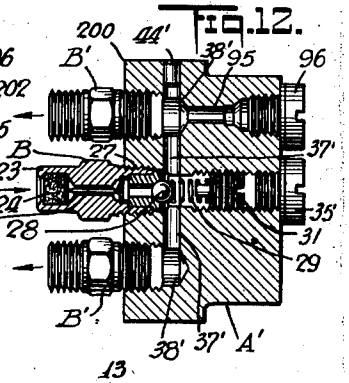
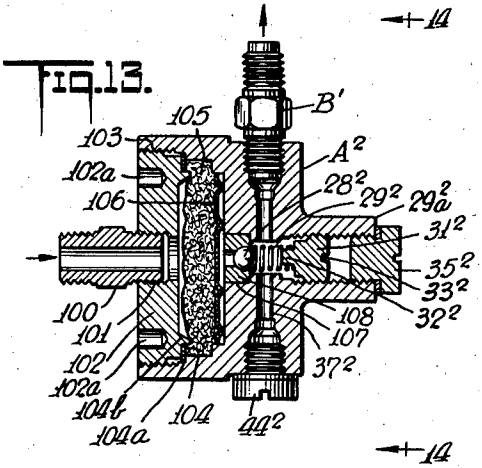


Fig. 12.



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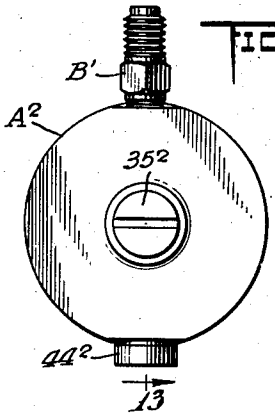
Fig. 13.



14

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Fig. 14.



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INVENTOR
Edward H. Kocher
BY Lean, Fairbanks & Hirsh
ATTORNEYS

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Fig. 15.

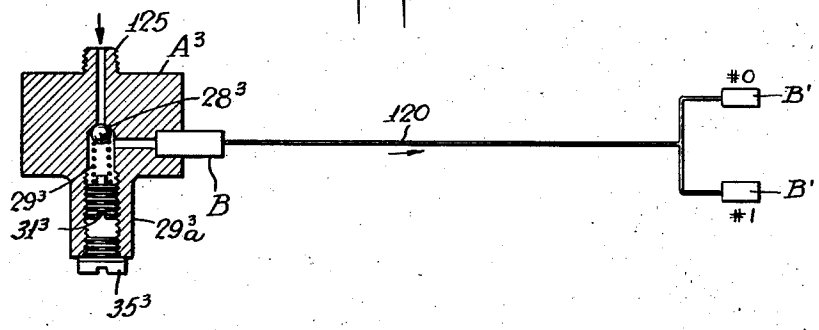


Fig. 16.

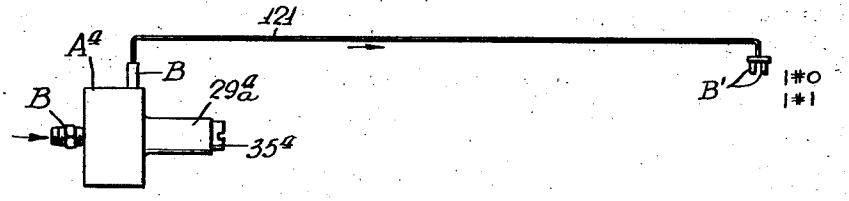


Fig. 17.

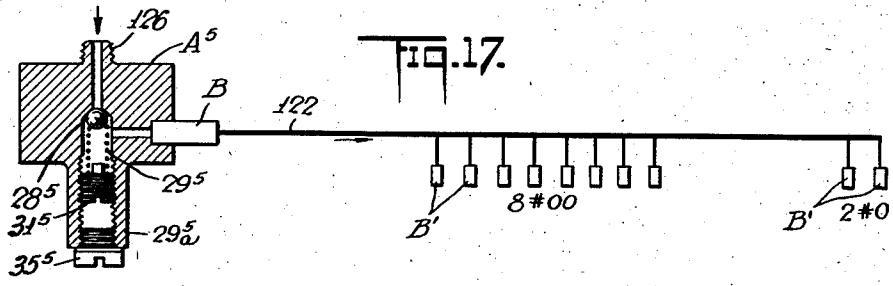
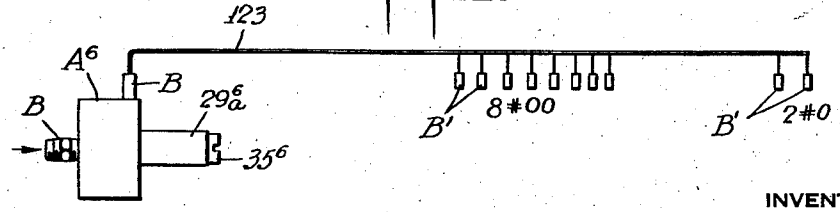


Fig. 18.



INVENTOR
Edward H. Kocher
BY *Lewis, Fairbank & Hirsh*
ATTORNEYS

Patented June 20, 1944 2,351,620

UNITED STATES PATENT OFFICE

2,351,620

HYDRAULICALLY OPERATED MACHINE TOOL

Edward H. Kocher, Boonton, N. J., assignor to Auto Research Corporation, a corporation of Delaware

Application August 3, 1940, Serial No. 350,648

10 Claims. (Cl. 184—6)

The present invention relates to a centralized lubricating installation and it particularly relates to a centralized lubricating installation which may be utilized with a high restriction flow metering outlet system.

Although not specifically restricted thereto, the present invention will be particularly described in connection with its application to the lubrication of hydraulically operated machine tools, such as lathes, boring mills, rotary cutters and so forth.

In connection with such devices, it is customary to utilize high oil pressures varying from about 200 to 300 or more pounds per square inch for operating parts of the machinery.

It is among the objects of the present invention to provide a lubricating installation for the bearings of a hydraulically operated machine tool which will utilize the supply and pressure of the hydraulic oil without substantially diminishing the pressure and without materially decreasing the supply of oil available for hydraulic operation, and at the same time without excessive feed to the bearings, which require relatively small, yet predetermined amounts of lubricant throughout the entire period of operation.

Still further objects and advantages will appear from the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the invention.

In accomplishing the above objects, it has been found most suitable to provide a large number of high restriction metering fittings at the outlets to the bearings, which are arranged in parallel and which are supplied with oil under pressure from the hydraulic operating system.

In series with all of these metering units and at the inlet to the branched tubing or conduit system leading to the bearings, is preferably provided a master restriction which at the same time is placed in series with a loading valve. This loading valve is directly connected to the hydraulic system.

In the preferred arrangement, the pressure drop across the loading valve should range between 50 to 85% of the total pressure drop, while the pressure drop across the master restriction should vary from 25 to 47½% of the total pressure drop, while the pressure drop across the individual meter units arranged in parallel should not exceed between 1 to 5%.

Preferably, the master restriction may have the same or slightly greater restricting effect than the parallel units arranged at the outlets to the bearings to be lubricated.

In the drawings which illustrate several of the various embodiments of the present invention, but to which the present invention is by no means restricted since many alternatives and variations could be made without departing from the scope and spirit of the invention,

Fig. 1 is a fragmentary top plan view of a part of a machine tool bed, such as a lathe, showing the lubricating installation of the present invention applied thereto;

Fig. 2 is an end view taken from the line 2—2 of Fig. 1;

Fig. 3 is a side elevational view taken from the line 3—3 of Fig. 1;

Figs. 4, 5 and 6 illustrate the high restriction pressure reducing unit shown in combination with the machine in Figs. 1 to 4, Fig. 4 being a front elevational view in partial section upon a somewhat larger scale than the view shown in Fig. 3, Fig. 5 being a top view in partial section upon the line 5—5 of Fig. 4, and Fig. 6 being a transverse sectional view upon the line 6—6 of Fig. 4;

Figs. 7 and 8 are longitudinal sectional views of the respective high restriction metering small units which may be utilized in connection with the master units of Figs. 4 to 6, upon an enlarged scale as compared to Figs. 4 to 6;

Figs. 9 to 11 illustrate still another lubricating installation to be associated with a hydraulically operated machine tool, Fig. 9 being a top plan view partly in section, Fig. 10 being a side elevational view upon the line 10—10 of Fig. 9, and Fig. 11 being a sectional view upon the line 11—11 of Fig. 9;

Fig. 12 illustrates a master high restriction pressure reducing unit as used in connection with the installation of Figs. 9 to 11, upon an enlarged scale as compared to Figs. 9 to 11;

Figs. 13 and 14 illustrate an alternative form of high restriction pressure reduction unit, Fig. 13 being a transverse sectional view upon the line 13—13 of Fig. 14 and Fig. 14 being an elevational view upon the line 14—14 of Fig. 13;

Figs. 15, 16, 17 and 18 are respectively diagrammatic conduit or tubing distributing layouts for alternative installations according to the present invention.

Referring to Figs. 1 to 3, there is shown a hydraulically actuated lathe in which the carriage is reciprocated by hydraulic pressure. As

is indicated upon Fig. 2, there is a base structure 10 upon which is superimposed a way structure 11 carrying the side members 12 with the inside inclined faces 13 which contact the reciprocating carriage.

The upper faces 14 are to be lubricated together with the inside faces 13. There is also another structure at the side of the lathe indicated at 15 in Figs. 1 and 3, which receives lubricant at 16.

The main lubricant pressure for actuating the lathe is applied to the pressure reduction and distributing unit A from the hydraulic chamber 17 (see Fig. 2) through the upwardly inclined bore 18 in the base structure 10.

The bore 18 communicates with the recess 19 into which projects the high restriction flow metering fitting B (see Figs. 2 and 6) with an unthreaded inlet end and with a pipe threaded outlet end which is screwed at 20 into a socket 21 on the inside face of the unit A. The unit B has a central body portion 22 of hexagonal or octagonal stock and a reduced diameter inlet portion 23 which has fitted therein a strainer 24 (see Fig. 6). The central portion of the body is provided with a bore 26 (see Fig. 6), which is substantially completely filled by a pin forming a narrow annular crevice therethrough.

At the outlet end of the unit B, there is an annular plug 27 the bevelled outside end of which is closed by the ball check 28 pressed against it by the spring 29. The spring 29 fits into the recess 30 and reacts against the adjustable plug 31 having the spring centering projection 32. This plug 31 is placed in the rearwardly extending nipple. The plug may be adjusted through the slot 33 to fix the seating pressure of the spring 29. This spring 29 is generally set so as to reduce the hydraulic pressure from between 250 to 600 pounds per square inch down to 40 to 100 pounds per square inch. The end of the tapped bore 34 is closed by the removable plug 35.

Extending through the unit A, is the vertical bore 37 which permits lubricant passing the ball check 28 to flow upwardly to the socket 38 and then to the transverse bore 39, which, in turn, communicates with the sockets 40, 41, 42 and 43. The upper end of the bore 37 is plugged by the member 44, while the open end of the transverse bore 39 is plugged by the plug 45 (see Fig. 4).

In the body A there are provided transverse recesses 46 and 47, by which said unit A may be bolted onto the side 48 of the mechanism, as best shown in Fig. 3. Each of the sockets 38 and 40 to 43 inclusive is tapped and receives the threaded inlet ends 23' of the flow restriction metering units B'. These units are of the same general construction as the pressure reducing unit B and similarly functioning parts are indicated by the same numerals primed.

These units are preferably of the type best shown in Fig. 7, in which there is a pin 26' closely fitting in the bore 25' with an inlet strainer at 24' and an outlet check valve 28'. This check valve 28' in the case of the unit B' does not serve substantially to reduce the pressure, but has a very light spring 29'. The valve 28' primarily serves to check reverse flow or ingress of air at a high point with leakage at a low point.

As is indicated in Fig. 7, the outlet end 20' may have a machine thread to receive a compression coupling connection, while the inlet end 23' may have a pipe thread to be screwed directly in lubricant tight fashion into a tapped socket in body A.

In the unit as shown in Figs. 4 to 6 and also as utilized in Figs. 1 to 3, there are provided five units B', which project into the recesses 50, 51, 52, 53 and 54, in the side of the mechanism to be lubricated (see Figs. 1 and 2).

In certain instances, it is also possible to screw the threaded ends 20' directly into sockets in the body of the mechanism, as shown in Figs. 1 to 3, which would avoid the necessity of using a lubricant tight gasket connection between the upper part of the unit A and the body of the machine.

In such case, there would have to be a lubricant tight press fit connection to seal the inlet ends of the fittings B', or such fittings B' would have to have oppositely directed pipe threads on their inlet and outlet ends, so that it would be possible to screw such fittings simultaneously into the machine body and into sockets in the unit A.

From the socket 50, there extends a bore 55 crossing the entire mechanism, which is best shown in Figs. 1 and 2. Adjacent the other side of the device, the bore connects with an upright bore 56 which feeds lubricant into the groove 57 in one of the faces 14.

The other face 14, as is best shown in Fig. 1, is supplied with lubricant through the bores 58, 59 and the groove 60.

The face 61 in the channel 62 is supplied by the bores 63 and 64 from the socket 51 (see particularly, Fig. 1).

The chamber 53, through the bores 65, 66, 67 and 68, feeds lubricant to the face 69 (see Fig. 3).

The chamber 54, through the bores 70 and 71, feeds lubricant to other parts of the mechanism to be lubricated. It will be noted that the bores 66 and 70 are plugged at 73 and 74 after they have been bored into the structure from the recess 16 while the bores 67 and 71 are plugged at 67^a and 71^a (see Fig. 3).

In operation, the lubricant under high pressure will be fed from the chamber 17 past the restriction unit B, the loading valve 28 and the flow restriction metering outlet fittings B' into bores in the mechanism, as best shown in Figs. 1 to 3, which will be lubricated.

The drop in pressure is so regulated, together with the restricting effect of the fittings B and B', as to prevent discharge of an excessive amount of lubricant into the bearings, with resultant depletion of oil in the hydraulic system.

The various reductions in pressure and restricting effects should be so regulated that just sufficient lubricant will be supplied in minute yet accurately metered quantities throughout operation of the mechanism.

The devices B', as shown in Figs. 5 and 7, are particularly designed to be utilized where the outlet ends of the units fit into sockets such as indicated at 50 to 54 in Fig. 1.

But where the restriction devices B' are placed at the end of the conduits and may be connected to tail pipes, units such as shown at B^2 in Fig. 8, may be utilized in which similarly functioning parts are indicated by the same letters and numerals provided with a superior 2. In Fig. 8, it will be noted that the self sealing pipe thread 23^2 is placed at the inlet end adjacent the strainer 24^2, while the check valve 28^2 at the outlet end is encircled by a machine threaded portion 20^2.

In Figs. 9 to 11 is shown another mechanism which may be lubricated in any manner similar to that indicated in connection with Figs. 1 to 6.

In Figs. 9 to 11, there is shown a base structure 80 having a bottom slide structure 81, with

the side inclined face 82 and with the bottom faces 83.

In the construction as shown in Fig. 11, there is a hydraulic chamber at 84 from which lubricant under pressure passes through the bore 85 into the recess 86 which receives the unit B. The unit A has a round base 200 fitting in the socket 201 and the elongated projection 202. The unit B with the inlet strainer 24 at its inlet end 23 and the restriction 26, is screwed into unit A'. At its outlet end, the unit B is provided with the spring seated ball check 28 with the seat 27 (see Fig. 12) which feeds the outlet units B', B' by the bores 37', 37', and sockets 38', 38'. The bores 37', 37' are plugged at 44'.

The ball check 28 has a spring 29, the seating pressure of which is adjustable by the threaded plug 31 which is accessible upon removal of the sealing plug 35'.

The upper unit B', as indicated in Fig. 11, empties into a chamber 87 which, through the bores 88 and 89, feeds the groove 90 on the face 83. The other chamber 91 feeds the bore 92 and the groove 93 on the other face 83.

As is indicated in Figs. 9 and 10, the unit A' may be held in position by the bolts 94 with the compressed gasket 94^a forming a lubricant tight connection. The upper bore 95 may be plugged by the element 96, but if desired, additional outlets might be provided to lubricate the ways 97 (see Fig. 10).

In the unit of Fig. 11, for example, the pressure may be supplied to the unit B at 350 pounds per square inch and then, before it passes through the unit B, may be reduced to 5 pounds per square inch.

In the unit A^2, shown in Figs. 13 and 14, the inlet connection 100 (similarly functioning parts as in the units A and A' being indicated by the same numerals and letters with a superior 2) is threaded into the threaded socket 101 in the threaded circular plate 102. The plate 102 by the tool receiving openings 102^a, is screwed at 103 into a tapped recess in the circular body A^2.

In the recess 104 there is positioned a felt strainer 105 with the wire backing screen 106, which strainer 105 is peripherally compressed by the lip 104^b. The gasket 104^a will form a lubricant tight seal.

At the bottom of the recess 104, there is provided an opening 107 receiving the valve seat 108 against which the ball check 28^2 is pressed by the spring 29^2. The device as shown, has a single restricted outlet B', which may be connected to feed lubricant and the bore 37^2 is plugged by the plug 44^2.

In the layouts of Figs. 15 to 18, there are shown various arrangements of master units A^3, A^4, A^5, A^6 with or without restriction inlet fittings B, and with the flow metering restriction outlets B' positioned at the ends of bore systems or tubing systems indicated at 120, 121, 122 and 123.

In the unit of Fig. 15, lubricant is admitted at the inlet nipple 125 under 500 pounds per square inch pressure. It passes the loading valve 28^3 where its pressure is reduced to 80 pounds per square inch and then the restriction B where the pressure is reduced to 20 pounds per square inch, and then it is fed to the outlets B' by the tube 120. With lubricant of about 300 viscosity rating, this should give a flow through the units B' of about 10 and 20 drops per minute respectively or 0.3 to 0.6 cc. per minute. The fitting No. 0 has about twice the restricting effect of the fitting No. 1, No. 0 and No. 1 being restriction ratings.

In the installation shown in Fig. 16, there may be provided an additional restriction B at the inlet of the unit A^4 to give a greater reduction of pressure. One of the fittings B' has a No. 0 rating and the other has a No. 1 rating.

In the installation of Fig. 17, lubricant may be fed into the unit A^5 through the nipple 126 past the loading valve 28^5, the feed pressure being 250 pounds per square inch, and said feeding pressure being reduced to about 55 pounds per square inch by the loading valve 28^5 and further to 4½ pounds per square inch by the restriction B. The various fittings B' fed from the line 122, namely, 8 with a rating of No. 00 and 2 with a rating of No. 0, may be utilized to distribute or proportion the lubricant among the bearings and they may have a delivery of from 1 to 3 drops a minute, each cubic centimeter being equivalent to about 30 drops.

In the installation shown in Fig. 18, as in that of Fig. 16 there may be provided restriction elements B positioned both before and after the loading valve which is included in the unit A^6. The lubricant is fed by the tube 123 to the various outlet units indicated at B'. This installation also feeds 8 units B' rated No. 00 and two units B' rated No. 0.

It is thus apparent that the applicant has provided a novel lubricating installation for hydraulic mechanisms which may be widely utilized for the lubrication of bearings without impairing the effectiveness of the oil for the hydraulic tool operation and without supplying an excess of oil to the bearings to be lubricated.

It will be understood that many changes could be made in the particular features of mechanism as shown, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a hydraulically operated lathe the ways of which are to be lubricated, said lathe being provided with a source of oil pressure, a plurality of bores leading to said ways, a pressure reduction and oil distributing unit connected to the outside of said lathe and controlling the inlet to said bores and a connection to said unit from said hydraulic pressure source, said unit carrying a pressure reduction valve and also a plurality of high restriction metering fittings connected in parallel to the surfaces to be lubricated.

2. In a hydraulically operated lathe the ways of which are to be lubricated, said lathe being provided with a source of oil pressure, a plurality of bores leading to said ways, a pressure reduction and oil distributing unit connected to the outside of said lathe and controlling the inlet to said bores and a connection to said unit from said hydraulic pressure source, said unit carrying a pressure reduction spring seated ball check valve a restricted metering fitting in advance of said valve and a plurality of high restriction metering fittings after said valve connected in parallel to the surfaces to be lubricated.

3. In a centralized lubricating installation for a machine tool having a reciprocating carriage and hydraulic means for operating said reciprocating carriage employing a fluid which may be utilized as a lubricant for the bearings of said

carriage, an internal bore system to supply lubricant to the bearings of said carriage, said bores being provided with inlet sockets at an exterior accessible side of the machine tool, and a supply socket also being positioned closely adjacent said inlet sockets, a fluid connection from a hydraulic means to supply said fluid used by the hydraulic means to said supply socket and means carried on an exterior accessible side of the tool, sealing said inlet and supply sockets and reducing the pressure between said supply and inlet sockets and distributing the fluid proportionately among said inlet sockets and said internal bore system.

4. The installation of claim 3, said last-mentioned means comprising a unit having a plurality of high restriction flow metering fittings extending into said inlet sockets and connected in parallel with each other and a pressure reducing fitting extending into the inlet socket.

5. The installation of claim 3, said last mentioned means comprising a unit having a plurality of sockets conforming in arrangement and position to said inlet sockets and said supply socket, said sockets receiving high restriction inlet and outlet fittings, one inlet fitting being provided for the supply socket and an outlet fitting being provided for each inlet socket, said unit having a plurality of bores connecting said inlet fitting in series with said outlet fittings the latter being connected in parallel.

6. The installation of claim 3, said last mentioned means comprising a unit providing a high restriction flow metering outlet for said supply socket and high restriction flow metering inlets for said inlet sockets and a fluid connection between said high restriction flow metering outlet and said high restriction flow metering inlets.

7. The installation of claim 3, said last mentioned means comprising a unit providing a high restriction flow metering outlet for said supply socket and high restriction flow metering inlets for said inlet sockets and a fluid connection between said high restriction flow metering outlet and said high restriction flow metering inlet, said connection including a pressure reducing valve.

8. The installation of claim 3, said last mentioned means comprising a unit providing a high restriction flow metering outlet for said supply socket and high restriction flow metering inlets for said inlet sockets and a fluid connection between said high restriction flow metering outlet and said high restriction flow metering inlets, said connection including a spring seated ball valve serving as a pressure reducing valve, and means accessible from the outside of the fitting for adjusting the amount of pressure reduction resulting upon passage of the fluid past said valve.

9. In a centralized lubricating system, a lubricant pressure reducing and distributing unit, comprising a body having a bored and tapped single supply socket and a plurality of bored and tapped distributing sockets, a passageway through said unit connecting said supply socket with said distributing sockets high restriction flow metering fittings in both said supply and said distributing sockets and a spring seated pressure reducing valve positioned in said passageway between said supply and said distributing sockets.

10. The unit of claim 9, in which the unit comprises a flat cover plate adapted to be secured to a machine part and said sockets are all on the same side of said unit and have parallel axes.

EDWARD H. KOCHER.