Oct. 9, 1934. B. A. KEARNS 1,975,951

MACHINE TOOL

Filed Aug. 9, 1928

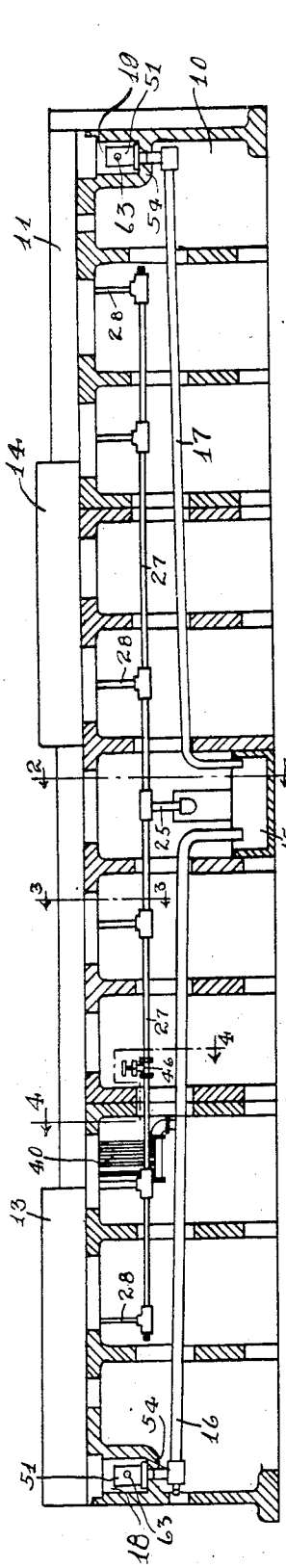


Fig. 1.

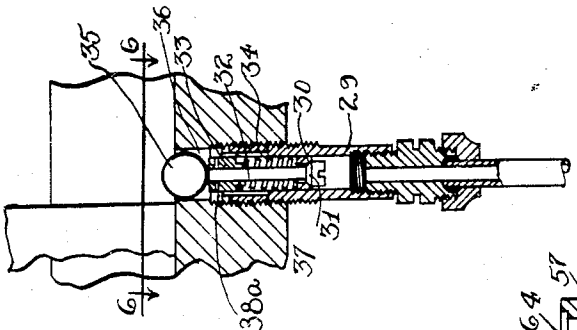


Fig. 5.

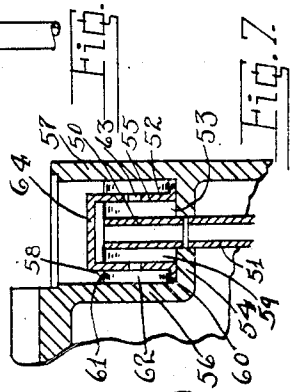


Fig. 7.

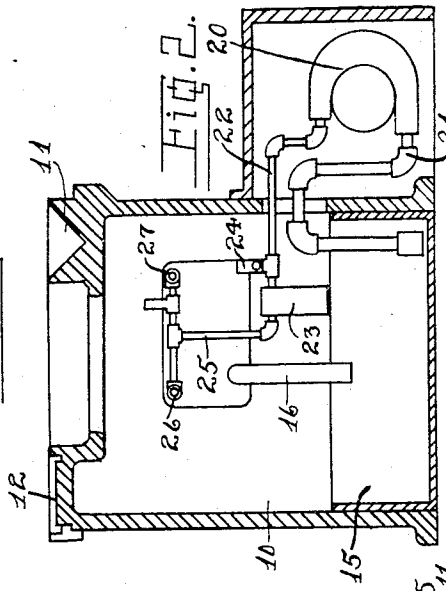


Fig. 2.

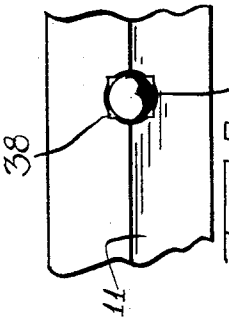


Fig. 6.

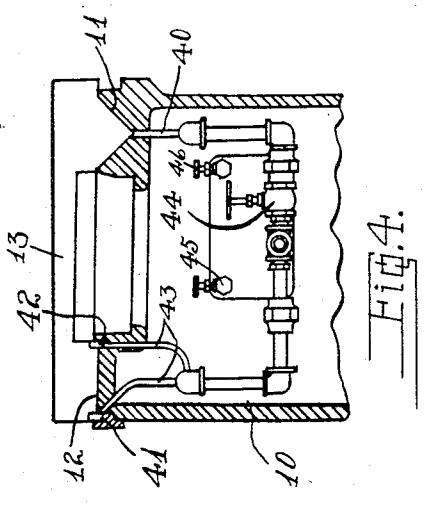


Fig. 4.

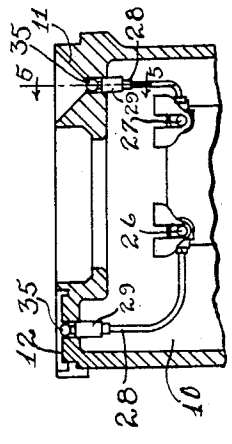


Fig. 3.

Inventor

BERNARD A. KEARNS,

By H. K. Parsons

Attorney

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# UNITED STATES PATENT OFFICE

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## MACHINE TOOL

Bernard A. Kearns, Cincinnati, Ohio, assignor to Cincinnati Grinders Incorporated, Cincinnati, Ohio, a corporation of Ohio

Application August 9, 1928, Serial No. 298,466

10 Claims. (Cl. 184—5)

This invention relates to improvements in machine tools and has particular reference to the lubrication thereof.

One of the principal objects of the present invention is to insure proper lubrication of inter-engaging supporting surfaces such as the ways on which a grinder or other table is moved.

A further object of the invention is the provision of means for insuring proper lubrication in a controlled manner and without wastage of the lubricating fluid.

Another object of the invention is the provision of a structure which will facilitate equalization of oil distribution to the various portions of the ways as well as proper return drainage of any excess present.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification considered in conjunction with the accompanying drawing, and it will be understood that any modifications may be made in the specific structural details illustrated within the scope of the appended claims without departing from or exceeding the spirit of the invention.

Figure 1 is a longitudinal sectional view of a machine tool bed and tables showing the application of the improvements thereto.

Figure 2 is a transverse section on line 2—2 of Figure 1.

Figure 3 is a fragmentary transverse section on line 3—3 of Figure 1.

Figure 4 is a similar section through the oil returns.

Figure 5 is an enlarged sectional view on line 5—5 of Figure 3 showing the discharge control valve mechanism, and

Figure 6 is a fragmentary plan view.

Figure 7 is an enlarged sectional view of one end of the bed.

Prior to the present invention considerable difficulty has been experienced in large machinery intended for production of accurate precision work in maintaining the accuracy of the machine and prevention of wear of the table and ways or like relatively translatable parts unless an excess quantity of lubricant was supplied thereto which latter has proved both wasteful and tended to slop over and gum up the machine. The present machine has been shown as applied to a long bed grinding machine capable of utilizing either one or two translatable tables supported by a single set of ways on the machine.

The numeral 10 designates the bed frame or casting of such a machine having the V way 11 extending longitudinally at one side thereof and a second flat way 12 at the opposite side thereof. Movable along and guided by these ways are the pair of work supporting table members 13 and 14 capable of being employed either jointly or individually depending upon the length and type of work to be handled by the machine.

Contained within the bed 10 is an oil tank or reservoir 15 while extending longitudinally of the bed are the return pipes 16 and 17 coupled near their end with the collecting tanks 18 and 19 respectively. These tanks it will be noted are disposed at the ends of the bed in such position that excess oil pushed ahead of the table in its movement toward either end of the machine will be collected and prevented from flowing off the ends of the ways and exteriorly down the sides and ends of the bed. For supplying the oil to the ways use is made of a suitable pressure pump 20 having a suction side 21 coupled with the tank 15 and a pressure line 22 extending therefrom to the oil filter 23. A relief valve 24 of suitable construction is coupled in the pressure line intermediate the pump and oil filter so that only such oil as is actually being used in the machine will pass through the filter while excess oil will be discharged back into the tank by way of the relief valve 24. From the filter a connection 25 extends and branches to the feed lines 26 and 27 intended to supply oil respectively to the flat and V ways of the machine. The distribution from each of these lines is effected at a plurality of points by the branch feeders 28 controlled by suitable valves. As shown these valves comprise a sleeve 29 having the valve seat 30 interiorly thereof for cooperation with the conical valve 31 having an upwardly extending stem 32 bearing the plunger head 33 sliding in the upper end of the sleeve. A spring 34 interposed between the valve seat flange 30 and head 33 normally holds the valve in raised position shutting off the flow of oil. To open the valve and permit discharge of a limited amount of oil to the ways at the proper time use is made of the contact balls 35 fitting in the apertures 36 centrally of the ways and in position to contact with the under side of the table member such as 13.

Under normal conditions the valves are closed and no oil can escape but as the table is moved along the ways its end will successively ride over and depress various balls 35 thus correspondingly depressing valves 31 and allowing a flow of oil or lubricant into the ways immediately in advance of the table and continuing a lubricant pressure against the table during the time that

the same is moving over the individual valve. To facilitate the flow of oil the sleeve is preferably formed with the interior oil grooves 37, and the apertures 36 are formed with the corresponding grooves 38 to permit unrestricted flow of the oil around the contact balls 35.

Adjustment of the height of the individual sleeves 29 will vary the amount the valve will be depressed by ball 35 so that the rate of flow may be accurately controlled and determined. This adjustment may be effected either from the interior of the bed by suitable rotation of sleeve 29 or may be effected from the outside. To facilitate this the balls are loosely held within the apertures 36 and capable of removal when desired while the upper end of sleeve 29 is provided with notches 38A into which a screw driver may be readily inserted for normal adjustments.

As it is desirable to operate the oiling system under as low a pressure as possible and since depression of the valves nearest the pump tends to reduce the pressure in the pressure supply line the central feeder pipe valves are preferably set to distribute a relative lesser amount of oil than do those more distant from the pump and further along the feed lines. This insures an equalized oil distribution throughout the ways and further a distribution of oil at a particular place only when a friction causing member is at that moment being moved over the ways, the oil being shut off except under actual operating conditions so that no excess or free lubricant is placed on the ways.

Since the pressure of the weight of the moving table along the ways tends to squeeze out the oil film present it is necessary that proper precaution be taken to insure proper dispositions of any excess oil present. This is effected on the flat way side of the machine by the drains 43 leading back to pipes 16 and 17, the V way providing a natural oil containing trough from which the excess may be satisfactorily drained.

Due to the inability of a flat way correspondingly to retain the oil suitable grooves 41 and 42 are provided at the sides of this way 12 for trapping the oil and conducting it back through lines 43 to the main return lines.

It will be understood that when the tables 13 and 14 are being jointly employed for the handling of long work pieces the excess oil at the outer side of the table will be forced into the receiving chamber 18 or 19 depending on the direction of movement. When a single table is being employed however the table 13 is left stationary at the left hand end of the bed as is shown in Figure 1, thus blocking off access to chamber 18 with the result that the oil will tend to pile up between tables 13 and 14 as the latter is moved to the left. The drains 43 are calculated to take care of this excess on the flat way and are at all times left open or in operative condition. To prevent the excess amount from grooves 11 being forced out over the machine a plurality of drain members 40 may be utilized, controlled by a valve 44 so that these members will be operative only when table 13 is stationary so that the excess in the way 11 will be properly drained off under these backing up conditions but will be carried along past the series of drains 40 and to the chamber 18 when the table 13 is being utilized.

It will further be noted that the supply lines 26 and 27 for the respective ways are provided with control valves 45 and 46 which may be individually utilized to regulate the flow through the particular line in question according to the amount desired and the capacity of the outlet or discharge members to conduct the lubricant away.

From the foregoing description it will be seen that there has been provided an improved system and mechanism for insuring proper lubrication of the ways of a machine tool which is particularly applicable to long bed structures such as grinding machines or the like and in which the supplying of the lubricant to the ways is automatically controlled by table depressed valves, in which the valves themselves may be set to open different degrees in different parts of the system according to the need of the particular point for lubrication and the relative pressure and supply of lubricant available at that particular point in the system. It will further be noted that improved means have been provided for conducting away the excess both at intermediate points and in accordance with the volume being supplied and also at the terminal portions of the machine thus preventing waste of the lubricant or flow or excess on the machine or floor.

Each of the settling or collecting tanks 18 is provided with an up-standing pipe 50 which communicates with a nipple 51 secured to the end of the drain pipes 17 and 16. The pipe 50 is provided with a cylindrical cover 52, the open end 53 of which is adapted to rest upon the base 54 of the settling tank. The walls 55 of the cover 52 are spaced from the pipe 50 and the walls 56 and 57 of the collecting and settling tank 18 so as to provide spaces or chambers 58 and 59, within the settling or collecting tank. The lubricant is drained from the ways of the bed into the space 58 between the walls of the cover and collecting tank where the heavy materials 60 settle upon the base 54 while the light materials 61 float on the surface of the collected lubricant leaving a central strata 62 of fairly clean or pure oil. The housing 52 is provided with openings 63 intermediate its open end 53 and closed end 64 whereby the central strata of pure oil is admitted to the chamber or space 59 then into up-standing pipe 50 to the drain 17 or 16.

I claim:

1. A machine tool structure including a bed having flat and V ways, a table movable over the bed, table controlled means for supplying lubricant to the ways comprising a plurality of valve bodies depending from beneath each table way, a valve associated with each valve body, means normally holding the valve to its seat, and a valve actuator extending above the table ways for engagement by the table to open the valve and release the lubricant, means for centrally draining excess lubricant from the V way, and additional means for laterally draining excess lubricant from the flat way.

2. In a machine tool structure the combination of a bed having flat and V ways, a table movable thereover, means for supplying lubricant to the ways including a plurality of normally closed valves for each of the ways, a valve actuator for each of said valves disposed above the ways and adapted to be successively engaged by the table for opening said valves to release the lubricant to the ways, a storage tank for the lubricant, separate means for draining excess lubricant from the V way and the flat way to the storage tank, and means for rendering certain of said drain means inoperative.

3. A machine tool structure including an elon-

gated bed having guide ways, a table movable along said ways, a lubricant supply line, a plurality of branch lubricant supply lines, a valve at the terminus of each branch lubricant supply line carried at selected points by the guideways, means associated with each valve projecting about the guideways operable by movement of the table to supply lubricant to the ways at said selected points during the movement of the table, and means for adjustably determining the amount of projection of the last named means for determining the amount of lubricant supplied at a given point for a constant pressure in the lubricant supply line.

4. A machine tool including an elongated bed having guide ways, a pair of tables jointly or severally movable on the ways, means for supplying lubricant to the ways during movement of the table, a drain reservoir at one end of the bed for receiving excess lubricant urged along the ways by movement of the table, and a controllable drain intermediate the length of the bed for relief of oil trapped between the tables.

5. In a machine tool organization the combination of a bed having ways extending longitudinally thereof, means delivering oil to the ways, a pocket formed at the end of the bed for receiving the excess oil from the ways, an up-standing pipe in the pocket for draining the oil from the pocket, a guard surrounding the up-standing pipe but having the walls thereof spaced from the pipe, the guard being provided with openings for establishing a communication between the walls of the guard and the pipe and the walls of the pocket and the guard, whereby the heavy foreign impurities in the oil are collected at the base of the pocket between the walls of the guard and the walls of the pocket while the floating or light impurities are confined between the walls of the guard and the walls of the pocket above the openings in the guard, and means for conveying the lubricant from the up-standing pipe to a reservoir.

6. An oiling system for beds of machine tools comprising a bed, ways extending longitudinally thereof, a table translatable longitudinally of the bed on the ways, means operable by the table for supplying lubricant under pressure to the ways of the bed, lubricant receiving pockets at each end of the table to receive the lubricant pushed ahead of the table and drained from the ways, means within the pockets for removing impurities from the collected lubricant, said means comprising an up-standing pipe and a cover surrounding the pipe but spaced therefrom to provide a passage between the pipe and cover, said cover being provided with openings mid-way of its length to permit the lubricant to enter the passage between the cover and pipe and eventually discharge itself through the pipe, and the cover preventing the light impurities from entering the pipe but forcing it to float on top of the lubricant and the heavy material to settle at the bottom of the pockets, and a drain pipe for returning the lubricant to a storage tank.

7. The combination with a machine tool bed provided with ways extending longitudinally thereof, of oil receiving pockets formed at the end of the bed to receive lubricant from the ways, means within the pocket for removing impurities from the lubricant, said means including an upstanding pipe the level of which the lubricant must reach before it will be discharged from the pocket, a guard entirely surrounding but spaced from the pipe, said guard dividing the pocket into two chambers, one chamber extending from the walls of the pocket to the walls of the guard while the second chamber extends from the walls of the guards to the walls of the pipe, openings in the guard for establishing a communication between the two chambers, the chamber between the walls of the pocket and the walls of the guard being adapted to receive the lubricant from the ways of the bed and to confine at the bottom thereof the heavy impurities and to exclude the light impurities floating on the lubricant, while the relatively pure lubricant is drawn from the center of the chamber into the chamber between the walls of the guard and pipe, and means for conveying the lubricant from the pipe to a storage tank.

8. In a machine tool structure the combination of a bed having ways formed thereon, a pair of tables translatable on the ways and adapted to be jointly or severally actuated, means for supplying lubricant under pressure to the ways, means for draining the excess lubricant from the ways, including means at the opposite ends of the bed for receiving the excess lubricant when the tables are actuated jointly, and means for draining said excess lubricant trapped intermediate the tables when one of the tables is operated independently.

9. In a machine tool structure the combination of a bed having ways formed thereon, a pair of tables translatable on the ways and adapted to be jointly or severally actuated, means for supplying lubricant under pressure to the ways, including a plurality of outlets or ducts terminating at the ways, depressible means preventing discharge of the lubricant to the ways adapted to be engaged by the table or tables during movement thereof, and means for draining the excess lubricant from the ways when the tables are actuated jointly and intermediate the ends of the ways when the tables are actuated separately.

10. A machine tool structure including an elongated bed having guideways, a table movable along said ways, a lubricant supply line including a pump for maintaining a constant pressure on the lubricant in the supply line, a plurality of branches extending from the supply line to the ways, means adjustable to control the quantity of flow of lubricant from the branches at a pressure inversely proportioned to the distance they are spaced from the pump, and means operable by the table as it passes over the ways for operating the last mentioned means.

BERNARD A. KEARNS.