

Feb. 16, 1971

L. DAY

3,562,964

LAPPING MACHINE

Filed Feb. 24, 1970

2 Sheets-Sheet 1

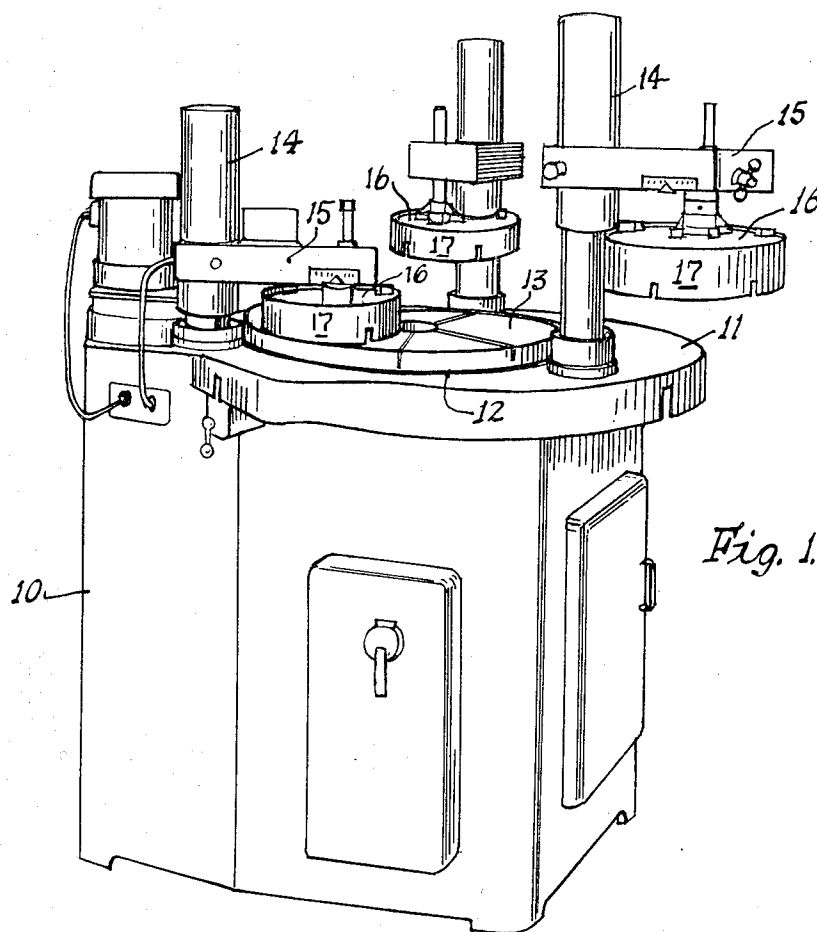


Fig. 1.

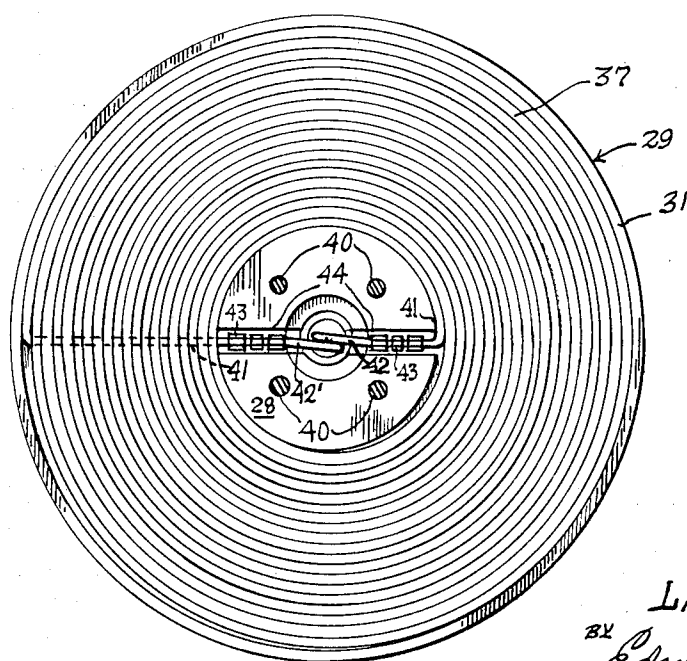


Fig. 3.

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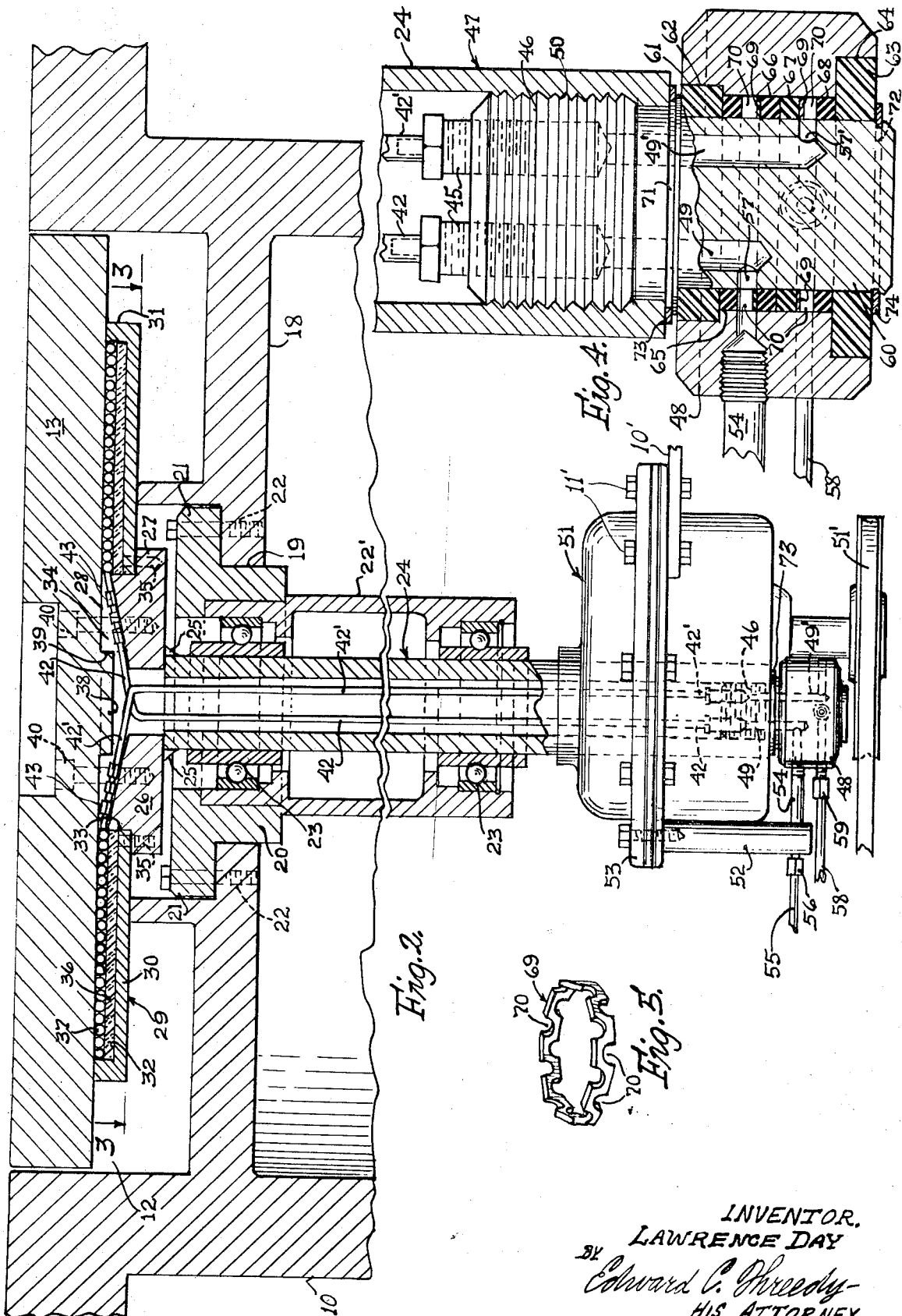
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2 Sheets-Sheet 2



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LAPPING MACHINE

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6 Claims

ABSTRACT OF THE DISCLOSURE

A lapping machine having a horizontally rotatable relatively flat lapping plate in facial contact with a relatively flat spirally wound tubular coil arranged therebeneath and through which a coolant circulates to maintain throughout a lapping operation a uniform temperature of the lapping plate and a pressure plate therein and of the work disposed upon the lapping plate beneath the pressure plate.

SUMMARY OF THE INVENTION

A conventional lapping machine within which my invention is incorporated is shown and described in U.S. Letters Pat. No. 3,032,937, dated May 8, 1962. Such a lapping machine generally comprises a relatively flat rotatable lapping plate supported with respect to a base structure. On the lapping plate is arranged one or more dressing and work retaining rings within which the work to be lapped is arranged upon the lapping plate. Removably positioned upon the work within each of such rings and removable from position on the lapping plate with such rings, as fully described in the aforesaid patent, is a pressure plate. During the lapping operation, a suitable abrasive material is fed to the lapping plate.

As the work is pressure-held by the pressure plates within the work rings against the flat surface of the lapping plate, the work engaging the surfaces of the lapping plate will be lapped upon rotation of the lapping plate. As the work is confined in the defined area of the rotation of the lapping plate and pressure-held thereagainst by the pressure plates, heat is generated which, if not controlled, will be detrimental to the work and prevent successful precision lapping operation.

I propose to uniformly control the temperature of the surface of the lapping plate as well as the surfaces of the work and the surfaces of the pressure plates by a simple, economical and effective arrangement which includes a coolant element in facial contact with an adjacent surface of the lap plate to effectively reduce and uniformly maintain at a predetermined degree during the lapping operation the temperature of the lapping plate and hence that of the work-engaging surfaces of the pressure plate and the work therebeneath. Inasmuch as the work is disposed between the pressure plate and the surfaces of the lapping plate, the work will have the same uniform temperature as the lapping plate and pressure plate.

DESCRIPTION OF THE INVENTION

My invention consists of the preferred form of construction shown and described in the accompanying drawings, in which:

FIG. 1 is a perspective view of a well-known conventional lapping machine with which my invention is associated;

FIG. 2 is a fragmentary vertical sectional detail view of the same;

FIG. 3 is a plan view taken substantially on line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional detail view of a dual-passage water joint seen in FIG. 2; and

FIG. 5 is a perspective view of a spacer ring embodied in the water joint shown in FIG. 4.

Referring particularly to FIG. 1, the conventional lapping machine there shown includes a base cabinet 10 having a top wall 11 provided with a circular well or depression 12 within which is arranged a lapping plate 13.

At predetermined points with respect to the top wall 11 are pneumatic lifts 14 each of which includes an adjustable arm 15 carrying a pressure plate 16 arranged within a dressing or work holding ring 17. As described in my aforementioned patent, each of the rings 17 and pressure plate 16 are elevated together from their respective positions upon the lapping plate 13 in a manner and by a construction fully shown and described in said patent. It is in a lapping machine of this general type that my invention is incorporated.

In this connection and referring particularly to FIG. 2, the well 12 includes a horizontal partition 18 within the cabinet 10 and having a central opening 19 formed therein. In this opening 19 is arranged a flanged mounting plate 20, the flanges of the same being indicated at 21 and bolted as at 22 to the partition 18. Extending downwardly from and supported by the plate 20 is an elongated pedestal 22' having press-fitted into its opposite ends roller bearings 23 which rotatably support a tubular shaft 24 extending through the pedestal 22'. The upper end portion of the shaft 24 is welded as at 25 to a plate 26. The plate 26 defines an annular supporting flange 27 located a suitable distance below the top surface 28 of the plate 26.

A tray is indicated at 29. This tray includes a bottom wall 30 and a peripheral upstanding flange 31 which forms, together with the bottom wall, a receptacle 32. The bottom wall 30 has a central opening 33 formed therein, through which the upper portion 34 of the plate 26 projects. The tray 29 is secured to the flange 27 by means of bolts 35. Arranged upon the bottom wall 30 of tray 29 within the receptacle 32 is an insulating or heat resisting disc 36. Positioned upon this insulating disc within the receptacle 32 is a spirally wound tube forming a relatively flat coil 37.

Positioned upon the tray 29 with its bottom surface in contact with the coil 37 is the lapping face 13. The lapping plate 13 has a centrally located stud 38 formed on the under surface thereof which projects into an opening 39 formed in the plate 26. The lapping plate 13 is removably connected to the plate 26 by a series of bolts 40. The opposite ends 41 of the tube forming the coil 37 are coupled to tubular conduits 42 and 42' by means of couplers 43 which are located between the lapping plate 13 and the mounting plate 26. To accommodate these couplers 43, oppositely disposed aligned grooves 44 are milled in the top surface 28 of the plate 26.

The conduits 42 and 42' extend downwardly through the shaft 24 and are connected as at 45 to the rotatable stud 46 of a fixture 47 providing a dual water passage and which comprises, in addition to the rotatable stud 46, a stationary collar 48. In this fixture 47 are formed passages 49 and 49' through which the coolant (water) flows into and out of the conduits 42 and 42'. The rotatable stud 46 of the fixture 47 is threaded as at 50 to the end of the shaft 24 which extends into a gear train housing 51, the shaft 24 being rotated by a train of gears (not shown) within the housing 51, in a manner well known in the art, through operation of the pulley 51'. The gear housing 51 may be supported in any suitable manner from the wall of the cabinet 10, as, for example, by means of a bracket 10' (FIG. 2) connected to the housing 51 by bolts 11' or the like.

The stationary collar 48 is restrained from rotation with the shaft 24 by a depending rod 52 carried by and

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fixed to the flange 53 of the gear train housing 51. This rod 52 has projected through its lower end portion a sleeve 54 fixed to the stationary collar 48. This sleeve 54 and rod 52 thus prevent the stationary collar 48 from rotating with the shaft 24. A water line 55 is connected to the sleeve 54 by a coupling 56.

The sleeve 54 communicates with a passage 57 which in turn communicates with the passage 49 and thence the conduit 42. A second water line 58 is connected as at 59 to the stationary collar 48 and communicates with the passage 57', which in turn communicates with the passage 49' and thence the conduit 42'.

Communication between the water line 55 and the passages 57, 49, and the water line 58 and passages 57' and 49', regardless of the relative position between the stationary collar 48 and the rotatable stud 46, is accomplished in the following manner:

The lower end portion of the rotatable stud 46 provides a reduced extension 60 which projects into the stationary collar 48 through a bearing 61 mounted in a seat 62 formed in the stationary collar 48 and through a lower bearing 63 mounted in a seat 64 formed in such stationary collar 48. Surrounding the extension 60 and located within the stationary collar 48 are rubber type sealing rings 65, 66, 67 and 68. Between the rings 65 and 68 in the area of the passage 57, is a spacer ring 69 formed preferably, though not necessarily, of nylon. This ring 69 has circumferential transversely extending and alternately located upper and lower open notches 70 formed therein. The spacing of the notches 70 is such that during operation at least one of these notches will be in registration with the passage 57 to allow a continuous flow of water through the conduit 42 and its line 55. A similar spacer ring 69 is arranged between the bearings 67 and 68 to allow a continuous flow of water through the line 58 and the conduit 42 and its passage 57'.

By this construction, irrespective of the relative position between the rotatable stud 46 and the stationary collar 48, the circulation of water will be uninterrupted through the conduits 42 and 42'. Suitable control valves may be installed in the lines 55 and 58 for shutting off the flow of water therethrough.

On the top and bottom sides of the stationary collar 48 there is formed in the extension 60 circumferential grooves 71 and 72. In each of these grooves 71 and 72 there is arranged a retainer ring 73 and 74, respectively.

If line 55 is the supply line to the fixture 47, the line 58 will serve as the return line, thus effecting uninterrupted circulation of the coolant (water) through the coil 37 during rotation of the lapping plate 13.

The use of a relatively flat spiral coil through which the coolant circulates, eliminates the possibilities of leakage as would result when a water compartment or a series of such compartments are provided by plates secured to the lapping plate. As the coil is a continuous uninterrupted tube, the possibility of leakage is remote.

One of the advantages of the foregoing structure resides in the fact that the material from which the coolant coil is made, is of noncorroding and rust-resistant material. Consequently by the use of such coil the coolant flowing therethrough will not become obstructed by reason of corrosion or formation of rust. Should it be necessary to replace the coolant coil for any reason, access thereto is by simply disconnecting the couplings of the coil to the

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inlet and outlet supply conduits after the lapping plate has been removed from above the coil.

While I have herein referred to the use of a "coolant" for maintaining the temperature of the lapping plate, pressure plate, and the work at, for example, room temperature, it is also possible when the nature of the work to be lapped requires, to circulate through the coil 37 hot water for the purpose of raising the temperature of the lapping plate, pressure plate, and the work.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. An improvement in a lapping machine having a horizontally rotatable relatively flat lapping plate, the improvement comprising

- (a) a flat spirally wound tubular coil disposed beneath and in facial contact with the bottom surface of the lapping plate,
- (b) means for supporting the coil beneath and in facial contact with such plate and for rotation therewith,
- (c) and means for supplying a coolant to said coil for circulation therethrough.

2. The improvement in a lapping machine defined in claim 1 wherein the lapping plate is supported by a hollow rotatable shaft and the means for supplying a coolant to said coil for circulation therethrough comprises tubular members housed in said shaft and having coupling means providing connection with the opposite ends of the coil.

3. The improvement in a lapping machine defined in claim 1 wherein the means for supporting the coil beneath and in facial contact with the lapping plate, and the lapping plate, are rotatably supported by and rotatable with said shaft.

4. The improvement in a lapping machine defined in claim 3 characterized by the provision of a dual passage water joint connecting the tubular members to a supply and discharge line, said joint comprising interfitting rotatable and stationary sections.

5. The improvement in a lapping machine defined in claim 1 wherein the means for supporting the coil beneath and in contact with the lapping plate for rotation therewith comprises a tray forming a receptacle into which said coil is arranged.

6. The improvement in a lapping machine defined in claim 2 characterized by the inclusion of an insulating plate arranged in said receptacle beneath said coil.

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WILLIAM R. ARMSTRONG, Primary Examiner

U.S. Cl. X.R.

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