

June 26, 1928.

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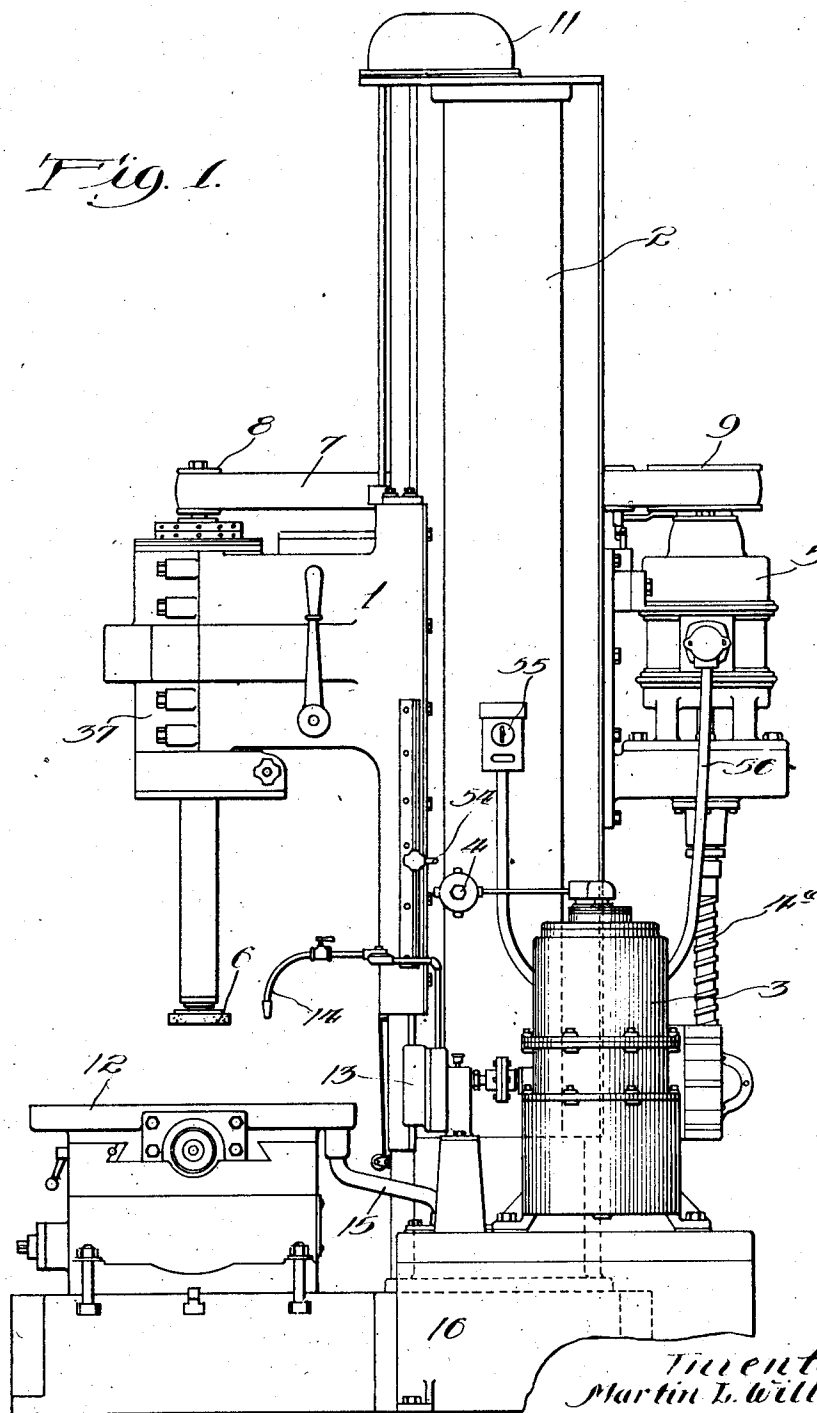
M. L. WILLIAMS

GRINDING MACHINE

Filed March 8, 1923

3 Sheets-Sheet 1

Fig. 1.



Inventor:
Martin L. Williams

Witness:
Stephen K. Reine

by Frank L. Belknap, Atty.

June 26, 1928.

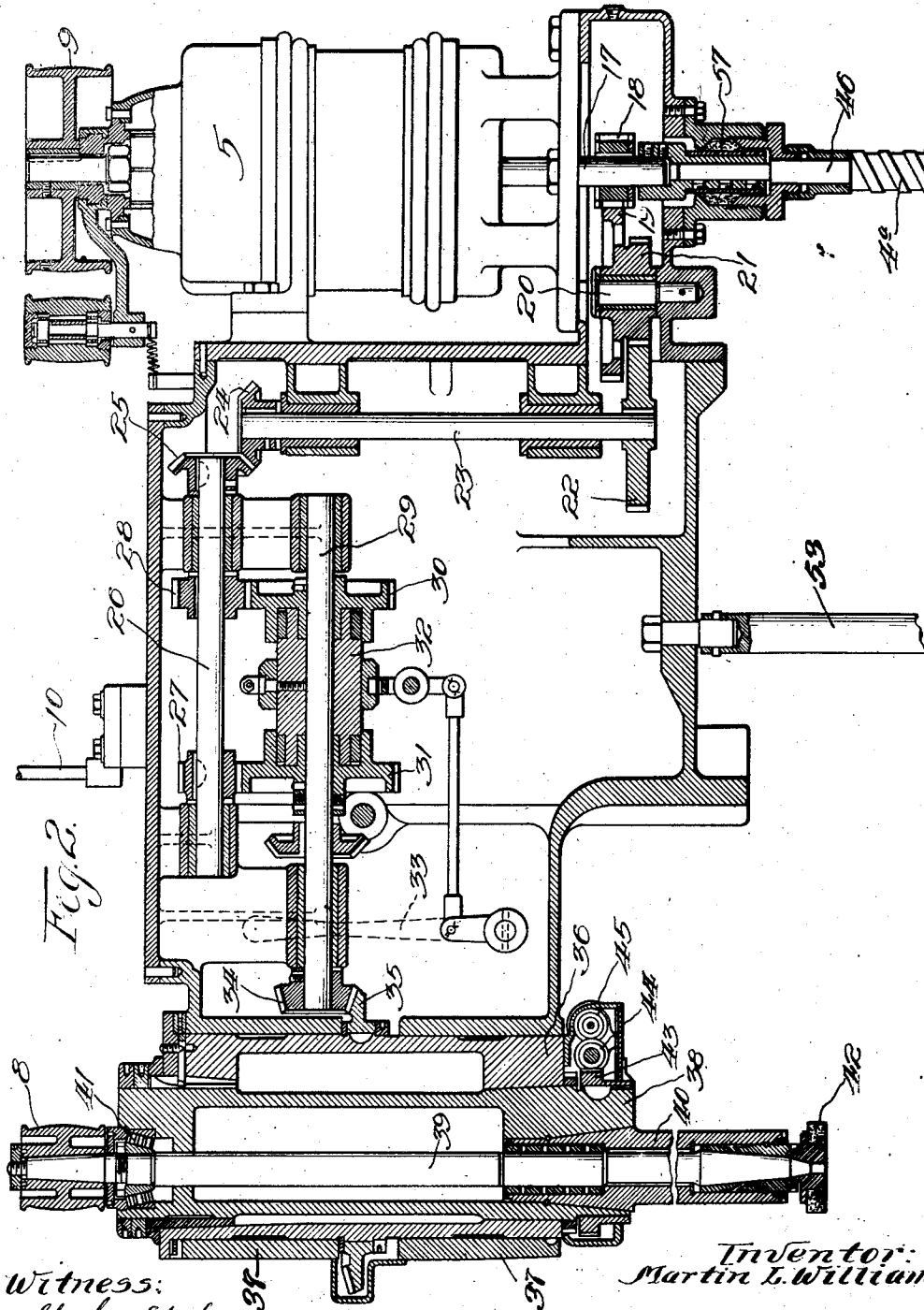
M. L. WILLIAMS

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GRINDING MACHINE

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3 Sheets-Sheet 2



Witness:

Stephen S. Reber

Inventor:
Martin L. Williams

by Frank L. Bilknop, Atty.

June 26, 1928.

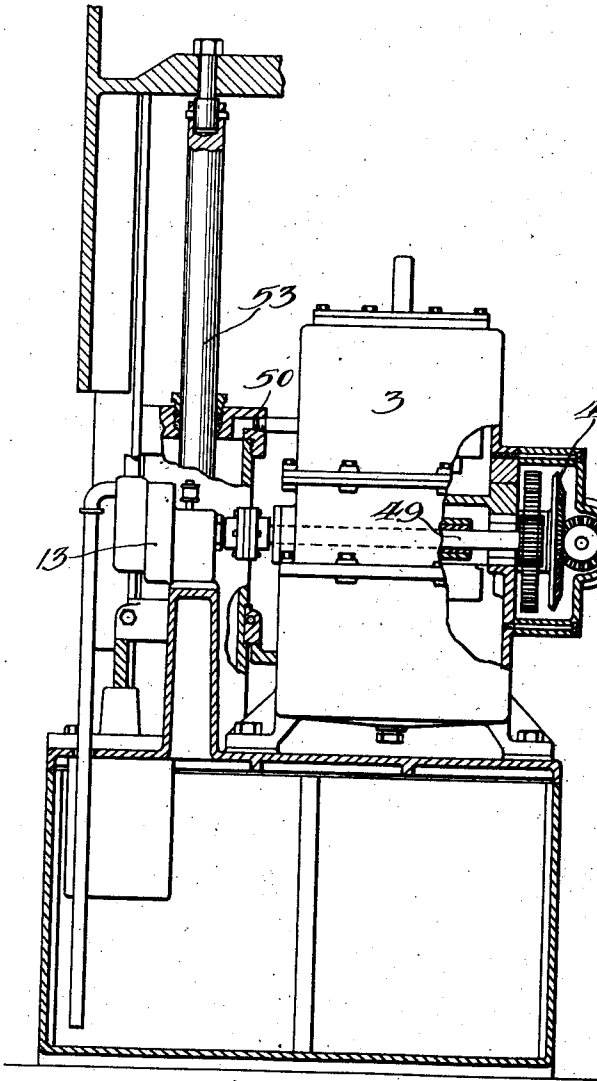
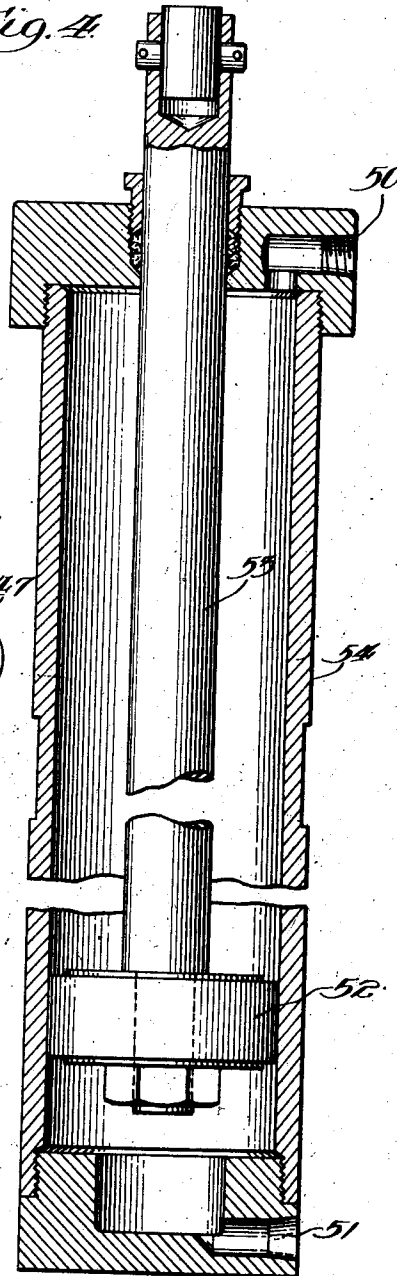
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3 Sheets-Sheet 3

Fig. 3.

Fig. 4.



Witness:

Stephen H. Petru

Inventor:
Martin L. Williams,

by Frank L. Belknap, Atty.

Patented June 26, 1928.

1,674,673

UNITED STATES PATENT OFFICE.

MARTIN L. WILLIAMS, OF SOUTH BEND, INDIANA.

GRINDING MACHINE.

Application filed March 8, 1923. Serial No. 623,671.

This invention relates to improvements in grinding machines and refers more particularly to a machine for vertically grinding interior surfaces, such as cylinders, of internal combustion engines.

Among the salient objects of the invention are to provide a machine in which in place of horizontal grinding, the cylinders are ground while positioned vertically, the work being kept stationary while the grinding wheel is reciprocated vertically and rotated at a high speed, permitting the wet grinding of the surface; to provide a machine in which the grinding mechanism together with the drive therefor are mounted upon a unitary head which is balanced upon vertical columns and supported by counter-balanced weights; to provide a machine in which the head reciprocates upon ways on the columns and due to the balancing of the head, the weight of the head and pressures produced during the grinding operation are substantially negligible; to provide a positively operated elevating device which functions to smoothly raise and lower the head permitting accurate control of the vertical reciprocation; to provide a machine in which, due to the stationary table upon which the work is mounted, pressure upon the machine and supporting ways of the columns is materially reduced; to provide a machine which is simple and accurate in operation.

This invention is an improvement over previous application, Serial No. 537,388 filed February 18th, 1922. Only those parts of the improvement which are substantially different from the previous application, and which have to do with the invention here involved, will be described in detail. Parts of the drive together with the mounting of the motor and positioning of the eccentric sleeves have been somewhat diagrammatically shown, as their construction is substantially identical with the construction in the previous application.

Fig. 1 is a diagrammatic side elevational view of the apparatus. Fig. 2 is a sectional view taken through the head with parts omitted. Fig. 3 is a fragmentary view, with parts in section, of the elevating device, and Fig. 4 is an enlarged detail of the elevating ram.

Briefly, the function of the machine is as follows:

The head 1 mounted upon the columns

2 is raised and lowered by means of a hydraulic mechanism 3 which is controlled by a mechanism 4. The hydraulic mechanism 3 is driven through a flexible shaft 4^a from the motor 5 mounted upon the rear of the head 1. The grinding wheel 6 is driven through the belt 7 running over pulleys 8 and 9, the latter being mounted upon the upper shaft of the motor.

The weight of the head is supported by counter-balance weights positioned centrally of the columns and not shown in the drawings. The cables supporting the head are somewhat diagrammatically shown at 10 and operate over sheaves mounted within the casing 11 at the top of the columns.

The work, such as a cylinder block is mounted upon the universal table 12 and the head is raised and lowered into the separate holes of the cylinders while the grinding wheel is rotated at a rapid rate. Wet grinding is done by flowing water or a grinding solution through the pump 13 and pipe 14 on the grinding surfaces. This grinding fluid is drawn off from the table 12 through the drain 15 and is recycled after being filtered in the base of the machine shown at 16.

Referring now to the details of the mechanism, and particularly to the drive of the grinding spindle, on the lower end of the motor shaft 17 is mounted a pinion 18 which meshes with a gear 19 on the stub shaft 20. A second gear 21 on this shaft meshes with the gear 22 on the vertical intermediate shaft 23. At the top of this vertical shaft is a beveled gear 24 meshing with a second beveled gear 25 mounted upon the shaft 26 upon which are also mounted the pinions 27 and 28. A parallel shaft 29 supported just below the shaft 26 by suitable brackets, has gears 30 and 31 mounted thereon. Between these gears is a clutch arrangement 32 which is a standard shoe clutch, Johnson type, actuated by a pivoted handle 33. By means of this clutch arrangement the shaft 29 may be driven from the shaft 26 either through the gears 28 and 30 or through the gears 27 and 31. This permits variation in the speed of the rotation of the eccentric sleeves which gives the grinding stone its circular movement against the surface of the inner walls of the cylinders to be ground.

At the end of the shaft 29 is a bevel gear 34 meshing with the bevel ring 35 mounted

upon the outer eccentric sleeve 36. This outer sleeve is mounted in the head and held in position by the bolted cap 37. Within the outer eccentric sleeve is a second eccentric sleeve 38 within which the grinding spindle 39 bears. The inner and outer sleeves are eccentrically positioned relative to each other, and the spindle eccentrically positioned relative to the inner sleeve. The spindle arbor 40 supports the spindle 39 at the lower portion of the spindle while upper ball bearings 41 serve to support the spindle at its upper portion in the inner sleeve.

At the lower extremity of the spindle is mounted the grinding stone 42. The inner eccentric sleeve may be dialed or rotated within the outer eccentric sleeve by means of the worm gear 43, worm 44 and a spiral gear 45, so as to position the grinding spindle arbor and grinding stone at any desired position. Thus with the rotation of the outer sleeve by means of the bevel gears 34 and 35, the grinding stone traveling at a high speed will be rotated about the inner surface of the cylinder simultaneously with the vertical reciprocation of the head. Thus as the head is slowly moved downward during the grinding operation, the grinding stone will be rotating at high speed, due to the motor drive through the belt 7, and will be rotated about the axis of the cylinder hole by the proper dialing of the eccentric sleeve.

The lower end of the shaft 17 of the motor 5 is directly connected as shown in Fig. 2, to a flexible shaft 46, at the lower extremity of which is mounted a bevel gear 47, shown in Fig. 3, meshing with a larger bevel gear 48. This latter gear 48 through intermediate gears rotates the shaft 49 which drives the pump 13 and also pumps mounted in the upper and lower sections of the casing 3 containing the hydraulic mechanism.

The details of this hydraulic mechanism are purposely omitted, as this mechanism forms no part of the present invention. It suffices to say that the power transmitted through the flexible shaft serves to automatically introduce liquids through the pipes 50 and 51 above and below the piston 52 mounted on the ram 53. This piston is positioned in a hydraulic chamber or cylinder 54, shown in Figs. 3 and 4. The functioning of the mechanism is briefly as follows: The head is lowered by the action of the liquid introduced above the piston which forces out the liquid below the piston through the discharge line 51 while the liquid is being introduced through the inlet pipe 50 above the piston. When the head has reached the bottom of the hole which is being ground, the finger 54 shown in Fig. 1 will trip the mechanism shown diagrammatically at 4 in Fig. 1 and cause a reversal of the hydraulic mechanism which will force the liquid through the line 51 which now be-

comes the inlet pipe and will discharge the liquid above the piston of the hydraulic cylinder through the line 50 back into the mechanism.

When the head has been raised out of the cylinder hole, the mechanism may be then manually functioned by means of the mechanism 4 when it is again desired to lower the head and grinding spindle. When in a raised position the grinding spindle is set for the next cut prior to its downward travel. At 55 is shown a switch having armored wire connections 56 to the motor. This gives a central control for the entire mechanism positioned on the side of the columns.

A stuffing box 57 is interposed in the coupling between the flexible shaft and the shaft of the motor to prevent the passage of oil from the gears on the flexible shaft.

It will be noted that the head is balanced as to weight, the motor being positioned on one side of the columns, while the grinding spindle with its parts are on the opposite side of the columns.

A further advantage of this particular type of mechanism is the hydraulic lowering and elevating device for the reciprocating head. Heretofore, where the reciprocation was produced by racks and gears, the drive was not as positive nor was the mechanism as smooth in operation as when operated hydraulically.

In place of a flexible shaft, a separate motor may be positioned on the base for driving the hydraulic mechanism, thus obviating the necessary connection between the head and stationary portion of the machine by the flexible shaft 4^a.

I claim as my invention:

1. In a grinding machine having vertical columns and an open passageway therebetween, the combination with a reciprocating head mounted between the columns, of a grinding spindle positioned within eccentric sleeves, and a motor for driving said spindle mounted upon the head, a hydraulic ram attached to the head and automatically operated to lower and raise the head during the grinding operation.

2. In a grinding machine having vertical columns and an open passageway therebetween, the combination with a reciprocating head mounted between the columns, of a grinding spindle positioned within eccentric sleeves, and a motor for driving said spindle mounted upon the head, a hydraulic ram attached to the head and functioning to raise and lower the head during the grinding operation, means actuated by the head to automatically reverse the reciprocation of the head when the grinding wheel reaches the bottom of the hole during the grinding operation.

3. In a grinding machine having vertical columns, the combination with a reciprocating

ing head slidably mounted upon the ways of
said vertical columns, of a grinding means
positioned within eccentric sleeves and
adapted to be rotated to predetermined posi-
tions relative to the axis of the hole to be
ground, and a motor for driving the grind-
ing spindle, said spindle and driving means
mounted upon the head, a hydraulic ram con-
nected to the head and to a hydraulic mecha-
nism automatically functioned to raise and
lower the head at a predetermined rate dur-
ing the grinding operation.

MARTIN L. WILLIAMS.