

Jan. 19, 1937.

L. SELETSKY

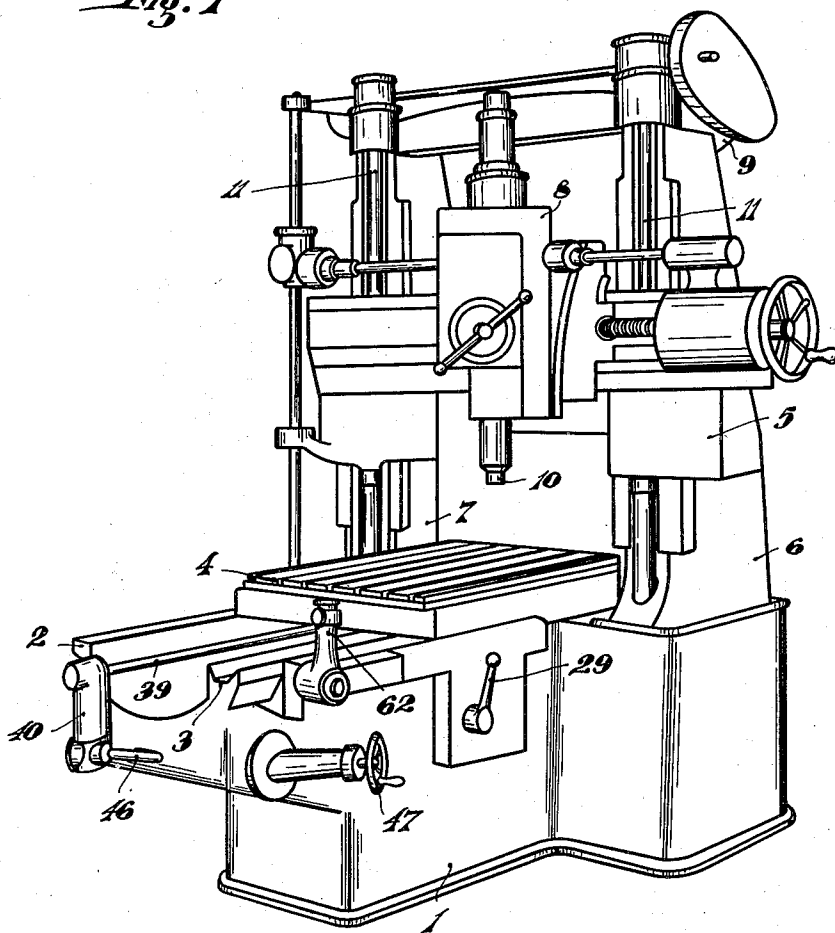
2,068,199

PRECISION MACHINE TOOL

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3 Sheets-Sheet 1

Fig. 1



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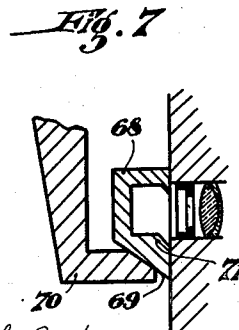
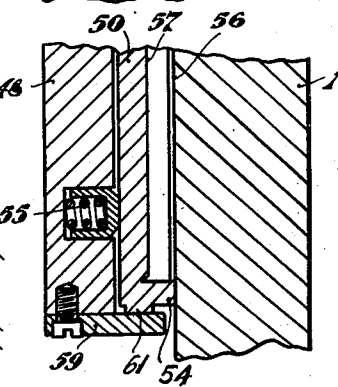
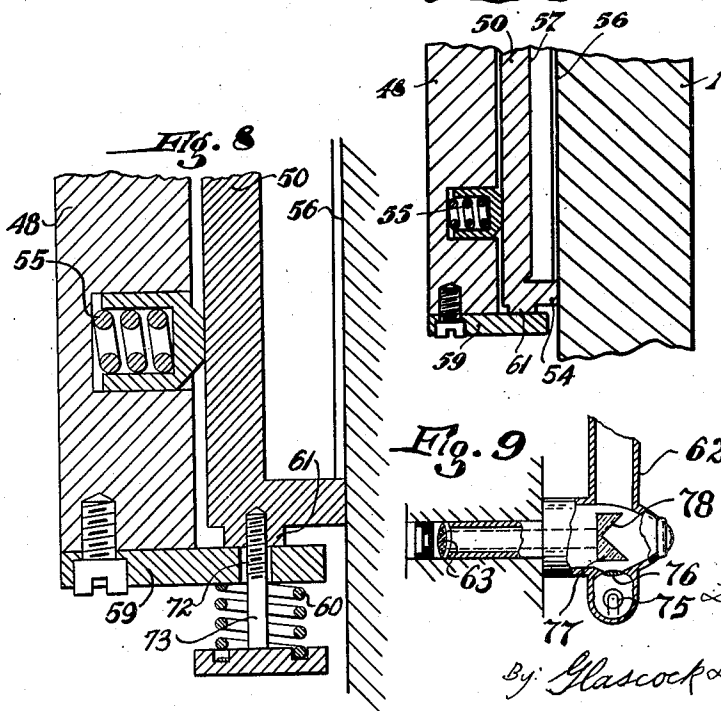
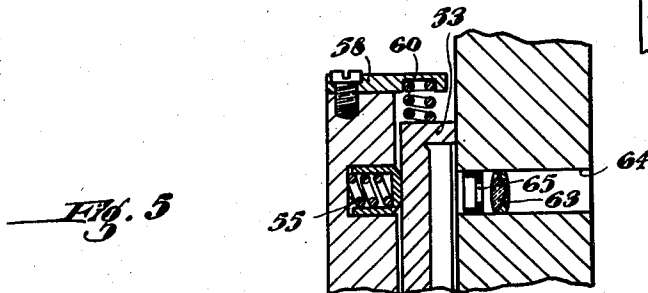
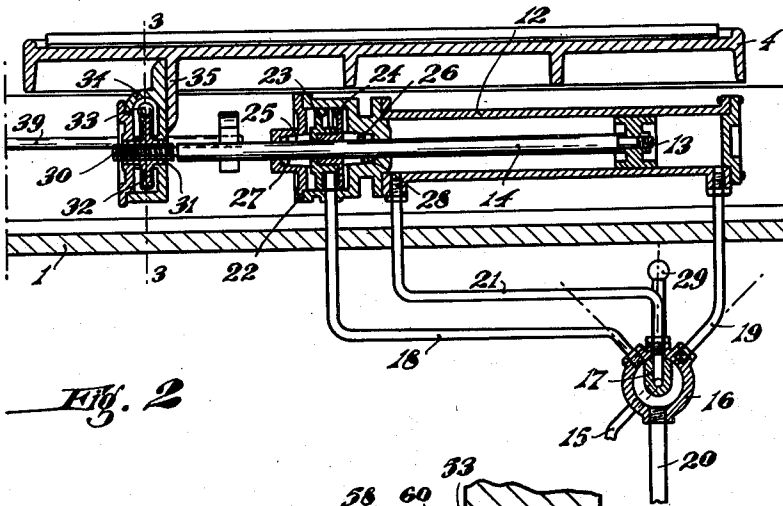
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3 Sheets-Sheet 2



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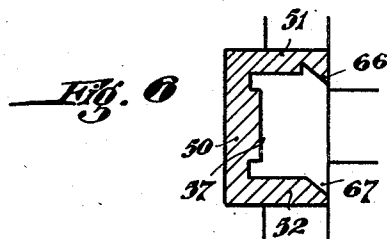
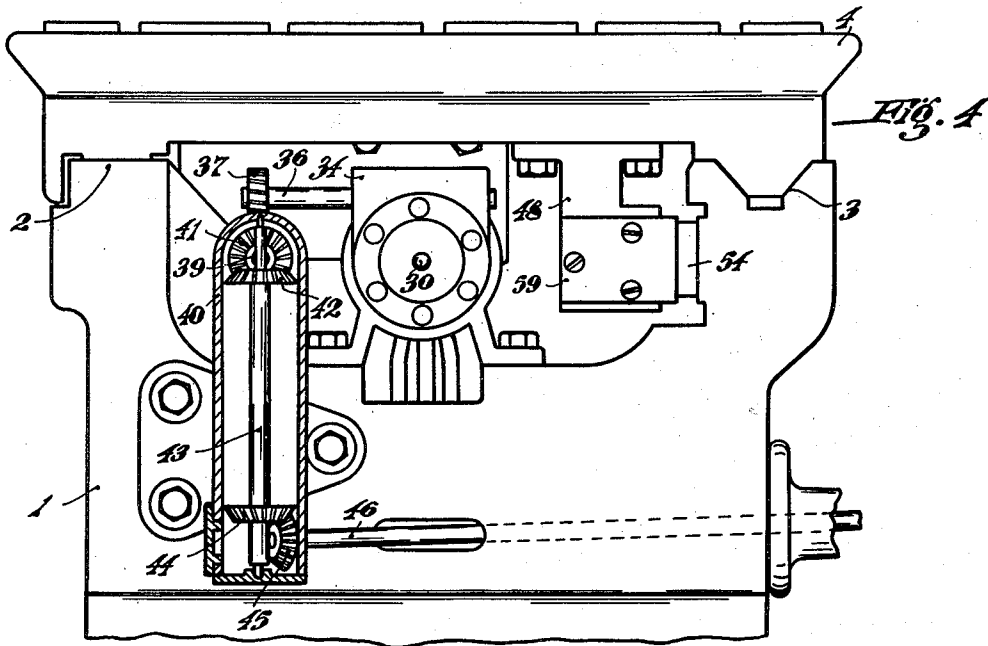
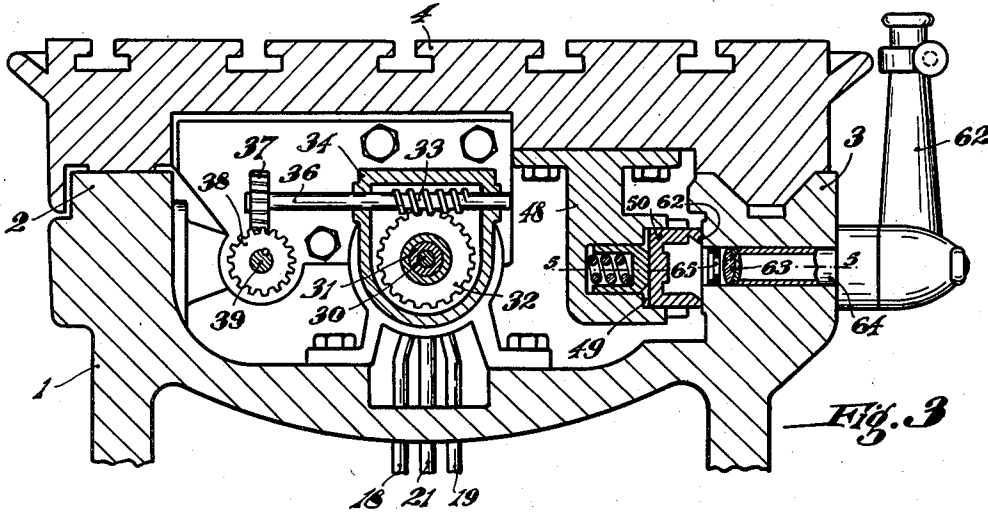
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PRECISION MACHINE TOOL

2,068,199

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,068,199

PRECISION MACHINE TOOL

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Application March 13, 1935, Serial No. 10,939
In Germany March 24, 1934

7 Claims. (Cl. 77—63)

This invention relates to precision machine-
tools such as locating-, boring-, milling-, or
grinding machines of the type having a table
which is movable relative to a tool carrier which
5 may be stationary or movable.

The primary object of this invention is the pro-
vision of a machine-tool of the above type in-
cluding the combination of a fluid pressure mo-
tor for moving the table with an optically read
10 precision measuring scale for measuring the
movements of the table, whereby the time re-
quired for precisely adjusting the table to a fixed
point on the scale may be greatly reduced with
respect to that required for exactly adjusting the
15 table by means of the methods heretofore used
in machine-tools of this type.

A further object of the invention is the provi-
sion of a machine-tool of the type referred to in
which the movable table carries the measuring
scale which is connected to the table by means
20 of a resilient coupling member and constitutes
a slide moving along a guideway provided on a
fixed part of the machine to form an enclosed
space, the graduation of the measuring scale be-
ing provided on an internal wall of this space
25 so as to be protected from any wear by rough
treatment, or from becoming soiled by lubricat-
ing oil or by dust.

With the above and other objects in view, the
30 invention consists in the features of construc-
tion and operation set forth in the following
specification and illustrated in the accompany-
ing drawings in which,

Figure 1 is a perspective view of a boring ma-
chine in which the invention is embodied.

Figure 2 is a longitudinal section through the
work table and the fluid pressure motor for oper-
ating the same.

Figure 3 is a transverse section through the
work table and the bed of the machine, taken
along the line 3—3 of Fig. 2.

Figure 4 is a front view, partly drawn in sec-
tion, of the work table and the bed of the ma-
chine.

Figure 5 is a longitudinal section taken on the
line 5—5 of Fig. 2.

Figure 6 is a transverse section through the
measuring scale.

Figures 7 and 8 show each a modification of
a detail concerning the measuring scale.

Fig. 9 is a fragmentary view of a conventional
device for illuminating the measuring scale.

The illustrated boring machine comprises a
bed 1 provided with guideways 2 and 3 for the
55 horizontally movable work table 4. A cross rail

5 is mounted for vertical movement on the two
uprights 6 and 7 and supports a tool slide 8. An
electric motor 9 is provided to impart move-
ment to the tool spindle 10 and to the cross rail
elevating screws 11.

The work table 4 is operated by means of a
fluid pressure motor particularly illustrated in
Figure 2. A similar mechanism has been de-
scribed in detail and claimed in the earlier U. S.
Patent No. 1,956,110.

A motor cylinder 12 is supported on the bed
1 beneath the table 4. A piston 13 on a rod 14
can reciprocate within the cylinder. The pres-
sure fluid destined to actuate the piston is de-
livered by a pump (not shown) through a pipe 15
10 to a distributor 16 provided with a rotatable valve
17 which can direct the fluid either into the pipe
18 or into the pipe 19, to deliver it to one or the
other side of the piston 13, while the fluid which
is discharged from the cylinder 12 through the pipes
20 18 or 19, according to the direction of movement
of the piston, returns to the pump by the pipe 20.
A third pipe 21 connects the distributor to a
locking cylinder 22 to deliver pressure fluid into
a space formed between two pistons 23 and 24
25 carrying each on its outer face conical locking
jaws 25 and 26 surrounding the piston rod 14.
These jaws coact with the walls of conical rec-
esses 27 and 28 in the cylinder 22, so that when
pressure fluid arrives between the pistons 23
30 and 24 and tends to drive them away from each
other, the jaws are strongly pressed against the
piston rod 14 and firmly lock the rod against any
movement. The distributor valve 17 is connected
35 to an operating handle 29 which is visible also in
Fig. 1.

The end of the piston rod is provided with a
screw threaded portion 30. A rotatable nut 31 is
engaged on the screw thread and forms the hub
of a gear wheel 32 meshing with a worm gear 33.
40 The wheel 32 is held against longitudinal move-
ment relative to the table 4 by a casing 34 which
is secured to an extension 35 of the table. The
worm 33 is provided on a shaft 36 carrying a heli-
coidal wheel 37 meshing with a helicoidal wheel
38 which is mounted on a shaft 39 for rotation
45 with the shaft and capable of axially sliding along
this shaft which is supported with its rear end by
the bed of the machine and with its front end by a
casing 40 carried by the bed. A bevel wheel 41
50 on the front end of this shaft meshes with a bevel
wheel 42 on a shaft 43, and a second pair of bevel
wheels 44 and 45 connects the shaft 43 to a shaft
46 which can be rotated by means of a hand wheel
55 47 disposed on the same side of the machine as

the handle 29 of the control member for the hydraulic table drive, and in proximity to this handle so that the operator of the machine can easily manipulate either the handle 29 or the wheel 47.

The lower face of the work table 4 carries a longitudinally extending bracket 48 provided with a recess 49 in which is freely engaged a measuring scale 50 having in cross section the general shape of a U or a channel standing on one of its branches. Thus the scale comprises an upper and a lower longitudinal wall 51 and 52, respectively, and two end walls 53 and 54. Two relatively weak springs 55 act to keep the scale in contact with a surface 56 provided on the machine bed and forming a guideway for the scale which moves together with the table 4. The graduation is formed on the interior face 57 of the scale, and is therefore situated in the interior of a completely closed space, so as to be fully protected from any rough treatment, as well as from oil or dust deposit.

In order to connect the scale 50 for movement with the table 4, the bracket 48 carries at both of its ends a plate 58 and 59, respectively. A spring 60 is inserted between the plate 58 and the wall 53 of the scale and maintains a face 61 of the wall 54 of the scale constantly in contact with the plate 59.

It is seen that the weight of the scale 50 is carried by the bracket 48 which is secured to the table 4. The friction of the scale along the surface 56 of the machine bed is only feeble, since the springs 55 exert only a slight pressure just necessary to maintain the scale in contact with the surface 56. The abutting face 61 of the scale is not subjected to any wear as it does not move relatively to the plate 59; for this reason the initial precision of the measuring scale is permanently maintained.

The graduation of the scale is observed by means of an optical system, as for example a microscope 62, the objective 63 of which is disposed in an opening 64 provided in the bed of the machine. A diaphragm 65 prevents any lubricating oil from penetrating to the objective. Illumination of the scale may be effected in any conventional manner. Fig. 9 shows a small electric bulb 75 carried by the micrometer casing and sending a beam of light across a condenser 76 and a reflecting prism 77 onto the graduation, while the prism 78 reflects an image of the graduation on the reticule of the microscope.

The edge of the upper wall 51 of the measuring scale is provided with a downwardly pointed projection 66 extending over the entire length of the scale and having as purpose to make any oil which may penetrate between the scale and the machine bed drop into a groove 67 formed between the lower wall 52 and the bed, and wherefrom such oil will be evacuated to the base of the machine. In this manner no oil can arrive on the graduation of the scale.

Figure 7 shows a modified arrangement for carrying the scale. The measuring scale 68 is provided with an inclined face 69 bearing on a correspondingly inclined face of the bracket 70. Owing to its weight the measuring scale will slide downwards on the inclined surface towards the machine bed 1, and no springs are required to maintain the scale in contact with the bed; only the arm 71 of the scale must be made heavy enough so that the scale cannot fall backwards.

In the modification shown in Figure 8, the spring 60 acts upon that end of the scale which is provided with the abutting surface 61. The

wall 59 of the bracket is provided with an opening 72 through which penetrates a stud 73 screwed into the measuring scale 50. The spring 60 is disposed between the head of the stud and the plate 59. This arrangement provides the advantage to prevent any stress due to spring pressure from acting upon the measuring scale.

The described hydraulic power drive is operated in the following manner. First the handle 29 is turned so as to establish communication between the fluid delivery conduit 15 and either pipe 18 or 19, according to the direction in which the table 4 is desired to be moved. Fluid will then be delivered to one end of the cylinder 12 and discharged from the other end. The piston rod 14 being rigidly connected to the table by the intermediary of the screw threaded portion 30, nut 31 and casing 34, the table 4 will move with the piston 13. The fluid distributor 16, 17 is constructed in such a manner that while effecting a displacement of the table, a quick acceleration of speed of this latter can be obtained in the beginning of the movement and then the speed can gradually be decreased to stop the table at the exact or almost the exact desired position. In order to stop the movement, the handle 29 is brought to its median position as represented in Fig. 2. Fluid is then directed into the locking cylinder 22 to cause the clamping jaws 25 and 26 to rigidly lock the piston rod, while both ends of the cylinder 12 are connected with the discharge conduit 20. During the movement of the table 4, the measuring scale 50 will be observed by means of the microscope 62. When after having stopped the table, a fine adjustment of its position is required, the hand wheel 47 will be turned, which wheel, as had been described, is operatively connected to the worm wheel 32 which is rigid with the nut 31. The nut will thus be rotated and since the piston rod 14 is locked, the table 4 will move and may be adjusted with great accuracy by observing the measuring scale through the microscope.

I am aware that the use of a hydraulic power drive for work tables of machine-tools is known in itself, as is also the use of optically read precision scales. But the combination of such driving and measuring devices on a single machine-tool is new and results in many advantages as well as in increased efficiency and utility.

I claim:—

1. In a machine-tool, the combination of a stationary member, a slidable member mounted for movement therealong, a channel-shaped measuring scale carried by the slidable member for measuring the movements thereof, means for urging the scale against a face of the stationary member whereby the walls of the channel-shaped scale and said face of the stationary member form a closed chamber, and a resilient coupling means at one end of the slidable member for connecting the measuring scale to said slidable member to allow for relative linear expansion of the scale and slidable member.

2. In a machine-tool, the combination of a frame member, a guideway thereon, a slidable member movable along said guideway, said frame member being provided with a surface extending parallel with said guideway, a channel-shaped measuring scale freely carried by said slidable member, spring means for holding the measuring scale in contact with said surface on the frame member whereby the walls of the channel-shaped scale and said surface form a closed chamber, an abutment on said slidable member, and a spring

interposed between the slidable member and the scale for maintaining the scale in contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

3. In a machine tool, the combination of a frame member, a slidable member mounted for movement therealong, a measuring scale mounted for movement with said slidable member for measuring the movements thereof, means for holding the measuring scale in engagement with said frame member during movement of the slidable member, an abutment at one end of said slidable member, and spring means at the opposed end thereof for holding said measuring scale in contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

4. In a machine-tool, the combination of a frame member, a slidable member mounted for movement therealong, said frame member being provided with a surface extending parallel with the direction of movement of said slidable member, a measuring scale mounted for movement with said slidable member for measuring the movements thereof, means for holding the measuring scale in contact with said surface on the frame member during movement of the slidable member, an abutment at one end of said slidable member, and spring means at the opposed end thereof for holding the measuring scale in contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

5. In a machine-tool, the combination of a frame member, a guideway thereon, a slidable member movable along said guideway, said frame member being provided with a surface extending parallel with said guideway, a channel-shaped measuring scale freely carried by said slidable member, spring means for holding the measuring

scale in contact with said surface on the frame member whereby the walls of the channel-shaped scale and said surface form a closed chamber, an abutment at one end of said slidable member, and a spring at the opposed end thereof for maintaining the scale in contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

6. In a machine-tool, the combination of a frame member, a slidable member mounted for movement therealong, said frame member being provided with a surface extending parallel with the direction of movement of said slidable member, a measuring scale mounted for movement with said slidable member for measuring the movements thereof, means for holding the measuring scale in contact with said surface on the frame member during movement of the slidable member, an abutment at one end of said slidable member, and spring means at the same end thereof for drawing the measuring scale into contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

7. In a machine-tool, the combination of a frame member, a guideway thereon, a slidable member movable along said guideway, a channel-shaped measuring scale freely carried by said slidable member, spring means for holding the measuring scale in contact with said surface on the frame member whereby the walls of the channel shaped scale and said surface form a closed chamber, an abutment at one end of said slidable member, and spring means at the same end thereof for drawing the measuring scale into contact with said abutment during movement of the slidable member and to allow for relative linear expansion of the scale and slidable member.

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