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MACHINE TOOL

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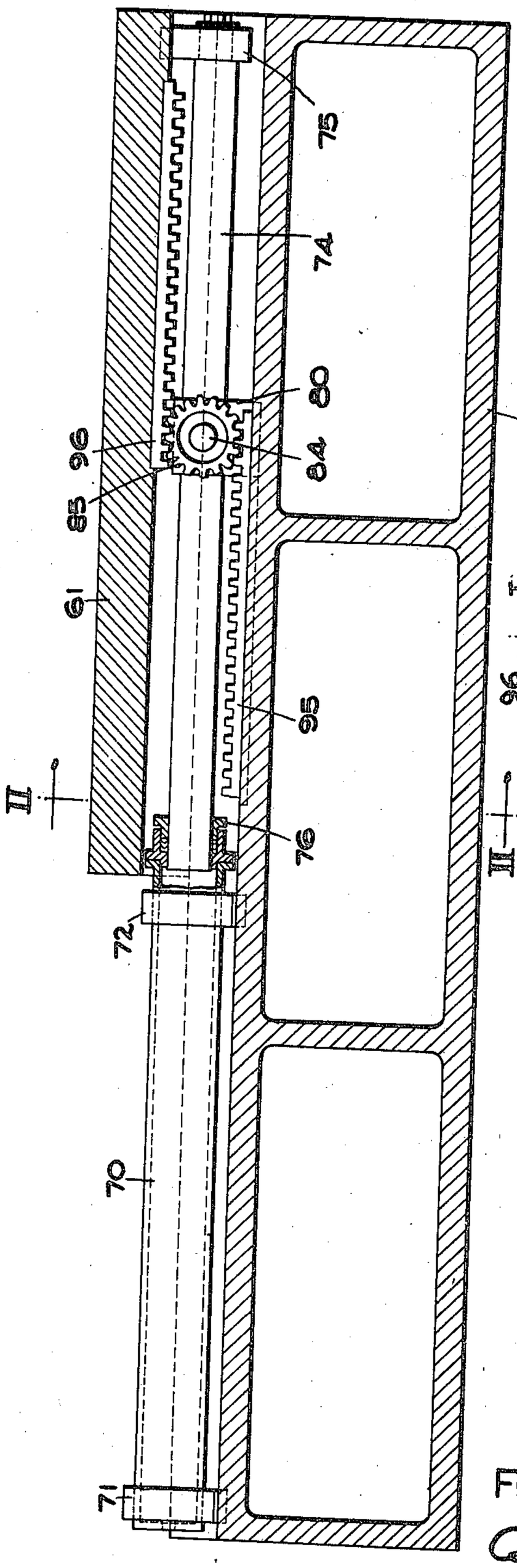

Fig. 1.

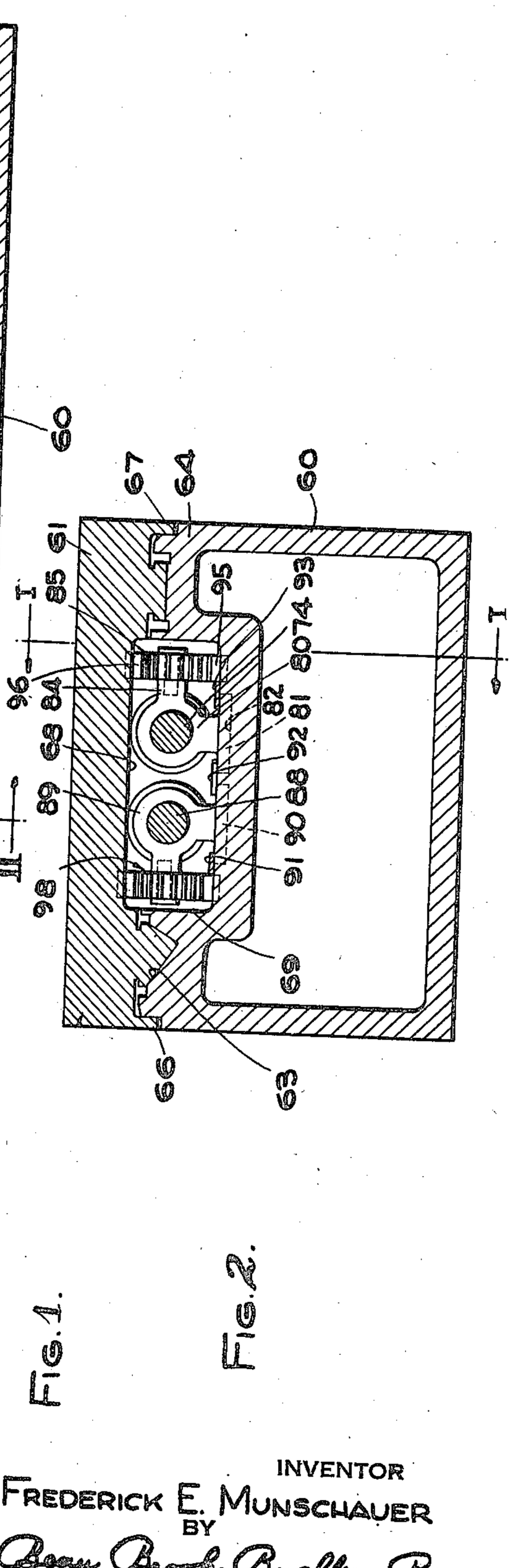

Fig. 2.

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MACHINE TOOL

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This invention relates to reciprocating work tables for machine tools and the like and particularly to fluid operated tables for machines of this class.

Heretofore in this art definite length limitations have existed which prevented satisfactory fluid operation of reciprocating work tables beyond certain stroke lengths, other factors considered. These limitations arise as a result of natural lateral flexural deflection of the parts when unusually long cylinders and pistons or piston rods are employed, deflections sufficient in degree to militate against satisfactory operation of hydraulic piston and cylinder constructions which by their nature must have accurate fluid-tight engagement, not only as between the pistons and cylinders but also as between the piston rods and the cylinder heads.

The present invention provides means whereby sturdy, accurate and wholly satisfactory hydraulic operation may be employed at stroke lengths hitherto deemed impractical and unworkable. The general desirability and advantages of hydraulic drives for machine tool and other reciprocating work tables are well established and recognized and the present invention extends the benefits of this expedient to ranges of operation not previously available.

Other objects and advantages of procedure in accordance with the principles of the present invention will occur to those skilled in the arts involved. While a specific example of the practice of the present invention is illustrated in the drawing and described herein by way of example, it is to be understood that the underlying principles are not limited thereto or otherwise than as defined in the appended claims. In the ensuing description, reference will be had to a surface grinder as one specific example of a machine tool wherein the principles of the present invention may be advantageously employed.

In the drawings:

Fig. 1 is a longitudinal cross sectional view of one form of the apparatus of the present invention taken on line I—I of Fig. 2; and

Fig. 2 is a transverse cross sectional view on the line II——II of Fig. 1.

Figs. 1 and 2 show apparatus for achieving the aims of the present invention by the use of a single piston with a traveling support which is at all times substantially midway between the cylinder head and the other end of the piston, thus giving medial support to the extended piston without interfering with free and full entry of the piston into the cylinder at its other limit of

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movement. Only so much of the machine tool as is novel to the present invention is illustrated and described, the remainder being conventional and subject to a wide range of variation in design and arrangement.

The embodiment of the invention illustrated in the present application contemplates the provision of duplicate but opposite piston and cylinder arrangements, one set for pushing the work table in each direction. One piston and cylinder assembly is shown in elevation in Fig. 1, that being the right-hand piston and cylinder arrangement of Fig. 2. The left-hand piston and cylinder arrangement of Fig. 2 is not shown in Fig. 1.

In Figs. 1 and 2 the numeral 60 designates a bed and the numeral 61 designates a work table which is reciprocable thereon. Referring to Fig. 2, bed 60 has ways 63 and 64 and work table 61 has complementary longitudinal formations at its under side for free longitudinal movement along bed 60. Depending marginal flanges 66 and 67 are provided on bed 61 for further guiding engagement against the upper marginal longitudinal portions of bed 60. The under side of work table 61 and the upper surface of bed 60 have cooperating well formations 68 and 69, respectively, which house the piston and cylinder assemblies and their accompanying mechanism.

Referring to Fig. 1, a cylinder 70 has one of its ends fixed securely to bed 60 as by means of a bracket 71 adjacent one end of bed 60. The other end of cylinder 70 is likewise securely supported upon bed 60 as by means of a bracket 72. A piston 74 has one of its ends secured rigidly to the end of work table 61 by a bracket 75 which is opposite to the end of the bed which supports cylinder 70. The other free end of piston 74 extends into cylinder 70 and the latter has a suitably packed cylinder head arrangement as at 76.

A bearing 80 is fitted about piston 74 for relative axial sliding movement and bearing 80 has a flanged base 81 for longitudinal movement along bed 60 in a guide groove 82. Bearing 80 is provided with a laterally extending trunnion 84 which rotatably supports a pinion 85.

The companion piston for movement of the work table 61 in the opposite direction is designated 88 in Fig. 2 and it is likewise provided with an axially sliding supporting bearing 89 having a flanged base 90. Retaining rails 91, 92 and 93 are depicted in Fig. 2.

A rack 95 is fixed to bed 60 and a second rack 96 is fixed to the under side of work table 61. Pinion 85 is in constant mesh with both of the

racks 95 and 96 and accordingly will always move equal relative amounts with respect to both racks. The result of this arrangement is that bearing 80 always occupies a position substantially midway between the bracket 75 which secures one end of piston 74 and the point where piston 74 enters cylinder 70 at cylinder head 76.

It will be seen from this that the effective length of piston 74, considered as a structural column, will always be just half of the length of the part of the piston projecting from cylinder 70, because of the lateral restraint imposed by bearing 85 which is securely guided in bed 60.

The opposite bearing 89 is provided with a similar but opposite pinion and rack mechanism which is merely designated generally at 98 in Fig. 2, and the description need not be duplicated in further detail.

What is claimed is:

1. In a machine tool, a bed element, a work table element mounted for guided lineal movement thereon, and drive means for effecting lineal movement of said work table element, said drive means comprising a cylinder fixed to one of said elements and piston means secured at one end to the other of said elements, the other end of said piston means being disposed for reciprocation in said cylinder, means guiding said piston means against lateral deflection and slidably engaging the piston means between its ends, gear means carried by the guiding means for free rotation, a rack fixed to said bed element and meshing with said gear means, and a rack fixed to said work table element and meshing with said gear means at the opposite side thereof, whereby said guiding means automatically moves along said bed element at a rate having a fixed fractional relation to the rate of movement of the work table element.

2. In a machine tool, a bed element, a work table element mounted for guided lineal movement thereon, and drive means for effecting lineal movement of said work table element, said drive means comprising a cylinder fixed to one of said elements and piston means secured at one end to the other of said elements, the other end of said piston means being disposed for reciprocation in said cylinder, means guiding said piston means against lateral deflection and slidably engaging the piston means between its ends, a pinion carried by the guiding means for free rotation, a rack fixed to said bed element and meshing with said pinion, and a rack fixed to said work table element and meshing with said pinion at the opposite side thereof, whereby said guiding means automatically moves along said bed element at one-half the rate of movement of the work table element.

3. In a machine tool, a bed element, a work table element mounted for reciprocation thereon, and a pair of opposed drive means for effecting alternate lineal movement of said work table element in opposite directions, each of said drive means comprising a cylinder fixed to one of said elements and piston means secured at one end to the other of said elements, the other end of said piston means being disposed for reciprocation in said cylinder, means guiding said piston means against lateral deflection and slidably engaging the piston means between its ends, gear means carried by the guiding means for free rotation, a rack fixed to said bed element and meshing with said gear means, and a rack fixed to said work table element and meshing with said gear means at the opposite side thereof, whereby said guiding means automatically moves along said bed element at a rate having a fixed fractional relation to the rate of movement of the work table element.

4. In a machine tool, a bed element, a work table element mounted for reciprocation thereon, and a pair of opposed drive means for effecting alternate lineal movement of said work table element in opposite directions, each of said drive means comprising a cylinder fixed to one of said elements and piston means secured at one end to the other of said elements, the other end of said piston means being disposed for reciprocation in said cylinder, means guiding said piston means against lateral deflection and slidably engaging the piston means between its ends, a rotatable pinion carried by the guiding means for free rotation, a rack fixed to said bed element and meshing with said pinion, and a rack fixed to said work table element and meshing with said pinion at the opposite side thereof, whereby said guiding means automatically moves along said bed element at one-half the rate of movement of the work table element.

5. In a machine tool, a bed, a work table mounted for guided lineal movement thereon, and drive means for effecting lineal movement of said work table element, said drive means comprising a cylinder fixed to said bed and piston means secured at one end to said work table, the other end of said piston means being disposed for reciprocation in said cylinder, means guiding said piston means against lateral deflection and slidably engaging the piston means between its ends, gear means carried by the guiding means for free rotation, a rack fixed to said bed and meshing with said gear means, and a rack fixed to said work table and meshing with said gear means at the opposite side thereof, whereby said guiding means automatically moves along said bed at a rate having a fixed fractional relation to the rate of movement of the work table.

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