L. E. BEAMAN.

MILLING MACHINE.

APPLICATION FILED NOV. 1, 1915.

1,218,044.

Patented Mar. 6, 1917.

4 SHEETS—SHEET 1.

Fig. 1

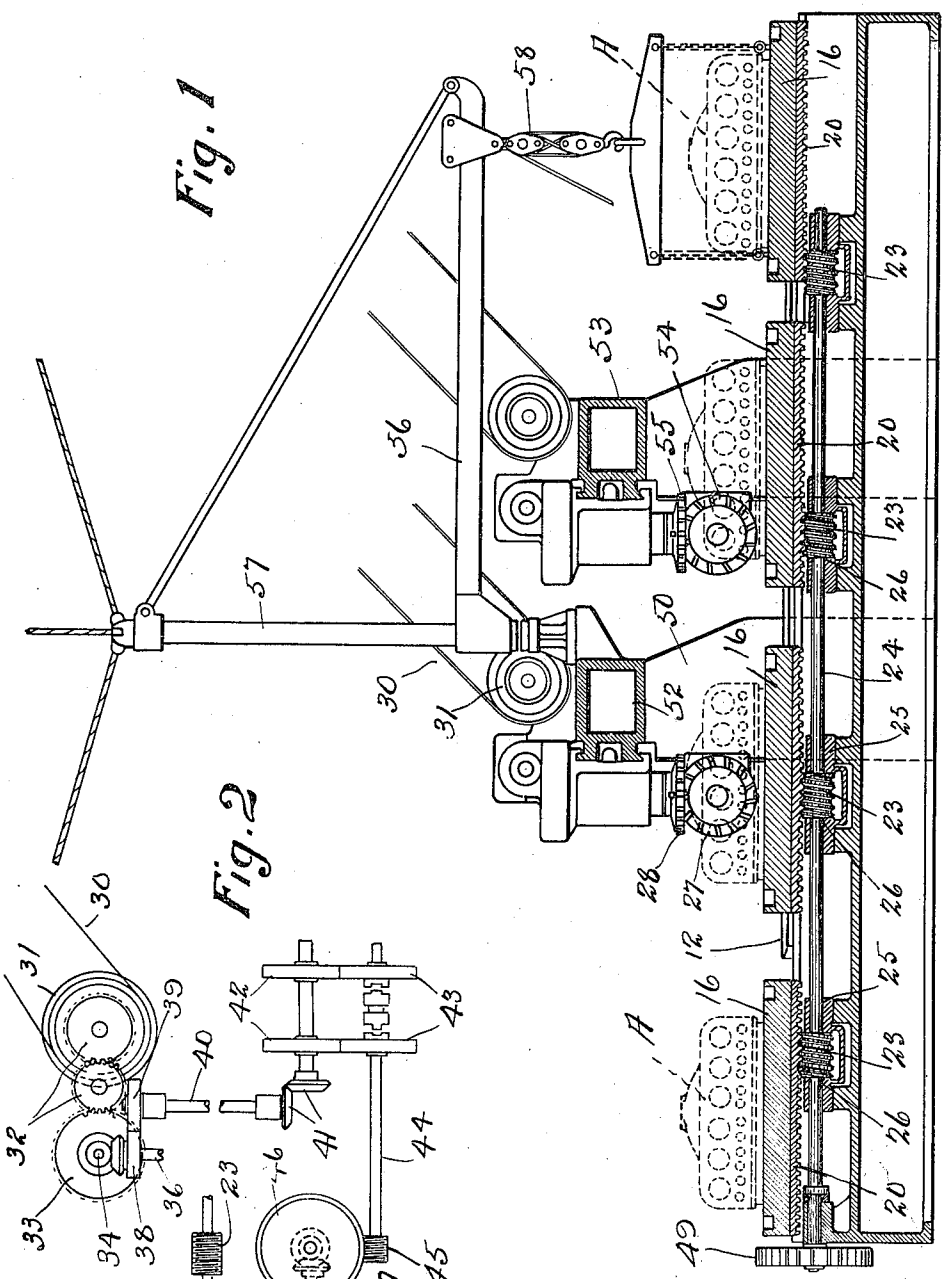


Fig. 2

Witnesses

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4 SHEETS—SHEET 2.

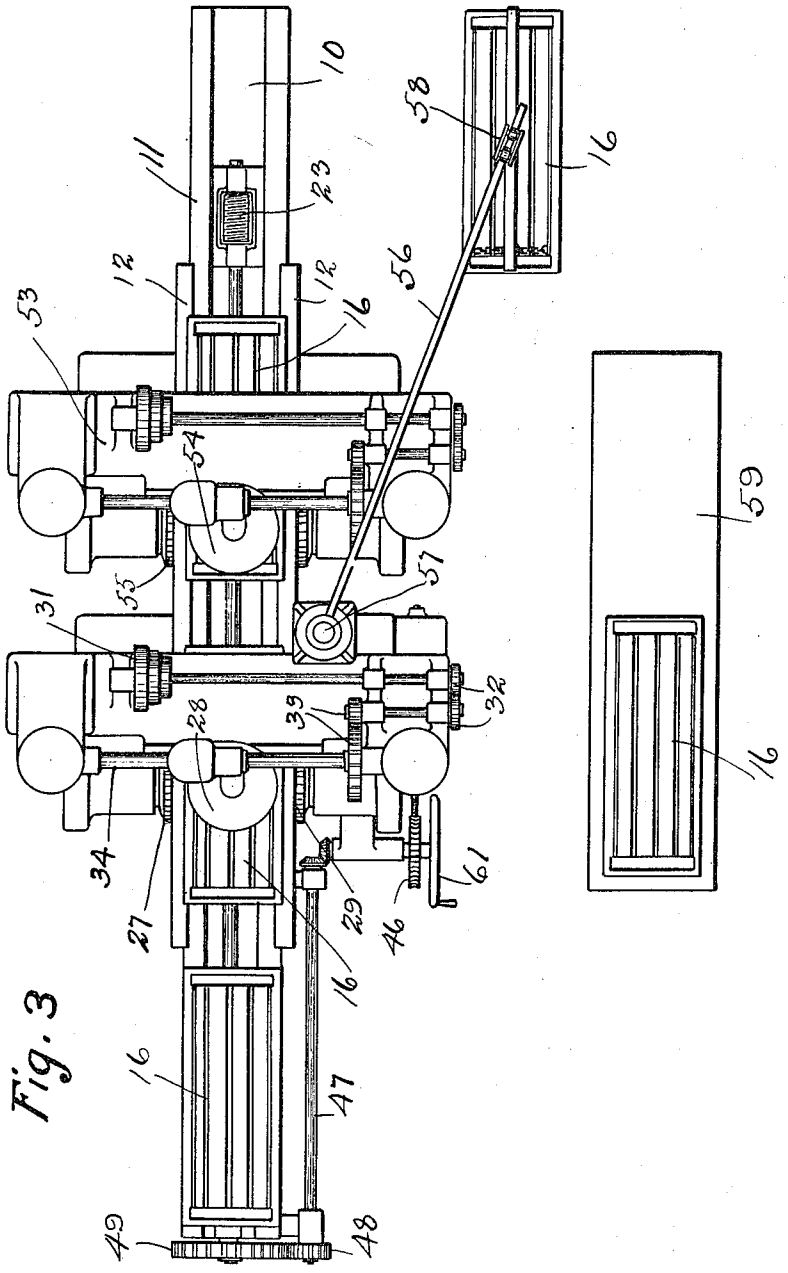


Fig. 3

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4 SHEETS—SHEET 3.

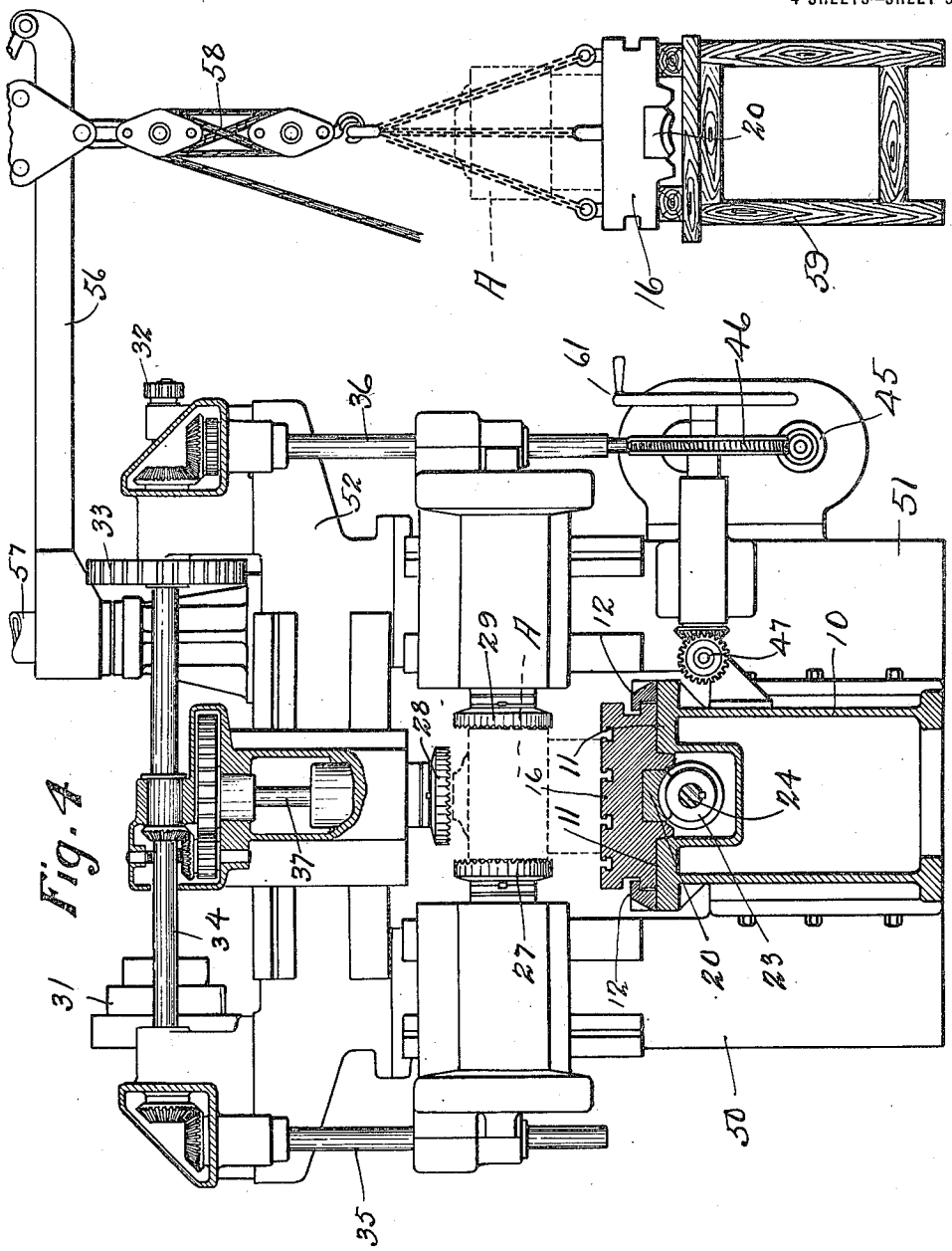


Fig. 4

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4 SHEETS—SHEET 4.

Fig. 5

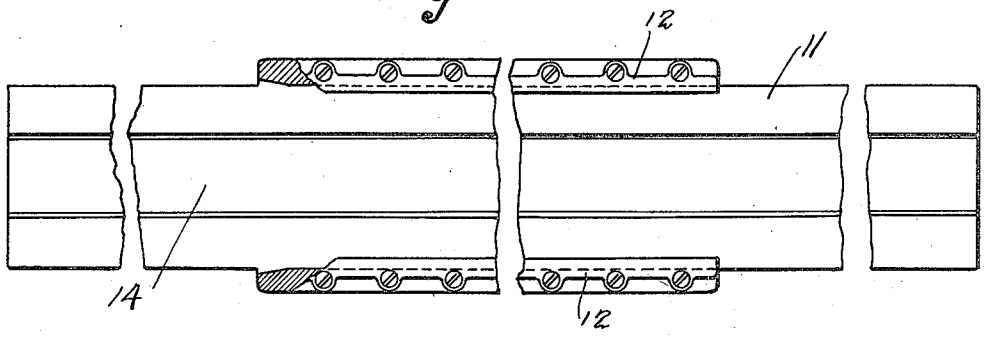


Fig. 6

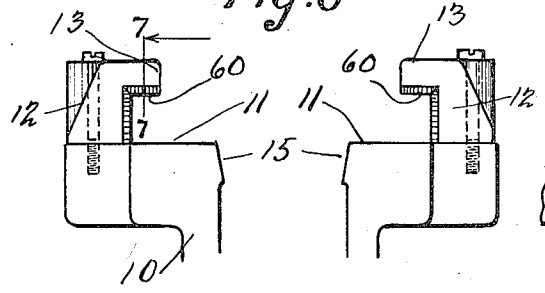


Fig. 7

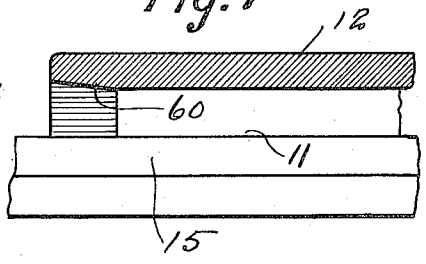


Fig. 8

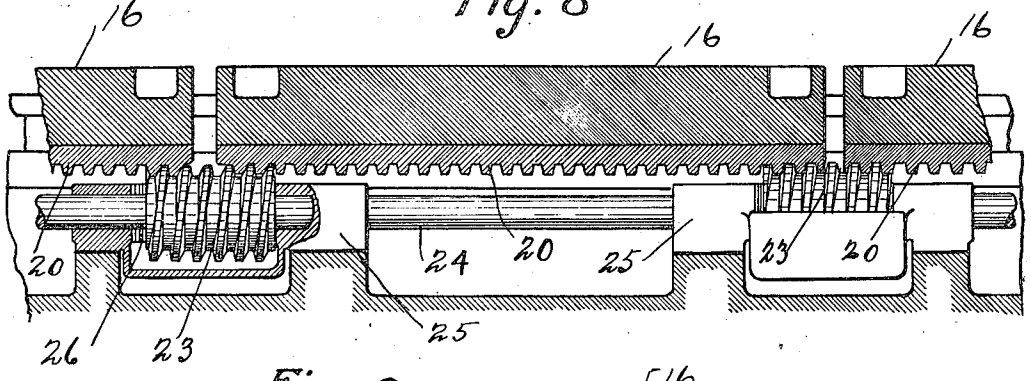
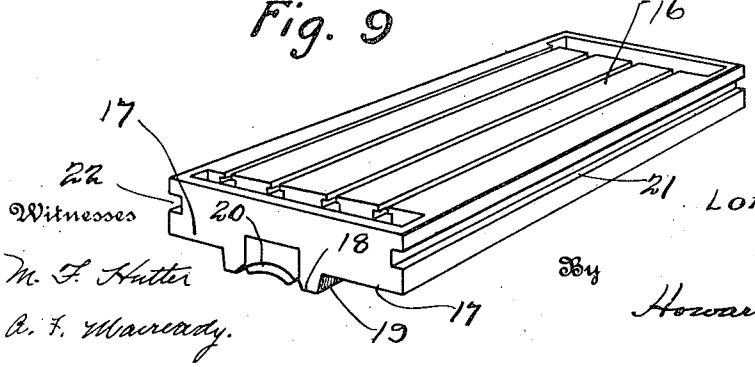


Fig. 9



Witnesses

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UNITED STATES PATENT OFFICE.

LORA ELMER BEAMAN, OF CRANSTON, RHODE ISLAND, ASSIGNOR TO THE BEAMAN & SMITH CO., OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND.

MILLING-MACHINE.

1,218,044. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed November 1, 1915. Serial No. 58,972.

To all whom it may concern:

Be it known that I, LORA ELMER BEAMAN, a citizen of the United States, and resident of Edgewood, city of Cranston, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Milling-Machines, of which the following is a specification.

This invention relates to improvements in milling machines, grinding machines, planers and the like, for working metal or other material, and the object of this invention is to provide an improved machine of this character having a bed or support, and a plurality of inter-exchangeable work carrying tables adapted to be readily positioned one after another at the entering end of this support and moved successively and continuously in one direction through the machine, for the purpose of increasing its production.

A further object of this invention is to provide suitable means whereby the work carrying tables, after having been passed through the machine, may be removed from its support and transferred to the opposite end thereof to be again passed therethrough in the same direction, means being provided whereby the table after leaving one end, may rest for a predetermined interval, in which the work thereon may be changed if desired, before the table is again passed through the machine.

The invention further consists in the provision of means whereby each of the work tables is driven independently of each other and continuously through the machine.

A further object of this invention is the provision of a single driving shaft extending lengthwise of the machine, said shaft being provided with a plurality of worms or short screws spaced apart a distance less than the length of the rack portion of one of the tables, whereby the tables are engaged successively and passed along the support to present the work carried thereon to the different tools and sets of tools, to be operated upon.

A further object of the invention is the provision of a thrust bearing behind each individual screw to receive its end thrust.

A still further object of the invention is the provision of a plurality of sets of operating tools, each set being mounted independently of the other, whereby the finishing cutters may operate upon the work without being affected by the chatter or vibration of the roughing cutters.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1— is a sectional side elevation of my improved machine showing a plurality of tables set tandem on the bed or support and the driving means for said tables.

Fig. 2— is a diagrammatic view illustrating the general arrangement of the driving mechanism.

Fig. 3— is a plan view of the machine showing one of the tables in the act of being removed from one end of the machine.

Fig. 4— is an end view of the machine showing the bed and one of the tables in section, also showing three tool carrying heads with one of said heads in section.

Fig. 5— is a plan view of the bed of the machine showing the gibs intermediate its ends which prevent the tables from lifting while the work carried by them is being operated upon by the tools.

Fig. 6— is an end view of the gibs showing the beveled ends of the gibs for guiding the entering tables.

Fig. 7— is a side elevation of one of the gibs partly in section showing its beveled entering end.

Fig. 8— is a sectional side elevation showing the relative position of the different driving elements and the tables whose racks are engaged by said elements to pass them successively and continuously through the machine.

Fig. 9— is a perspective view of one of the tables.

Referring to the drawings, 10 designates the base portion or bed of the machine which is provided with suitable ways 11 see Figs. 4 and 5 along which the work carrying tables are passed successively and continu-

ously by suitable driving mechanism hereinafter described. A pair of parallel longitudinally disposed gibs 12 are attached to opposite edges of the bed 10 having a portion overhanging the ways 11, see Fig. 6, the length of these gibs is somewhat less than the length of the bed, leaving an unobstructed length of bed at each end, substantially the length of a table. The middle portion of this bed is provided with a longitudinally disposed guiding recess 14 which extends the length thereof, and the side walls 15 of this recess are slightly beveled inwardly and finished to serve as a suitable guide for centralizing the tables. The entering ends of these gibs are beveled as at 60 to insure a smooth entering of the tables thereinto.

These tables 16 are made comparatively short and of a length to receive the work they are designed to carry. Each table is provided with two bearing surfaces 17 adapted to slide on the ways 11, and also with a downwardly projecting middle longitudinally disposed rib 18, whose side walls 19 are slightly beveled to fit between and be guided by the walls 15 of the recessed portion in the bed.

A rack portion 20, see Figs. 8 and 9, is secured to the underside of each table, to extend the length thereof and parallel grooves 21 and 22 are formed in opposite side edges of the tables, to receive the overhanging portions 13 of the opposite gibs, to prevent the tables from rising while the tools are operating upon the work carried by them, or other suitable means may be provided for this purpose.

The teeth of each rack are preferably formed on the arc of a circle similar to a portion of a nut in cross section for the purpose of better engaging and fitting the driving screws or worms 23.

The particular style of machine shown is especially designed for carrying pieces of work of substantially the size and style of an engine cylinder upon which a number of tools may operate simultaneously, requiring great driving power to carry the work along against the action of the cutters, therefore to accomplish this driving action in a simple, practical and effective manner, I have mounted a plurality of driving elements, such as short worms 23, which are disposed at intervals along the shaft, the space between the worms being less than the length of the table, or that portion of the table which constitutes the rack, whereby the table rack is caused to engage the next worm, before it leaves the one previously engaged to insure an uninterrupted and continuous passage through the machine.

Owing to the considerable length of this driving shaft and the excessive amount of work the worms are required to do, particularly while driving the work past the cutters, it is found essential to provide bearings 25 for this shaft disposed at intervals along the shaft to prevent the same from springing downward and in this manner insure perfect contact of the worm teeth with those of each table rack.

Then again by this construction each worm may be provided with an independent thrust bearing 26 to receive its end thrust directly, and without being obliged to transmit the same through the long shaft to the end thereof, thereby again reducing the driving friction on the machine.

These short sections of worms mounted on a main driving shaft are found in practice to be of considerable advantage over a single continuous screw, for several reasons, among others being first, a considerable reduction in cost of construction, and second the individual worms mounted on a driving shaft permit of a number of intermediate supporting bearings for the shaft which could not otherwise be provided.

In order to facilitate the operations on this machine, any number of cutters or operating tools may be employed, and these tools may be driven or operated in any suitable manner. I have illustrated one arrangement of mechanism which is shown as driving three milling cutters 27, 28, and 29. The power for this work may be received from any suitable source, but I have shown the same as being applied through a belt 30, see Fig. 2, and transmitted through cone pulley 31, gears 32 and 33, to the horizontal shaft 34, see Fig. 4, thence down on either side through shafts 35 and 36 to the side tools 27 and 29, and also through vertical shaft 37 to the horizontal tool 28.

A portion of the power is applied to the driving of the cutters and the balance is transmitted downward through gears 38 and 39, vertical shaft 40, beveled gears 41, change gears 42 and 43 through horizontal shaft 44, worm 45, and worm gear 46 through horizontal shaft 47, gears 48, and 49, to the longitudinal shaft 24, which transmits the power to the table driving worms 23 as above described. The worm 45, see Fig. 4, may be moved from engagement with the worm gear 46 if desired, so that the feed mechanism may be operated by the hand wheel 61 for adjusting the work relative to the tools.

The driving mechanism for the particular set of tools employed in this machine, is mounted on a suitable frame work comprising the side supports 50 and 51 connected by the cross rail 52, but any number of sets of these operating tools may be employed, and each set is mounted on a separate frame work, such as that illustrated at 53 in Figs. 1 and 3.

Where two or more sets of operating tools are employed, these sets are usually and pref-

erably spaced apart a distance greater than the working face of the table, so that the roughing cutters indicated at 27, 28, and 29, will have completed their action upon the work before the finishing cutters 54, and 55 are brought into contact therewith, therefore the chatter and vibration caused by the roughing cutters is not transmitted to the work while the finishing cutters are operating upon the same.

Any desired means may be employed for transferring the individual tables with the work from one end to the other end of the machine.

Owing to the considerable weight of these tables and the work carried thereon, which sometimes amounts to a ton, more or less it is found advisable to employ a derrick for this transferring operation, in which case a boom 56 is suspended from a mast 57 and on this boom is mounted a hoisting apparatus 58, which engages the table with its work, lifts the same clear of the bed of the machine as it has now been passed beyond the gibs, and swings it, load and all around and deposits the same upon a rest 59. The connecting chains are now released from the table, the work A, indicated by dotted lines, is removed and a fresh piece of work secured in place thereof, this table is then engaged by the derrick and swung around to the entering end of the machine and passed onto the bed ways to be again carried through the machine. This operation is repeated continually as fast as the tables pass through the machine.

I have shown and described one form of mechanism for passing a plurality of tables successively and continuously through the machine, but I do not wish to be limited to this particular arrangement of parts as the same may be rearranged as desired within the scope of the invention set forth in the following claims.

I claim:

1. In a machine of the character described, a plurality of work tables, a plurality of rotatable driving elements arranged to successively engage each table to move them continuously in one direction along said support, said tables being disconnected except through said driving elements and each of said tables being at all times in engagement with at least one of said driving elements, and tools located along said support for operating upon the work carried on said tables.

2. In a machine of the character described, a plurality of tables, a plurality of spaced apart rotatable driving elements arranged at intervals along said support for successively engaging each table to pass each continuously in one direction along said support, said tables being disconnected except through said driving elements and each of said tables being at all times in engagement with at least one of said driving elements, and tools located along said support for operating upon the work carried on said tables.

3. In a milling machine, a support, a plurality of work carrying tables movably mounted on said support, a driving shaft extending longitudinally along said support, a plurality of worms mounted at intervals along said shaft and a rack on each of said tables adapted to engage each worm successively to pass the tables along said support.

4. In a machine of the character described, a plurality of tables, a common support therefor, a plurality of spaced apart driving elements located at intervals along the support for successively engaging each table and passing it continuously along said support, the spaces between said elements being less than the length of one of said tables, and means for transferring said tables from the rear back to the front of said support.

5. In a milling machine, a bed, a plurality of tables set tandem on said bed, a plurality of spaced apart driving elements arranged at intervals along said support for successively engaging each table and passing it continuously along said support, the spaces between said elements being less than the length of said tables, and tools located along said support for operating upon the work carried by said tables.

6. In a machine of the character described, a plurality of work tables, a plurality of spaced apart worms for successively engaging each table and driving it continuously in one direction along said support, said tables being wholly disconnected except through said worm drives and each of said tables being at all times in engagement with at least one of said driving worms, and means for transferring said tables successively from one end of said bed to the other to again pass through the machine.

7. In a machine of the character described, a plurality of work tables, a bed for said tables, a plurality of spaced apart worms for successively engaging and driving each table continuously in one direction along said bed, said tables being wholly disconnected except through said worm drives and each of said tables being at all times in engagement with at least one of said driving worms, and means for lifting each table from said bed as it reaches the rear of the same and transferring it to the opposite end thereof.

8. In a machine of the character described, a support adapted to carry a plurality of work tables set tandem, a driving shaft carrying a plurality of spaced apart

worms for successively engaging and driving said tables, and a thrust bearing for each worm for carrying the driving load.

9. In a machine of the character described, a support, a plurality of spaced apart work carrying tables, means for moving said tables continuously along said support, a plurality of separate sets of operating tools arranged at intervals along said table support to operate upon the work as it passes by them, and a separate support for each separate set of tools.

In testimony whereof I affix my signature in presence of two witnesses.

LORA ELMER BEAMAN.

Witnesses:

LYMAN W. BUDLONG,

HOWARD E. BARLOW.