C. M. SPENCER.

MULTIPLE SPINDLE SCREW MACHINE.

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1,044,701.

Patented Nov. 19, 1912.

Fig. 1

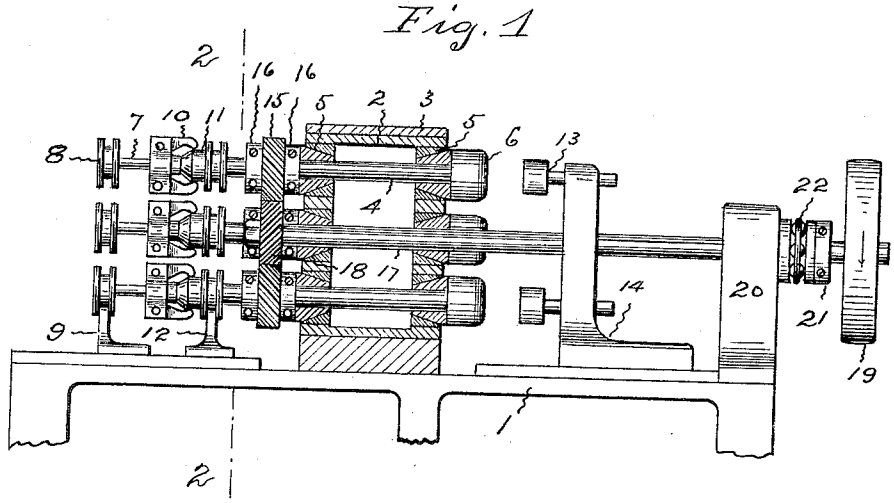
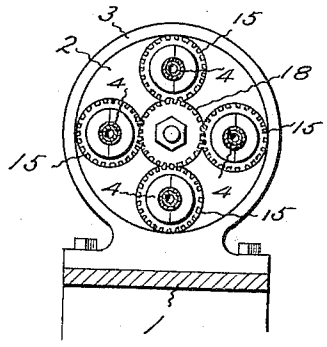


Fig. 2



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MULTIPLE-SPINDLE SCREW-MACHINE.

1,044,701. Specification of Letters Patent. Patented Nov. 19, 1912.

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To all whom it may concern:

Be it known that I, CHRISTOPHER M. SPENCER, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Multiple-Spindle Screw-Machines, of which the following is a specification.

This invention relates to the mechanism which is provided for rotating the spindles of a multiple spindle screw machine of the class in which the spindles are driven by gearing.

The object of the invention is to so design the spindle rotating mechanism of such a machine that the end thrusts resulting from the pressure of the tools against the stock is counterbalanced by simple means in such manner that the spindles are largely relieved of friction with a consequent reduction in the wear of the parts and a saving of power, whereby the machine will run very accurately for a long time with a minimum expenditure of energy. This object is attained by providing the rotatory stock spindles, which in this class of machines are commonly arranged in a circle in an intermittently rotated head, with spiral gears and engaging these spiral gears with a spiral gear on a central driving shaft which is provided with an anti-friction thrust bearing, the pitch of the gears being such that when the driving shaft is rotated for turning the spindles, the central gear tends to crowd the spindle gears meshing therewith forward in a direction opposite to the direction of the pressure of the tools against the stock carried by the spindles, or in other words, the spiral gears engage in such manner that all backward thrust on the stock spindles is transmitted through the gears to the central shaft and brought upon the single thrust bearing with which that shaft is provided.

Figure 1 of the accompanying drawings shows a front elevation, with parts in section, of portions of a multiple spindle screw machine of the type shown in Patent No. 816,510, issued March 27, 1906, provided with a spindle rotating mechanism which embodies the present invention. Fig. 2 shows a transverse section of the same on the plane indicated by the dotted line 2—2 on Fig. 1.

The mechanisms for rotating the spindle head, feeding and chucking the stock and advancing and retracting the tools are not shown and described herein, as they form no part of this invention, which relates solely to the arrangement of the spindle rotating means whereby the spindle bearings and spindles are relieved of all backward thrust, regardless of the amount of pressure of the tools against the stock carried by the spindles.

In the drawings, 1 indicates the top of the frame upon which the machine is built. The head 2 in this type of machine is rotatably mounted in a casing 3 that is fastened on the top of the frame. The tubular stock spindles 4 are rotatably held by bearings 5 set into the ends of the rotatable head. On the forward ends of these spindles are chuck heads 6. The stock is fed through the spindles at the proper time by the feed tubes 7, which are moved forward and backward by the engagement with the feed spools 8 of the feed slide 9 that is adapted to be moved along the frame. The chucks are operated by the action of the chucking levers 10 as the chucking cones 11 are moved by the chucking slide 12 which is movable along the frame. The tool holders 13 are carried by a tool slide 14, which is movable on the frame toward and from the spindles. The details of these parts and the cams for operating them at the proper times are not shown or specifically described herein, as they are well known to those familiar with this class of machines, and are not essential to this invention.

Keyed to each spindle is a spiral gear 15. These gears are held in proper position longitudinally of the spindles by clamp nuts 16 which are set upon the spindles each side of the gear. In the particular machine illustrated there are four spindles and four spiral gears which are located in the head the same distance from the center. Extending through the center of the head is the driving shaft 17. Fastened to the rear end of this shaft is a spiral gear 18, which meshes with the spiral gears on the spindles. The pitch of all of these gears is preferably forty-five degrees. On the front end of this central driving shaft may be a driving pulley 19. Between the bracket 20, which supports one end of the driving shaft and is fixed upon the frame, and the clamp nut 21 which is fastened on the shaft, is a thrust bearing 22, desirably of the ball type.

When a machine provided with this mechanism is in operation, and the tool slide is carrying the tools against the stock that is held in the rotating spindles, the pressure of the tools against the stock tends to force the spindles backward. However, as the central shaft cannot move backwardly, the engagement of the teeth of the spiral gear on the central shaft with the teeth of the spiral gears on the spindles is such that in effect the central spiral gear forces the spindle gears forwardly, and thus counteracts the pressure of the tools backwardly against the stock. Thus, no matter how great the pressure of the tools against the stock, that pressure is counterbalanced by the engagement of the spiral gears, and the thrust is all transmitted to and resisted by the single anti-friction thrust bearing on the central driving shaft. With this construction the forces so counteract each other that the harder the push on the spindles incident to the work, the greater is the tendency of the gear on the main shaft to press the spindles forward and overcome the backward push. As a result of this condition much friction is eliminated, and consequently the wear on the rapidly rotated spindles ordinarily due to end pressure is greatly reduced. This of course increases the efficiency of the machine, for it will run longer with greater accuracy than would be possible where there was much back pressure and considerable wear. Furthermore, the power required to drive the machine provided with this simple mechanism for relieving the end friction of the rapidly rotating spindles is greatly reduced without the necessity of providing anti-friction thrust-bearings for each of the spindles, which are cumbersome, increase the size of the machine, necessitate the use of more parts and require constant attention. Moreover, with anti-friction bearings provided for each spindle there is still much wear as the backward thrust caused by the pressure of the tools against the stock is not counterbalanced. The present construction practically eliminates all of the longitudinal wear on the spindles, and beside running with much less power than the prior machines of this class, the mechanisms run noiselessly.

The invention claimed is:

1. The combination in a screw machine of a rotary stock spindle, a head supporting the spindle, a spiral gear on the spindle, a driving shaft, a spiral gear on the driving shaft and meshing with the spiral gear on the spindle, and an anti-friction bearing arranged to take the back thrust on the driving shaft that is transmitted thereto from the spindle by the gears.

2. The combination in a screw machine, of rotatory stock spindles, a head supporting the spindles, a spiral gear on each spindle, a driving shaft, a spiral gear on the driving shaft and meshing with the several spiral gears on the spindles, and an anti-friction bearing arranged to take the back thrust on the driving shaft that is transmitted thereto from the spindles by the gears.

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