TENON FLUTING MACHINE

Inventor: Dexter H. MacQueston, Winchendon, Mass.
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References Cited
UNITED STATES PATENTS
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Primary Examiner—Donald R. Schran
Attorney—Charles R. Fay

ABSTRACT

Fluting either single or double-end wooden tenons (and dowels) with small equal generally V-shaped parallel and contiguous longitudinally and circumferentially arranged flutes, by compressing the tenon with a longitudinal motion in a circular die, and including a retractable lead-in to center the work and to provide that the die travels the entire distance of the tenon or dowel.

15 Claims, 7 Drawing Figures
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TECHNOLOGY MACHINE

BACKGROUND OF THE INVENTION

The problem of forming good furniture joints has existed for many years and has never been completely solved. There are presently systems which form reasonably good joints such as the Valiron system, see U.S. Pat. Nos. 2,263,198; 2,592,360. This system depended in part on crushing or cutting the fibers of the tenon in such a way as to reduce it to a size equal to or equal to the diameter of the mortise intended to receive it, and then the glue is applied, just prior to insertion in the mortise, causing the wooden fibers to swell after insertion. These tenons (and dowels) are apt to be somewhat out of round and unequal in holding effect circumferentially of the mortise and under conditions of use and changes in humidity, still are apt to become loose.

In the Valiron, as in other systems, it is necessary to crush or deform the tenon immediately prior to insertion in the mortise so as to avoid deformation of the tenon due to circumambient humidity. This obviously has limits in production due to the problems of handling and storage.

It is the general purpose of the present invention to provide a machine for making precise round tenons (or dowels) which are greatly improved over the prior art.

SUMMARY OF THE INVENTION

A machine is provided in which there is a relatively simple support (V-blocks) for a piece which is to be processed; independent, reciprocating die heads which are adjustable to accommodate different sizes of work; a stop bracket which is adjustable but fixed against which the work is stopped, and a movable stop or clamp for the opposite end of the work; there being centering means for the dies with respect to the workpiece whereby when the dies are moved to engage the workpiece they form precise round tenons by means of the die where the tenons have a continuous row of precise longitudinally equally spaced small flutes for e.g., a chair leg or stretcher, by compressive means, little material of the workpiece being removed, but a beneficial shaveling action results on retraction.

There are also provided means to cause lead-ins for the die heads to descend out of the way of the dies so that the dies may process substantially the entire length of the tenon.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation illustrating the machine in general;
FIG. 2 is a view on an enlarged scale illustrating one end of the machine;
FIG. 3 is a view in elevation illustrating a V-block mount;
FIG. 4 is a view in elevation illustrating the die head and lead-in in initial or retracted stroke position;
FIG. 5 illustrates one form of the work produced;
FIG. 6 is a view in elevation illustrating the lead-in and mount with relation to the fluted workpiece and looking in the direction of arrow 6 in FIG. 4; and
FIG. 7 is a view similar to FIG. 4 with parts omitted illustrating the start of the operation.

PREFERRED EMBODIMENT OF THE INVENTION

Referring to FIG. 1, there is shown a machine frame 10 of any desired description having a table 12. Work holders which may be of V form are indicated at 14, 14 mounted on the table and holding the work W out of the areas of operation which are here indicated at 16 and 18. In FIG. 1 the flutes are shown as well as the conventional small bevels or shoulders indicated at 20, 20 and the stop 22, 22 and then the glue is applied, just prior to insertion in the mortise, causing the wooden fibers to swell after insertion. These tenons (and dowels) are apt to be somewhat out of round and unequal in holding effect circumferentially of the mortise and under conditions of use and changes in humidity, still are apt to become loose.

There is provided at one end, at the left-hand end of the machine in FIG. 1, an adjustable workpiece stop member 22 which is fixed in correct position for the particular workpiece. There is a power operated stop or clamp 24 which moves oppositely to stop 22 and engages the opposite end of the work.

piece during the fluting. These stops are mounted in heads 26 and 28. The numerals 30 and 32 indicate die-holders or die heads which are moved in by power, e.g., fluid motors (cylinders) as at 34, which slide, for instance from the solid to the dotted line positions of the die heads, being fixed to rods 38 and 40. These rods are longitudinally adjustable for minimum and maximum turnings by relative rotation of nuts 42, 42 on framework 10.

The two die heads or either of them contains tools to be later described which move toward the center of the machine and flute the tenons at 16 and 18. These tenons are pre-turned and are impressed, not cut, as the dies corresponding to the fluting configurations move inwardly toward the center of the machine. The die heads are retracted automatically when the work is finished and have special means for insuring the making of the flutes substantially up to the bevel or shoulder 20, see FIG. 5, with only a very small gap between the inner ends of the flute and the bevel or shoulder.

There may be provided tracks or the like as at 58 mounting the cylinders and die heads on heavy carriages 44 for precise and smooth running of the die heads toward the center of the machine for the work stroke. Heavy wheels 48 with large bearings mount the carriages and a self-aligning joint generally indicated at 52 is provided between each of shafts 38 and 40 and their cylinders. The self-aligning joint relieves vertical and side loads or any tendency to misalignment between the cylinder rod bearings and the nut at 42. The power cylinders and carriages are very heavy to obtain precision of stroke; and 40 extremes of adjustment of rods 38 and 40 are apt to create too great a load on the cylinder rod bearings due to machining and assembly tolerances.

Referring now particularly to FIGS. 3 to 7 inclusive, there is here shown (FIG. 3) the tracks 58, vertical wheels 48, and the horizontal wheel 60 bearing against a vertical track 62, by which means it will be seen that the entire carriage including the die heads, etc., are very firmly guided. FIG. 3 also shows the range of adjustment of the V-blocks generally indicated at 14; the maximum adjustment thereof being indicated at 68 and the minimum adjustment at 70 showing the minimum and maximum turning diameters operated on. Each V-block is adjustable by reason of slots 72 and fastening means on the same to secure it as to a mounting bracket 74.

As well as being adjustable, the lead-ins 66 are spring-pressed in their mounting plates as by springs 78, 78, (FIG. 6) and the forward face thereof is beveled as at 80, see FIGS. 6 and 7, for a purpose to be described.

The fluting tool is indicated generally at 82 being held fixed in the die head referred to at 30 and 32 in FIG. 1. This tool is provided with a lead-in bevel 86 of short length and a series of small fluting teeth 88 arranged annularly, there being a different tool used for each diameter of tenon 90 which is to be processed.

The die head, as for instance in FIG. 7, is provided with an opening 92 for receiving the stop 24 abutting the end of the tenon. The die head carries with it both fluting die and the lead-in 66, the lead-in and mount being immediately in front of the tool 82 for the purpose of forming a very solid support as close to the fluting action as is possible and this together with the very heavy mounting of the die head carriage, etc., provides for an extremely accurate fluting action resulting in the most uniform product, see FIG. 5, as is possible to be manufactured.

The V-blocks 14 are placed in vertical adjustment so that the axes of tenons 90 are positioned slightly below the axis of the fluting tools 82.

Referring now to FIG. 4, a die head 32 is about to initiate its action. The operator has placed the work W on the V-blocks with the left end against fixed stop 22. The lead-in contacts the edge of the tenon body 90 on the V 80, FIG. 6, and this inclined surface causes a slight rise of the work from its V-blocks, precisely centering the tenons relative to the tools 82.

Then the stop rod 24 moves to the left to abut the right end of the work. Then the fluting tool immediately contacts the
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peripheral or forward edge of the tenon body and imparts the indentations shown in FIG. 5 thereto extremely evenly and accurately all about the entire circumference thereof.

Eventually the lead-in contacts the bevel or shoulder 20 and due to its spring mounting 78 is forced to descend into pocket 92 in the carriage to get completely out of the way of the tool 82 which therefore can travel for instance to the left in FIG. 7 until the bevel 86 coincides with the bevel or shoulder 20 at which time the action stops. It is to be noted that by this means not only is an accurate fluting achieved but the fact is that this fluting is accomplished as close to the bevel or shoulder or closer than has ever been possible with any other form of machine for accomplishing this purpose.

As soon as a reverse action occurs with respect to the die head, the lead-in 66 will return under influence of its springs out of pocket 92 to its normal position ready for the next motion stroke. The stop 24 retracts sufficiently for the operator to lift the workpiece out of the V-blocks 14, 14 and insert another one.

It is to be understood that both of the die heads 30 and 32 act simultaneously, but if only one end of the workpiece is to be fluted, then of course only one of these die heads is utilized.

The above described machine is accurate and versatile, fluting single or double ends rapidly and easily. The forward stroke recited above compresses the wood to form the flutes due in part to easy and smooth centering by means of the small, shallow lead-in die angle, and the retractive stroke, the die shaves, e.g., lessens the tenon diameter 0.002 inch – 0.004 inches because the die angle leading out is steeper, see 87 in FIG. 7. This retractive stroke also removes any possible "shine" caused by the forward compressive action. This shine is not desirable for gluing, and tends to appear on certain kinds of wood.

Because the tenon diameters are intentionally made 0.010 inch to 0.015 inch oversize to start with, and the tips of the flutes allow interference fits because these tips may further compress or flow into the valleys of the flutes, tight fits result even with varying hole or mortise tolerances.

Because of small varying tolerances which may be mechanical or caused by humidity, the completed and fluted tenons are able to be stored ahead waiting for assembly rather than the normal immediate "machine and assemble" technique. Also the glue flows more uniformly up the sides of the tenon as it will have many avenues for travel.

1. A fluting machine comprising a base, a table thereon, work holding means on the table, said work holding means being adapted to provide a rest for an elongated workpiece, a fixed stop for abutting one end of said workpiece, and a movable stop for abutting the opposite end thereof;
   a die head movable on said table, an annular compressor fluting die in the die head, flutes in the die, means to travel said die head with said fluting die to compress flutes in the adjacent end of said workpiece, and means for centering said workpiece with respect to said fluting die.

2. The fluting machine of claim 1 wherein the means for moving the die head comprises a fluid cylinder, a carriage mounting said fluid cylinder, said die head being mounted on said carriage, and including means for adjusting the position of the stroke of said carriage and die head.

3. The fluting machine of claim 1 wherein the means for moving the die head comprises a fluid cylinder, a carriage mounting said fluid cylinder, said die head being mounted on said carriage, and including means for adjusting the position of the stroke of said carriage and die head, said last-named means comprising a rod, means connecting the rod to the base, and means for adjusting said rod longitudinally, thereby adjusting the fluid cylinder, the carriage, and the die head.

4. The fluting machine of claim 1 wherein the means for traveling the die head comprises a fluid cylinder, a carriage mounting said fluid cylinder, said die head being mounted on said carriage, and including means for adjusting the position of the stroke of said carriage with die head thereon, said last-named means comprising a rod, means connecting the rod to the base, and means for adjusting said rod longitudinally, thereby adjusting the fluid cylinder, the carriage, and the die head.

5. The fluting machine of claim 1 wherein said work centering means comprises the lead-in on the die head, said lead-in including an inclined surface engaging and raising the workpiece slightly upon the stroke of the die head toward the workpiece.

6. The fluting machine of claim 1 wherein said work centering means comprises the lead-in on the die head, said lead-in including an inclined surface engaging and raising the workpiece slightly upon the stroke of the die head toward the workpiece, with a predetermined element of said workpiece whereby the lead-in accurately supports the work, but it is forced out of the way at a predetermined point to allow the compressor die to travel as close as possible to said predetermined element on the workpiece.

7. The fluting machine of claim 1 wherein said work centering means comprises a lead-in for the die which is vertically adjustable to contact, raise and center workpieces of different diameters.

8. The fluting machine of claim 1 wherein said workpiece includes a tenon, a shoulder at the base of the tenon, and said work centering means comprises a V-shaped member having a forward inclined surface facing the tenon, said inclined surface being adapted to engage the tenon at its extreme end and raise it slightly to align the same with the axis of the compressor fluting die.

9. The fluting machine of claim 1 wherein said workpiece includes a tenon, a shoulder at the base of the tenon, and said work centering means comprises a V-shaped member having a forward inclined surface facing the tenon said inclined surface being adapted to engage the tenon at its extreme end and raise it slightly to align the same with the axis of the compressor fluting die, the inclined surface on the lead-in being adapted to contact said shoulder, thereby moving the lead-in out of the way of the path of travel of the die.

10. The fluting machine of claim 1 wherein said work centering means comprises a vertically adjustable lead-in having a V contour and a forward beveled face for contact with the end of the work to raise the same, and a spring yieldingly maintaining said lead-in in its raised position for a major portion of the stroke of the die head.

11. The fluting machine of claim 1 wherein the means to travel the die head comprises a fluid cylinder, a carriage mounting said cylinder and said die head, a piston rod extending from said cylinder, a self-aligning joint on said piston rod, said rod being threaded, and a nut therefor for adjustment of the position of the entire die head carriage and cylinder.

12. The fluting machine of claim 1 including a carriage mounting the die head, said carriage being mounted on tracks under said table, wheels on said carriage having bearings therein for running along the tracks, the cylinder being mounted on the carriage and depending therefrom between said tracks.

13. The fluting machine of claim 1 wherein the die has a bevel in advance of the flutes therein.

14. The fluting machine of claim 1 wherein the die has bevels both in advance of the flutes and to the rear thereof.

15. The fluting machine of claim 1 wherein the die has bevels both in advance of the flutes and to the rear thereof, the bevel to the rear of the flutes being at a more acute angle relative to the axis of the die and of the workpiece than is the bevel in advance of the flutes.

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