Feb. 1, 1938. J. E. BOICE 2,107,174

JIGSAW

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Fig. 1

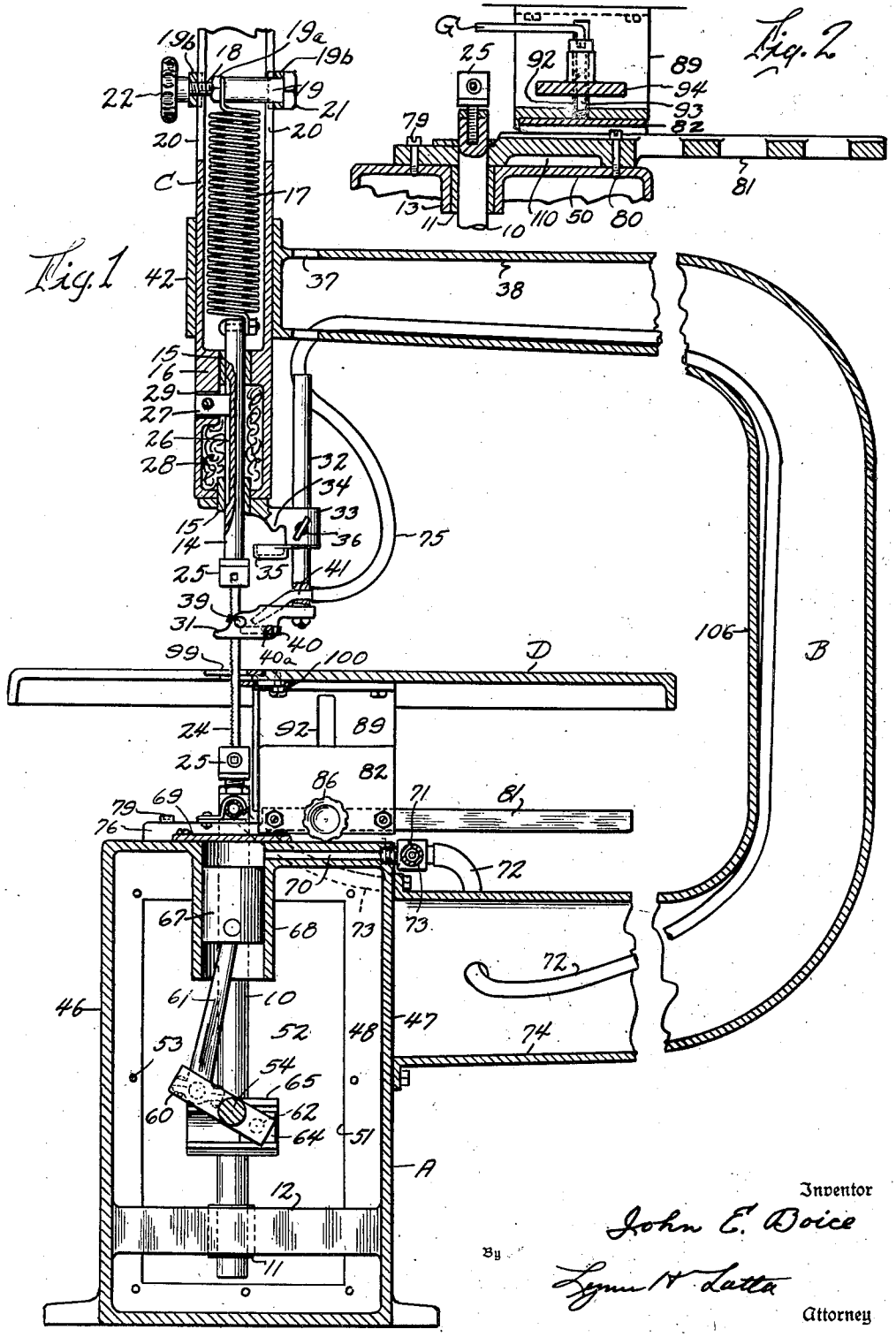

Fig. 2

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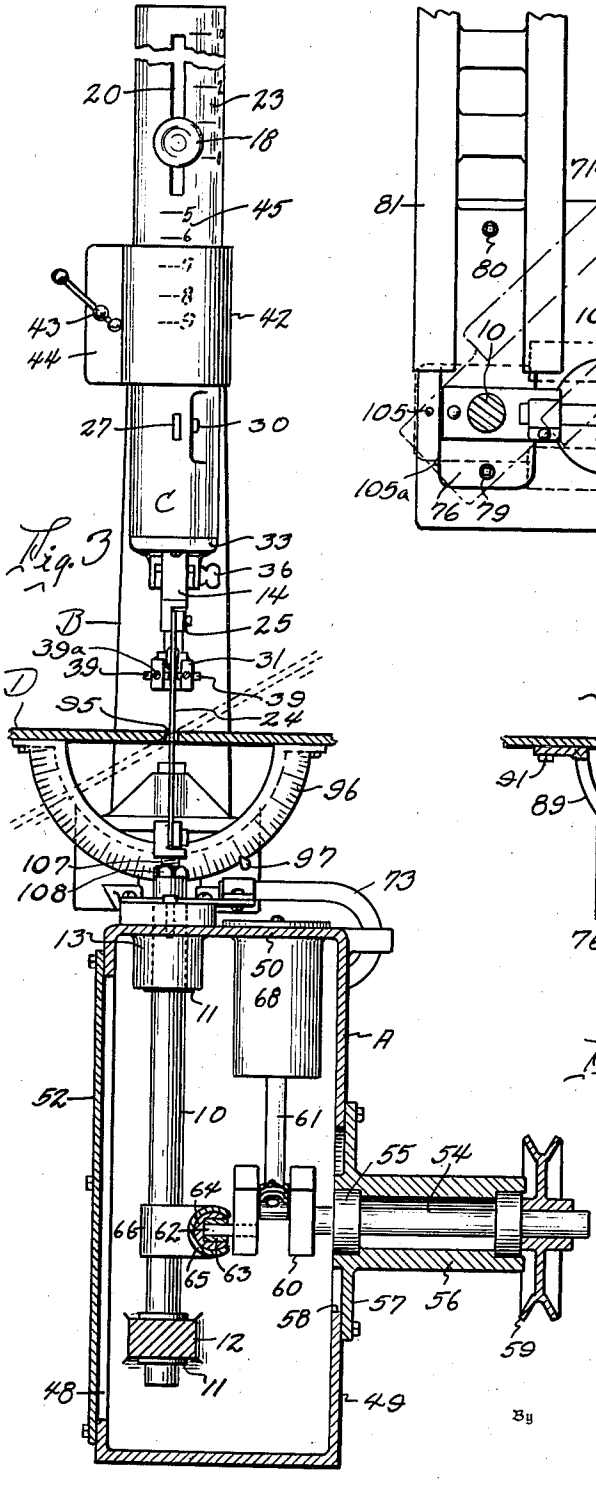

Fig. 3

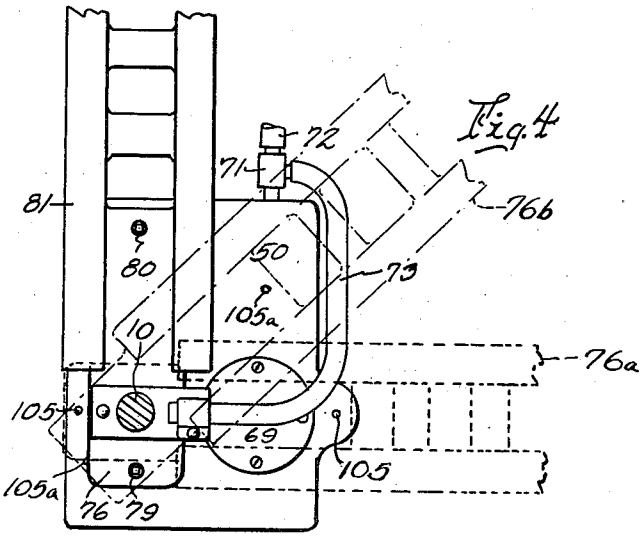

Fig. 4

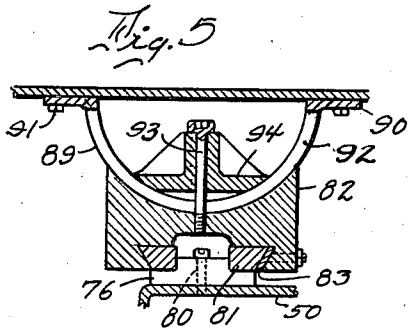

Fig. 5

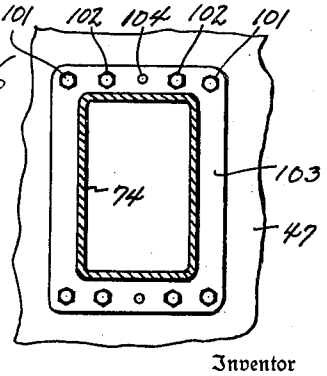

Fig. 6

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2,107,174

JIGSAW

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Application January 17, 1934, Serial No. 706,948

6 Claims. (Cl. 143—73)

This invention relates to jig saws, and has for its object to provide a saw of greater smoothness in operation than has hitherto been achieved in jig saws, and of greater adaptability to various conditions of working requirements.

One feature of the invention is the arrangement of a blower piston to serve both as a means to produce air jets for removing sawdust from the work and from the working parts of the machine, and as a means for counterbalancing the crankshaft to counteract vibration.

The invention further aims to provide a work table mounting which provides for tilting of the table around an axis that is transverse to the vertical plane of the saw frame, and which also provides for tilting the table around an axis that is parallel to said plane.

The invention has as another object to provide a frame mounting that will never twist the frame so as to cause misalignment of the saw plungers, no matter how uneven may be the surface to which it is affixed. In this connection, the invention relates particularly to bench type saws.

A further object is to provide for adjustment of the plungers so that the saw may operate either in a plane parallel to the plane of the saw frame, or in a plane perpendicular thereto. It is also aimed, in this connection to provide for shifting the table to correspond to such shifting of the plungers, or to merely shift the saw guide without shifting the table, so that the saw may be operated either parallel to or transversely to the medial line of the table.

Another object is to provide for adjusting the height of the upper plunger head without interfering with the tension of the upper plunger spring, and also for adjusting the tension of the spring independently of the position of the head. The invention also contemplates a novel plunger spring construction and arrangement in which the tension of the spring will not materially vary from one end to the other of the plunger stroke.

A further object is to eliminate the common difficulty of oil from the head bearings finding its way to the work and spoiling the same.

The invention further contemplates an anti-twist bearing for the upper plunger which is embodied in a sealed lubricant containing chamber so that its efficiency in preventing blade twisting may endure unimpaired during long life of the machine.

Another object of the invention is to provide an arrangement whereby the lower blade chuck may be fully exposed for blade changing so as to facilitate correct insertion of blades.

Other objects will appear in the ensuing specification, referring particularly to the drawings, in which:

Fig. 1 is a vertical sectional view showing a jig saw constructed according to the invention,

Fig. 2 is a longitudinal sectional view through the table mounting,

Fig. 3 is a transverse sectional view of the machine,

Fig. 4 is a plan view of the table mounting,

Fig. 5 is a transverse vertical sectional view of the same, and

Fig. 6 is a sectional view through the lower arm of the frame, illustrating the connection of the frame to the leg.

The saw comprises generally a leg A, which also serves as a housing for the operating mechanism, a frame B, an adjustable upper plunger head C, and a work table D.

The lower plunger 10 is slidingly mounted in bearing bushings 11 in the lower and upper bearings 12 and 13 respectively, cast integrally in the leg A. The upper plunger 14 is slidingly mounted in bearing bushings 15 mounted in the lower end and in the partition 15 respectively of the head C. A coil spring 17 is attached at its lower end to the upper end of the plunger 14, and its upper end is attached to a tie link comprising a bolt 19 having a reduced threaded portion 18 on which is threaded a hand nut 22. The bolt 19 is extended through and slides vertically in slots 20 in the head C, and the nut 22 and head 21 of the bolt 19, engage the opposite sides of the head C. A lock nut 19a secures the end of the spring against the shoulder formed between the body and the reduced threaded portion of the bolt 19. The engagement of the nut 22 and head 21 against the head C is through the medium of washers 19b the engaging faces of which are curved to fit the curvature of the head C. The washer adjacent the head 21 is snugly enough fitted to the bolt 19 so as to hold the latter against rotation. Tightening the nut 22 causes the link to grip the head C so as to hold the link in any of the various positions of adjustment of the spring 17. Positions of adjustment are indicated on a scale 23 on the outer face of the head C.

The blade 24 is secured in chucks 25 on the ends of the respective plungers, and serves to transfer the downward movement of the lower plunger to the upper plunger, being the sole means of doing so. Such movement is opposed

by the spring 17, which determines the tension in the blade according to the position of the tension adjusting link relative to the scale 23. The spring 17 also serves to raise the upper plunger and to thereby draw the blade smoothly upwardly through the work on the return stroke.

The spring 17 is characterized by large diameter and large number of turns, whereby its total capacity for stretching is about ten times the amount of stretch actually required. As a result, the tension of the spring will remain uniform from one end of the stroke to the other.

The upper plunger 14 has a keyway 26 which receives a key 27 mounted in the head C in the chamber formed between the partition 16 and the lower end of the head. This chamber is packed with a fibrous material 28 which is saturated with lubricant to lubricate the keyway and the bushings 15. The key extends through a slot 29 in the head C, and is secured by a set screw 30, loosening of which allows the removal of the key, which in turn allows lubricant to be inserted through the slot 29.

The upper blade guide and presser foot 31 is carried by a spindle 32 which in turn is mounted for vertical adjustment in a bracket 33 secured to the lower end of the head C. The bracket 33 has an inclined lower face terminating in a drip teat 34 from which all oil escaping through the lower bushing 15 will drip into a drip reservoir 35, so that none of it may reach the work.

Vertical adjustment of the spindle 32 relative to the head C is accomplished by loosening the set screw 36 which is threaded through the bracket 33 to engage the spindle, and sliding the spindle in the bracket. The upper part of the spindle may pass upwardly through openings 37 in the upper arm 38 of the frame B, when necessary.

The guide foot 31 carries two guide pins 39, one of which is slidably mounted in either side of the foot, and is held by a set screw 39*a*. The pins 39 form between their adjacent ends an adjustable slot in which the blade reciprocates. The pins provide bearing surface for the sides of the blade to oppose lateral weaving of the blade. A third pin 40, similarly mounted in the back of the foot, and held by a set screw 40*a*, engages the rear edge of the blade to form a back bearing. A blower nozzle 41 projects through the lower region of the spindle 32 and extends into the shoe, its discharge end directed at the region where the saw passes through the shoe.

The head C is mounted for vertical sliding adjustment in a split sleeve bearing 42 formed on the end of the upper arm 38. A clamping screw 43 connects the ears 44 of the bearing so as to apply constricting pressure to the bearing, whereby the head C may be supported by frictional engagement. A scale 45 on the face of the head C cooperates with the upper edge of the bearing to determine the position of vertical adjustment of the head. The object of thus adjusting the head is to vary the gap between the head and the table to accommodate blades of different lengths, and to maintain the tension factor, as determined by the position of adjustment of the tension adjusting link constant for all positions of adjustment of the head, i. e. for all blade lengths. In other words, the head adjustment compensates for the added elongation of the spring which would otherwise be caused by the shortening of the distance between the chucks 25 by insertion of a shorter blade, by bringing the upper end of the spring nearer to the lower chuck by the same amount that the upper chuck has been forced to approach by the shortening of the blade.

The leg A is in the form of a closed hollow casting having side walls 46 and 47, front and rear walls 48 and 49, and a top wall 50. The side wall 48 has an opening 51 which is closed by a cover plate 52 removably secured by screws 53. The bearing is in the form of a strut integrally connecting the end walls 46 and 47, and the bearing 13 is cast integrally with the top wall 50. A crankshaft 54 is journalled in bearings 55 in a bearing hub 56 having a flange 57 by means of which it is secured over the opening 58 in the side wall 49, through which opening 58 the crankshaft may be removed from the leg A. A pulley 59, through which the saw is driven, is secured to the other end of the shaft.

On the inner end of the shaft 55 is a crank 60, to one throw of which is journalled the pitman 61, and to the other throw of which is connected the lower plunger 10. The latter throw is comprised in a pin 62, which is received in a bushing 63 mounted in a slide block 64 which in turn is slidingly mounted in a slideway 65 formed in one side of a collar 66 secured on the plunger 10. As the crankshaft is rotated, the block will reciprocate in the slideway 65 while carrying it up and down to give the plunger 10 its reciprocatory motion.

To the upper end of the pitman 61 is connected a piston 67, which travels in a cylinder 68 formed on the top wall 50. The upper end of the cylinder is closed by a cap plate 69. A passage 70, formed in the top wall 50, extends from the upper end of the cylinder 68 to the end wall 47, where a nipple 71 is tapped into it. The nipple 71 has two outlet connections, to which are connected, respectively, the tubes 72 and 73. The tube 72 extends into the lower arm 74 of the frame B and thence extends inside the frame to the end of the upper arm 38, from which it issues to connect with the nozzle 41, leaving a free flexible portion 75 exterior of the frame, which may bow to allow the spindle 32 to be adjusted vertically. The tube 73 extends to the upper end of the lower plunger 10, and is held in position with its discharge end directed toward the region where the lower spindle emerges through the table mounting bracket 76, by a plate 7 secured to upper face of said bracket 76, and a clip 78 secured to the plate 77 and holding the end of the tube against the plate.

The eccentricity of the pin 62 is so related to that of the other throw that the moment of inertia of the plunger assembly is balanced by the moment of inertia of the piston 67, while the resistance of the spring 17 is balanced by the resistance of the air cushion above the piston 67. In this connection, it may be stated that it has been in the past the practice to attempt to balance the entire system including spring tension by the counterbalancing of the crankshaft. These attempts have not been highly successful owing to the inherent impossibility of balancing a constant pull against a rotating and reciprocating organization in which the moment of inertia is constantly changing.

I approach much nearer to a perfect balancing effect by opposing the spring tension (which is resilient) to the air cushion, which is also resilient, and which maintains approximately an even resistance similar to the uniform resistance

of the spring, by virtue of the fact that the air escapes through the passage 70.

The leg A is filled with lubricating oil to a height sufficient for the crankshaft and pitman to raise oil by the splash system for lubricating all moving parts inside the leg.

The table mounting comprises the bracket 76, secured to the top wall 50 of the leg by means of cap screws 79 and 80. It is formed with spaced slideways 81, together dovetailed in cross-section, and received in a dovetailed shaped groove in the base of the table carriage 82. A friction block 83 (Fig. 5) carries the pressure of the handscrew 86 (Fig. 1) to the slideway on one side of the assembly, for locking the carriage in any desired position on the slideway. A pair of set screws 87, locked by lock nuts 88, provide a constant frictional engagement allowing the carriage to be slid when the handscrew is loosened, but opposing too free sliding.

The upper region of the carriage is formed with a semi-cylindrical saddle in which is received the trunnion member 89 which carries the table D. The trunnion member is in the form of a semi-cylindrical inverted arch on the ends of which are the flanges 90 which are attached to the underside of the table by cap screws 91. Through a slot 92 in the trunnion member extends a clamp screw 93, the lower end of which is threaded into the carriage 82 and the upper end of which is extended through a clamping jaw 94. The ends of the jaw 94 are shaped to engage the inner surface of the trunnion member 89. A wrench socket in the head of the screw 93 receives the wrench G whereby the screw may be tightened until its head brings pressure against the jaw 94 to lock the trunnion member against movement relative to the carriage.

The trunnion, in moving relative to the carriage, is restrained against lateral movement by engagement of the sides of the slot 92 with the clamp screw 93, and thus simply rotates about the axis of the cylindrical bearing surface of the carriage, which axis is located in the plane of the table D, coincidental with the median slot 95 thereof. Thus the saw blade 24, which passes through the slot 95, may be free of contact with the edges of the slot, in any of the tilted positions of the table.

A scale 96 formed on one edge of the trunnion member 89, cooperates with the pointer 97 affixed to the carriage 82, to determine the angular inclination of the table.

The carriage, in travelling on the slideways 81 toward the column 98 of the frame B, carries the table D toward a position where the chuck 25 of the lower spindle is easily accessible for blade changing. If desired, the table may be moved sufficiently rearwardly to completely release the blade from the slot 95. This greatly facilitates the correct aligning of blades.

Where the blade passes through the table D, there is a soft metal insert 99, having a slot forming a continuation of the slot 95 when in normal position. The insert 99 is in the form of a circular disc, loosely supported in a correspondingly shaped depression in the table, so that it may be rotated to allow the saw blade to be operated in a position in a plane at right angles to its normal plane of operation relative to the table D.

The entire table may be shifted, relative to the leg A, to a position at right angles to its normal position shown in full lines in the drawings, or to a position intermediate said normal and right angle positions, such as, for instance, a position wherein the slot 95 extends at an angle of 45 degrees to its normal position. The latter position is one in which boards of common width, i. e., up to 12 inches in width, may be either ripped or cross-cut without any interference from the back column 106. The right angle position allows ripping of exceptionally wide boards. The blade may be adjusted to operate in either position by rotatably adjusting the upper head C, the lower chuck 25, and the insert 99, around the spindle axis. To allow such adjustment of the lower chuck, it is provided with a threaded stem 107 which is threaded into the upper end of the spindle 10 and locked by a lock nut 108.

Shifting of the table D around the spindle axis is provided for by removably securing the bracket 76 to the leg A by means of cap screws 79 and 80, threaded into either the holes 105, 105, the holes 105*a*, 105*a*, or the holes, not shown, in which they secure the bracket in its normal position shown in full lines. The position of the bracket in the right angle position of the table is shown in dotted lines at 76*a* in Fig. 4, and the position of the bracket in the 45 degree position of the table, is shown in broken lines at 76*b* in Fig. 4. The arched region 110 in the bracket 76 (Fig. 2) accommodates the cap plate 69.

From the position shown in Figs. 1 and 2, the table D may be tilted around the axis of the trunnion member 89, so that boards may be cross-cut on a bevel. By tilting the table around the axis of the slot 95 when the table has been adjusted to its secondary position at right angles to normal position, boards may be ripped on a bevel.

A back guide 100, adjustably secured to the under side of the table D by means of a cap screw 111 passing through a slot 112 with which it is provided, provides a bearing for the rear edge of the blade 24. If desired, the guide 100 may be adjusted into proper contact or proximity to the rear edge of the saw blade by simply adjusting the table D on the slideways 81.

The frame B is adjustably secured to the leg A by means of cap screws 101 and set screws 102, the former extended through the flange 103 of the frame arm 74 and threaded into the leg, and the latter threaded through the flange 103 and bearing against the leg. After proper alignment has been secured, the correct relative positions of the leg and frame are fixed by drilling through the flange and leg and inserting taper pins 104.

I claim as my invention:

1. In a jig saw, a tubular upper spindle head, provided with diametrically opposed lineal slots, a spindle slidable axially in the lower end of said head, a spring contained within said head and attached at its lower end to the upper end of said spindle, and means connecting the upper end of said spring to the head, comprising a stud extending transversely through said slots and through said head, a head on one end of said stud, engaging one side of said spindle head, and a nut threaded on the other end of said stud and engaging the other side of said spindle head, the spring being hooked over said stud.

2. In a jig saw, a tubular upper spindle head, provided with an internal transversely extending member intermediate its ends, a spindle slidably journalled in said member and in the lower end of the head, said spindle having a longitudinal keyway, a key projecting into the chamber formed between said member and the lower end of the head and engaged in said keyway to prevent rotation of a spindle, lubricating means in said chamber, and a coil spring in the head above

said member, connected to the spindle and to the head.

3. In a jig saw, a tubular upper spindle head, provided with diametrically opposed lineal slots, a spindle slidable axially in the lower end of said head, a spring contained within said head and attached at its lower end to the upper end of said spindle, and means connecting the upper end of said spring with the head, comprising two members threadedly connected together and extending transversely through said slots, each of said members having a portion engaging a respective side of the head, the spring being hooked over a portion of said means lying within the head.

4. In a jig saw, a tubular upper spindle head, a spindle slidably and non-rotatably mounted therein, resilient means in the head for moving the spindle upwardly, a saw guide foot carried by the head, and a frame including means in which said head is secured for vertical adjustment to allow said spindle to be connected to saw blades of various lengths, and for rotatable adjustment around its axis, said head, spindle and guide foot being adjustable as a single unit both vertically and rotatably.

5. In a jig saw, a tubular upper spindle head, provided with diametrically opposed lineal slots, a spindle slidable axially in the lower end of said head, a spring contained within the head and attached at its lower end to the upper end of said spindle, and means connecting the upper end of said spring with the head, comprising two members extending transversely through said slots and connected together, each of said members having a portion engaging a respective side of the head, said members adapted to clamp the head between them, the spring being hooked over a portion of said means lying within the head.

6. In a jig saw, a tubular upper spindle head, the upper region of which has a longitudinal slot, a frame including a sleeve in which the region below said slotted region is slidably mounted, means on said sleeve to exert clamping pressure against said latter region, the latter region being provided with a scale coacting with said sleeve to indicate positions of vertical adjustment of said head to accommodate saw blades of varying length, a spindle slidably mounted in the lower region of the head, a coil spring in the upper region of the head, its lower end attached to the upper end of the spindle, means projecting through said slot into the head and there attached to the upper end of said spring, said means including a clamping device for engaging the wall of the head to lock said means in various positions of adjustment wherein the tension of said spring is varied, and indicia on the upper region of the head, cooperating with said means to indicate the degree of tension.

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