ABSTRACT

A chain saw is provided having means for more effectively damping or reducing shocks and vibrations transmitted between the chain saw body and the operator than means heretofore proposed for this purpose. The chain saw has two separate handles, one near the front and one near the rear, and lying in generally mutually perpendicular planes. Each handle has shock-absorbing means connecting end portions thereof to the body of the chain saw. Each shock-absorbing means at each location is specifically designed to provide maximum shock-absorbing characteristics for that position. In one embodiment, the front handle with the shock-absorbing means is readily adapted for mounting on existing chain saws.

17 Claims, 15 Drawing Figures
CHAIN SAW WITH DAMPING MEANS

This is a continuation-in-part of our co-pending application Ser. No. 88,886 filed Nov. 12, 1970, now abandoned.

This invention relates to a chain saw with means for damping shocks and vibration between the chain saw body and the operator.

Chain saws equipped with high-torque, high-speed engines have a tendency to produce a certain amount of vibration during operation. Such saws with various anti-vibration designs have been heretofore proposed. In these chain saws, the damping means employed have tended to increase the cost of the chain saw excessively or to require excessive design changes to embody the damping means. Such saws also have not been as effective in damping or absorbing shocks and vibrations as is desirable.

The present invention provides an improved chain saw having spaced, separate handles, one near the front of the chain saw body and one at the rear. Each of the handles has shock-absorbing or damping means at end portions thereof, with each such means being specifically designed to provide maximum damping effectiveness in that particular location. Consequently, operator fatigue is reduced and productivity is increased.

For the front handle, the upper shock-absorbing means for the upper end of the handle is positioned at an angle to the vertical and preferably generally perpendicular to the general direction in which the operator's arm extends back and away from the front handle. This places the resilient shock-absorbing elements of the damping means in shear. The lower shock-absorbing means for the lower end portion of the front handle enables limited pivotal movement of the front handle relative to the chain saw body, with the shock-absorbing elements placed in torsion. In one embodiment, the shock-absorbing means and the front handle are particularly suitable for replacing conventional front handles of existing chain saws.

For the back handle, both upper and lower shock-absorbing means connecting the handle to the chain saw body extend generally perpendicularly to the longitudinal extent of the chain saw and to the operator's arm, with the shock-absorbing means placed in shear. The damping characteristics of this overall design exceed those of damping means of chain saws heretofore known. The new shock-absorbing provisions also are relatively inexpensive and require minimum design changes in the basic chain saw body.

It is, therefore, a principal object of the invention to provide a chain saw with improved damping means for minimizing transmission of chain saw shocks and vibrations to the operator during operation of the chain saw.

Another object of the invention is to provide a chain saw having shock-absorbing means which are inexpensive and require minimum modifications to the basic chain saw design.

A further object of the invention is to provide a chain saw front handle with shock-absorbing means which can be mounted on an existing chain saw in place of the conventional handle with minimum changes.

Other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a somewhat schematic view in perspective of a chain saw embodying the invention;

FIG. 2 is a somewhat schematic front view in elevation of the chain saw of FIG. 1, with the saw chain and guide bar removed;

FIG. 3 is a somewhat schematic side view in elevation of a rear portion of the chain saw of FIG. 1;

FIG. 4 is an enlarged view in central, longitudinal cross section of one shock-absorbing means or connection employed with the front chain saw handle;

FIG. 5 is a view in transverse cross section taken along the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary front view of another shock-absorbing means or connection for the front chain saw handle, with parts broken away and with parts in cross section;

FIG. 7 is a view in transverse cross section taken along the line 7—7 of FIG. 6;

FIG. 8 is a left-end view in elevation of the means of FIG. 6;

FIG. 9 is a fragmentary view in generally horizontal cross section, of upper shock-absorbing means for the rear handle of the chain saw;

FIG. 10 is a fragmentary view in generally horizontal cross section of lower shock-absorbing means for the rear handle of the chain saw;

FIG. 11 is a schematic view in perspective of a chain saw, indicated in dotted lines, with a modified front handle having vibration- or shock-absorbing means;

FIG. 12 is a front view of the handle of FIG. 11, along with the chain saw shown in solid lines;

FIG. 13 is an enlarged view in perspective, with parts broken away and with parts in cross section, of an upper shock-absorbing means or connection employed with the front chain saw handle of FIGS. 11 and 12;

FIG. 14 is a view in perspective of a lower shock-absorbing means or connection for the front chain saw handle; and

FIG. 15 is a view in transverse cross section taken along the line 15—15 of FIG. 14.

Referring to FIG. 1, a chain saw embodying the invention is shown somewhat schematically at 10 and includes a chain saw body 12, a chain saw bar 14, and a saw chain 16. The chain saw 10 is of a known design and includes an engine at an intermediate location in the body 12 having a crankshaft connected to a drive shaft and extending outwardly to a sprocket (not shown) which drives the saw chain, the sprocket being under a guard 18. A muffler 20 is located at the rear of the guard and a carburetor is located in an upper housing 22 having a cover 24.

A front handle 26 of generally C-shaped configuration is located at a forward portion of the chain saw body 12 in front of the chain saw engine. A separate rear handle 28 extends rearwardly from the chain saw body 12 and is located behind the engine of the chain saw. Both of these handles are of generally known shapes or designs and embody the invention without requiring any radical changes. Both handles incorporate shock- or vibration-absorbing means which dampen a substantial portion of the shock and vibration to which the chain saw body 12 is subjected. Consequently, little of such shock and vibration is transmitted to the chain saw operator who conventionally stands generally to the rear of the chain saw, holding the front handle 26 with one hand and the rear handle 28 with the other hand, controlling the chain saw speed and operation through a trigger control 30. Other con-
ventional controls for the saw, well known in the art, are not shown.

Referring particularly to FIG. 2, the front handle 26 includes a lower, generally horizontally extending leg 32, an intermediate, generally vertically extending leg 34, an upper leg 36, and a slanted portion 38. A tubular, resilient handle grip 40 is located on the upper leg 36 with this grip providing an additional cushioning effect for the operator. First shock-absorbing means indicated at 42 connects the upper end of the handle 26 with the chain saw body 12. Accordingly, an L-shaped arm 44 is suitably affixed, as by welding, to the end of the upper leg 36 and has a bracket 46 (FIGS. 4 and 5) connected to a lower portion thereof. The bracket 46 includes an intermediate web 48 and end flanges 50 and 52. These have arcuately shaped edges to receive a hollow or tubular member 54 which can be assembled as part of the bracket 46 and the arm 44 by a threaded fastener 56 (FIG. 5) extending through a hole 58 in the tubular member 54, a hole 60 in the bracket web 48, and a tapped opening 62 in the arm 44. Access to the fastener 56 is provided through a larger opening 64 in the tubular member 54.

At the ends of the hollow tubular member 54 are two resilient shock-absorbing elements or mounts 66 and 68. These have metal plates at the inner ends forming cylindrical extensions 70 and 72 extending into the ends of the tubular member 54. Metal end plates 74 and 76 at the outer ends of the elements 66 and 68 form central passages 78 and 80 through which a long bolt or threaded fastener 82 extends. This fastener 82 has a threaded end 84 received in a tapped opening 86 of a mounting bracket 88, which is suitably affixed to a portion of the chain saw body 12. A sleeve 90 extends around the bolt 82 and limits the extent to which the resilient elements 66 and 68 can be compressed by the tightening of the fastener 82. Excess tightening otherwise could reduce the shock-absorbing characteristics of the elements 66 and 68.

The tubular member 54 and the upper leg 36 of the handle 26 are isolated from the chain saw body 12 through the shock-absorbing elements 66 and 68. The longitudinal extent of the shock-absorbing means 42 is located generally perpendicular to the arm of the operator which extends rearwardly and upwardly from the front handle grip 40. With this position, the shock-absorbing elements 66 and 68 are placed more in shear and are more effective in reducing or damping shocks and vibrations from the chain saw body.

The lower end of the handle 26, and specifically the lower leg 32 thereof, is connected to the chain saw body by shock-absorbing means generally indicated at 92. This includes a resilient shock-absorbing element or bushing 94 having a cylindrical portion 96 slightly larger than the inner diameter of the handle leg 32, with a flange 98 extending transversely beyond the outer diameter of the leg 32. The bushing 94 also has a central passage 100 in which is received a supporting rod or member 102 having a circular flange 104 affixed thereto and backing up the bushing flange 98. The member 102 is affixed to a bracket 106 (see also FIG. 8) which flares upwardly and outwardly, and is attached to the chain saw body 12 by fasteners 108.

The shock-absorbing means 92 further includes at least one threaded fastener or machine screw 110 in the leg 32 in spaced relationship from the bushing 94. The fastener 110 extends through a passage 112 in a metal cylinder or rod 114. A first resilient pad 116 is located between the cylinder 114 and the inner surface of the leg 32, and a second resilient pad 118 is located between the outer surface of the leg 32 and an arcuate recess 120 of the chain saw body 12. A sleeve or collar 121 extends between the recess 120 and the cylinder 114 to limit the maximum compression of the pads 116 and 118. An opening 122 in the leg 32 through which the fastener 110 extends is larger than the collar 121 to enable the leg 32 to pivot somewhat relative to the fastener 110. A large opening 124 is located in the exposed portion of the leg 32 for access to the fastener. The fastener 110 is primarily used to prevent transverse movement of the front handle 26 and the lower leg 32 thereof which cannot be easily prevented solely by the rubber bushing 94. The resilient pads 116 and 118 also tend to dampen the pivotal movement of the lower leg 32 along with the rubber bushing 94 which is placed in torsion during pivotal movement of the leg 32.

This design of the shock-absorbing means 92 thus enables the overall front handle 26 to pivot to a limited extent relative to the chain saw body 12. Actually, the chain saw body 12 can pivot relative to the handle 26 when the upper leg 36 is held substantially stationary by the operator. Consequently, the chain saw body 12 can move to a limited extent under the influence of vibration or shock while the upper leg 36 and the operator's hand and arm remain substantially stationary.

An upper end 126 of the rear handle 28 is connected to a rear portion, specifically the carburetor housing 22 of the chain saw body 12, by shock-absorbing means 128. The shock-absorbing means 128 includes a yoke 130 terminating in forwardly extending, spaced arms 132 and 134. Shock-absorbing elements or mounts 136 and 138 extend inwardly from the arms 132 and 134 and have metal end plates 140 and 142 with threaded passages 144 and 146. Threaded fasteners 148 and 150 extend through openings 152 and 154 of the arms and are threadedly engaged in the passages 144 and 146 to hold the elements securely in place. The inner ends of the elements 136 and 138 have metal plates forming cylindrical extensions 156 and 158 which are received in recesses 160 and 162 in the chain saw body 12 and specifically in the side walls of the housing 22. The cylindrical extensions 156 and 158 are telescopeically received in the recesses 160 and 162 with no fasteners therebetween.

With the shock-absorbing means 128, the elements 136 and 138 are placed in shear and provide utmost effectiveness in minimizing transmission of shock and vibration from the body 12 through the yoke 130 and the handle 28 to the hand and arm of the operator. Further, effective control of the chain saw body through the handle 28 is retained by the operator, even with the resilient nature of the elements 136 and 138, because of their wide spacing achieved through the use of the wide yoke 130.

A lower end 164 of the rear handle 28 is connected to the chain saw body 12 through fourth shock-absorbing means 166. This means includes a narrow yoke 168 integrally connected to the handle end 164 and having forwardly extending arms 170 and 172. Resilient
shock-absorbing elements or mounts 174 and 176 have outer metal end plates 178 and 180 with passages 182 and 184 therein. A long fastener or through-bolt 186 extends through the passages 182 and 184 and through yoke arm openings 188 and 190 with a nut 192 located on the end of the bolt 186. The inner ends of the elements 174 and 176 have metal plates forming cylindrical extensions 194 and 196 which extend into an opening or cylindrical passage 198 formed in a lug 200 extending rearwardly from the body 12. The fastener 186 also passes through the leg opening 198 and holds the elements 174 and 176 securely in place relative to the lug 200. However, the extent to which the elements 174 and 176 can be compressed is limited by the rigid yoke arms 170 and 172.

The shock-absorbing elements 174 and 176 are placed in shear, as are the elements 136 and 138. Again, maximum damping effectiveness of this mount is achieved with this design.

Referring to FIG. 11, a chain saw 202 indicated in dotted lines includes a chain saw body 204 having a modified front handle 206 shown in solid lines. The chain saw 202 otherwise can be similar to that shown in FIG. 1. The front handle 206 has an upper vibration-or shock-absorbing means which is less expensive, and a lower vibration- or shock-absorbing means which is more readily adapted for use with an existing chain saw than those used with the front handle 26.

The front handle 206, as shown in FIG. 12, includes a lower leg 208, an intermediate, generally vertically extending leg 210, an upper leg 212, and a slanted portion 214. A thick resilient handle grip 216 is located on the upper leg, with this grip providing additional damping means for the operator. An upper shock-absorbing means or connection 218 connects the upper leg 212 of the handle 206 with the chain saw body 204 and a lower shock-absorbing means or connection indicated at 220 connects the lower leg 208 of the handle 206 to the chain saw body 204.

Referring more particularly to the details of the first shock-absorbing means 218, as shown in FIG. 13, a generally L-shaped arm 222 is suitably affixed to the end of the upper leg 212 and terminates in a bracket comprising upper and lower flanges 224 and 226 and an intermediate integral web 228. The flanges 224 and 226 have circular openings 230 and 232 which receive two resilient shock-absorbing elements or mounts 234 and 236. These are substantially identical, having metal plates 238 and 240 at the inner ends terminating in cylindrical extensions 242 and 244 which are received in the circular openings 230 and 232. The mounts also have circular metal end plates 246 and 248 at the outer ends with a long bolt or threaded fastener 250 extending therebetween. The fastener has a threaded lower end 252 received in a tapped opening of a mounting bracket 254 which is affixed to the chain saw body 204 by screws extending through suitable openings 256. A sleeve 248 is located around the bolt 250 and limits the extent to which the elements 234 and 236 can be compressed by the tightening of the fastener.

The bracket flanges 224 and 226 are isolated from the chain saw body 204 through the shock-absorbing elements 234 and 236. As with the shock-absorbing means 42, the longitudinal extent of the shock-absorbing means 218 is located generally perpendicular to the arm of the operator which extends rearwardly and upwardly from the grip 216. Consequently, the shock-absorbing elements 234 and 236 are placed principally in shear and are more effective in reducing or damping shocks and vibrations from the chain saw body. The shock-absorbing means 218 is also less expensive to make than the shock-absorbing means 42 because the bracket between the resilient elements 234 and 236 can be made in one stamped piece.

The shock-absorbing means 218 can be readily mounted on an existing chain saw body by removing the post extending up from the body at the position where the bracket 254 would be and then tapping two holes in the body for screws to mount the bracket 254 through the holes 256.

A lower portion of the handle 206, and specifically the lower leg 208, is connected to the chain saw body 204 by the shock-absorbing means 220. This includes a flange 258 affixed to the end of the lower leg 208 and extending transversely thereof, terminating in two spaced ears 260 and 262. Two resilient shock-absorbing elements or mounts 264 and 266, which are identical, are affixed to the ears 260 and 262. The elements 264, shown in section in FIG. 15, has a pair of end plates 268 and 270 affixed thereto, with threaded studs or shanks 272 and 274 extending outwardly therefrom. These can be affixed to the plates 268 and 270 by end welding, for example. The shock elements 264 and 266 are fastened to the ears 260 and 262 by nuts 276 threadedly received on the studs 272.

The opposite ends of the elements 264 and 266 are affixed by nuts 278 on the studs 274 to a second flange 280 and specifically ears 282 and 284 thereof. The flanges 258 and 280 are parallel and are maintained in spaced relationship by the elements 264 and 266, there being no metal contact at all between the flanges. The second flange 280 is affixed, as by welding, to an end of an elongate tubular member 286. This member has a cylindrical supporting rod 288 therein adjacent holes 290 and 292 to provide strength for the member. Fasteners are then received through the holes 290 and 292 into tapped holes in the chain saw body 204 to connect the elongate member 286 to the body in the usual manner, no modifications whatsoever being necessary for the chain saw body in this location.

The shock-absorbing means 220 enables the handle 206 to pivot somewhat relative to the member 286 and the housing 204 to effectively absorb shock and vibration along with the shock-absorbing means 218. In so doing, the elements 264 and 266 are primarily placed in shear. The chain saw body 204 can pivot relative to the handle 206 with the upper leg 212 and the grip 216 being substantially still. Hence, the chain saw body 204 can move somewhat under the influence of vibration or shock while the upper leg, grip, and the operator's arm and hand remain substantially stationary. Consequently, the front handle 206 and the shock-absorbing means 218 and 220 not only effectively absorb shock and vibration but can additionally be used with an existing chain saw with minimum modification. Further, the shock-absorbing means 218 can be produced less expensively and still have the advantages of the shock-absorbing means 42.

Various modifications of the above described embodiment of the invention will be apparent to those
skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if they are within the spirit and the tenor of the accompanying claims.

We claim:

1. A chain saw comprising a chain saw body, a front handle, spaced shock-absorbing means connecting spaced portions of said front handle to said chain saw body, a rear handle spaced rearwardly from and independent of said front handle, and spaced portions of said rear handle being connected to said chain saw body.

2. A chain saw according to claim 1 characterized by said shock-absorbing means for said front handle being located at end portions of said front handle.

3. A chain saw according to claim 1 characterized further by shock-absorbing means for said rear handle connecting said body to end portions of said rear handle.

4. A chain saw according to claim 1 wherein said front handle is C-shaped the shock-absorbing means for the upper end of said C-shaped front handle comprises bracket means, a shock-absorbing element at one side of said bracket means, a second shock-absorbing element at the other side of said bracket means, fastening means extending through both of said shock-absorbing elements and said bracket means and connected to said chain saw body.

5. A chain saw according to claim 4 characterized by said fastening means comprising an elongate threaded shank, and a sleeve around said shank and extending between outer end portions of said shock-absorbing elements to limit the compression on said shock-absorbing elements when said fastening means is tightened.

6. A chain saw according to claim 1 characterized further by said front handle being C-shaped said C-shaped front handle having a tubular lower end and the shock-absorbing means at the lower end of said front handle comprises a resilient element extending into the lower end of said front handle, a rigid member centrally engaging said resilient element, and a bracket connecting said rigid member to said chain saw body.

7. A chain saw according to claim 2 characterized further by said front handle having a lower end and an upper end and the shock-absorbing means at the lower end of the front handle comprises flange means extending outwardly from said lower end of said front handle, two resilient elements transversely spaced outwardly from said lower end and having ends connected to said flange means, second flange means connected to the opposite ends of said resilient elements, and means connecting said second flange means with said chain saw body.

8. A chain saw according to claim 7 characterized further by said means connecting said second flange means with said chain saw body comprises an elongate member, one end of said elongate member being affixed to said second flange means, and fastener means affixing a portion of said elongate member spaced from said second flange means directly to said chain saw body.

9. A chain saw according to claim 3 characterized by the upper shock-absorbing means for said rear handle comprising a yoke with spaced arms integrally connected to the upper end of said rear handle, a shock-absorbing element connected to the end of each yoke arm, and said chain saw body having recesses receiving the other ends of said shock-absorbing elements.

10. A chain saw according to claim 9 characterized by said chain saw body having a carburetor housing with side walls, said recesses being formed in said side walls.

11. A chain saw comprising a chain saw body, a front handle located generally in a vertical plane transverse to the longitudinal extent of the chain saw, first shock-absorbing means connecting an upper portion of said front handle to said chain saw body and extending downwardly from said handle to said body, second shock-absorbing means connecting a lower portion of said front handle and said chain saw body and enabling limited pivotal movement of the lower portion of said front handle, a rear handle spaced from and independent of said front handle, and located generally in a vertical plane parallel to the longitudinal extent of the chain saw and perpendicular to the plane of the front handle.

12. A chain saw according to claim 11 wherein said first shock-absorbing means comprises bracket means connected to said front handle, a resilient shock-absorbing element located on opposite sides of said bracket means, a fastener member extending through both of said resilient elements and said bracket means, and means connecting said fastener member to said chain saw body.

13. A chain saw according to claim 11 characterized by said second shock-absorbing means comprising a resilient bushing extending into a lower end of said front handle, and bracket means connecting a central portion of said bushing to said chain saw body.

14. A chain saw according to claim 17 characterized by said second shock-absorbing means comprising flange means extending outwardly from the lower portion of said front handle, a pair of resilient elements transversely spaced outwardly from said lower portion and connected at ends to said flange means, second flange means connected to the opposite ends of said resilient elements, and means connecting said second flange means to said chain saw body.

15. A chain saw according to claim 14 characterized further by said means connecting said second flange means with said chain saw body comprising an elongate member, one end of said elongate member being affixed to said second flange means, and fastener means affixing a portion of said elongate member directly to said body.

16. A chain saw according to claim 11 characterized by third shock-absorbing means connecting an upper portion of said rear handle to said chain saw body, and fourth shock-absorbing means connecting a lower portion of said rear handle to said chain saw body.

17. A chain saw according to claim 2 characterized further by said front handle having a lower end and an upper end, and the shock-absorbing means at the lower end comprises at least one resilient element spaced transversely from the axis of the lower end of said handle, and means axially aligned with said lower end and connecting said transversely spaced resilient element with said chain saw body.