United States Patent

[11] 3,620,269

[72] Inventor **Alfonso Lange**
Dorpfeldstrasse 8, 2000 Hamburg 52, Germany

[21] Appl. No. **852,235**
[22] Filed **Aug. 22, 1969**
[45] Patented **Nov. 16, 1971**
[32] Priority **Feb. 20, 1969**
[33] **Germany**
[31] **P 19 08 451.6**

---

[54] **PORTABLE CHAIN SAW WITH ANTIVIBRATION HANDLE**
6 Claims, 16 Drawing Figs.

[52] **U.S. Cl.** **143/32,** 173/162
[51] **Int. Cl.** **B27b 17/02**
[50] **Field of Search** 143/32; 16/116; 173/162

[56] **References Cited**
UNITED STATES PATENTS

2,610,657	9/1952	Kiekhaefer	143/32
1,800,254	4/1931	Holmes	16/116 X
786,050	3/1905	Richwood	173/162

Primary Examiner—Donald R. Schran
Attorney—Milmore & Cypher

ABSTRACT: In a portable chain saw powered by a reciprocating engine, vibrations from the engine to the handle grasped by the operator(s) are absorbed by forming the handle with a core which is rigidly attached to the chain saw body and a sheath which surrounds the handle in spaced relation and held relatively to the core by a spacer of yieldable material, such as one or more pieces of rubberlike material or corrugated leaf springs or radial coiled expansion springs which engage both the core and the sheath, the latter being grasped by the operator.

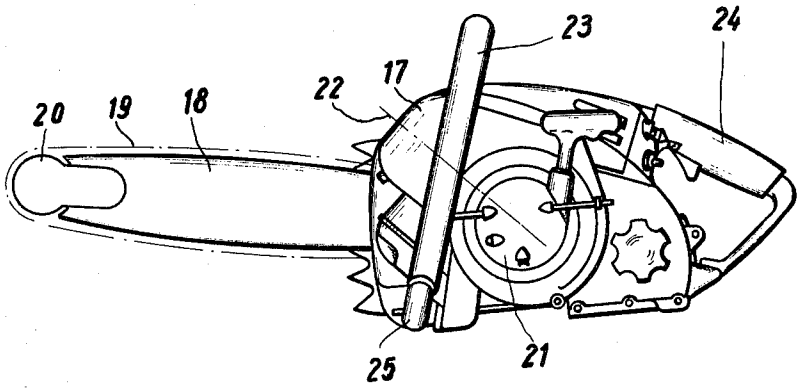


Fig. 1

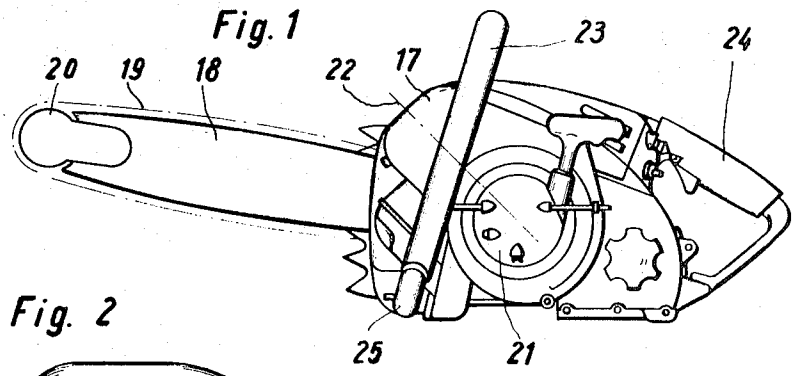


Fig. 2

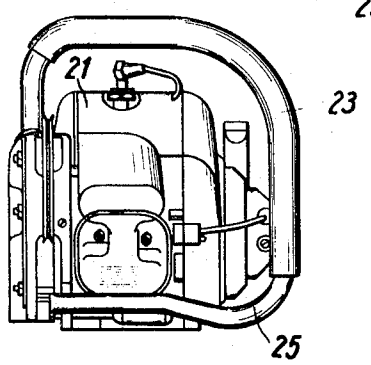


Fig. 4

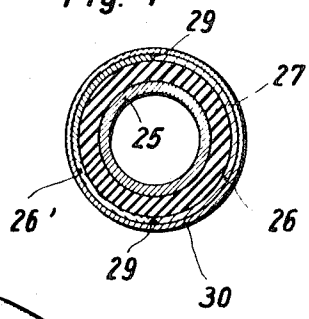
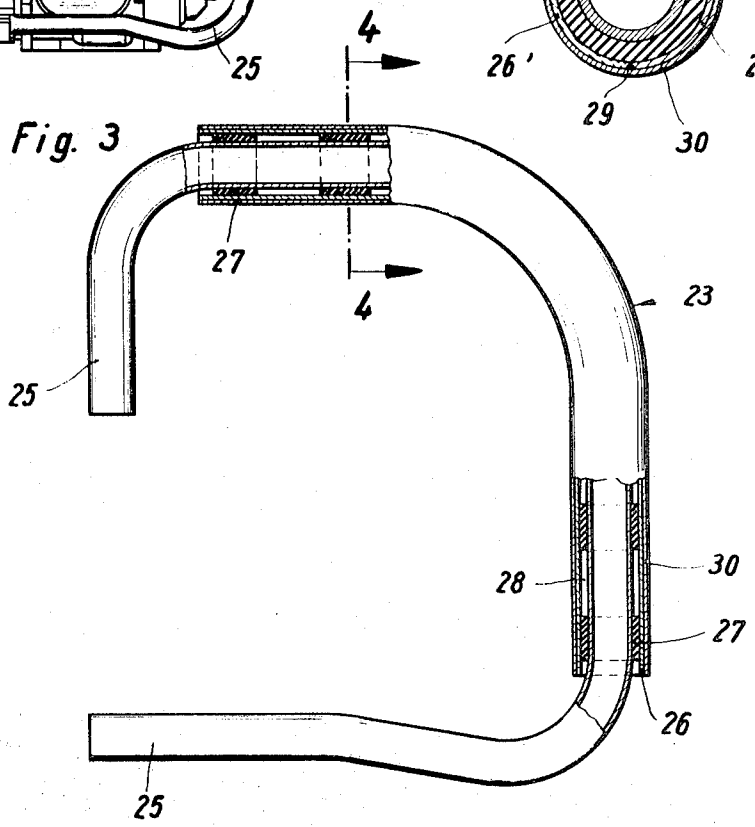


Fig. 3



Inventor:
Alfonso Lange
by Milmore & Cypher
Attorneys

Fig. 5

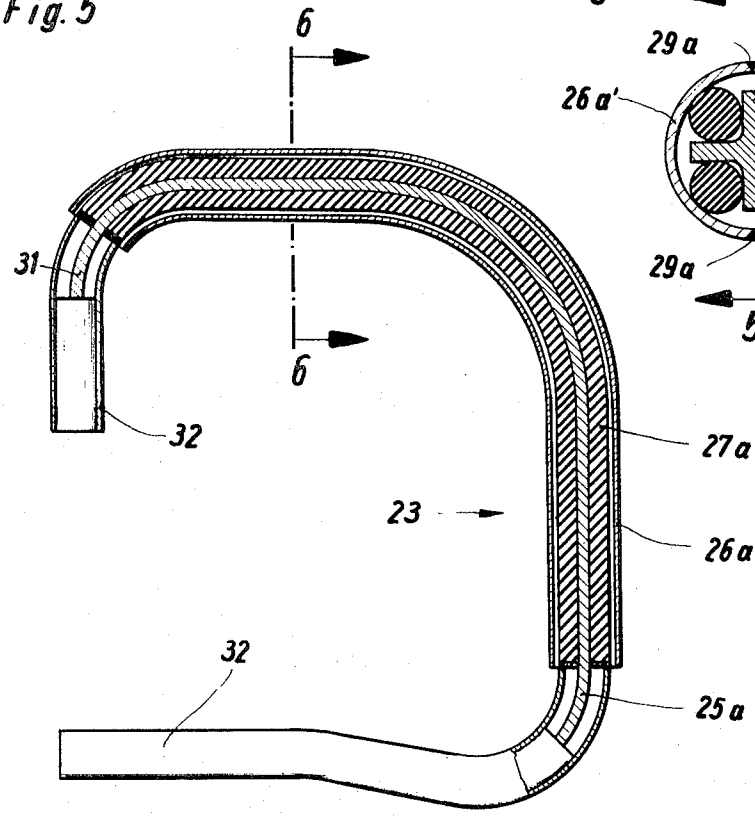


Fig. 6

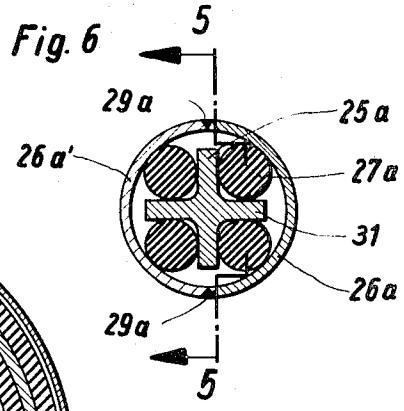


Fig. 7

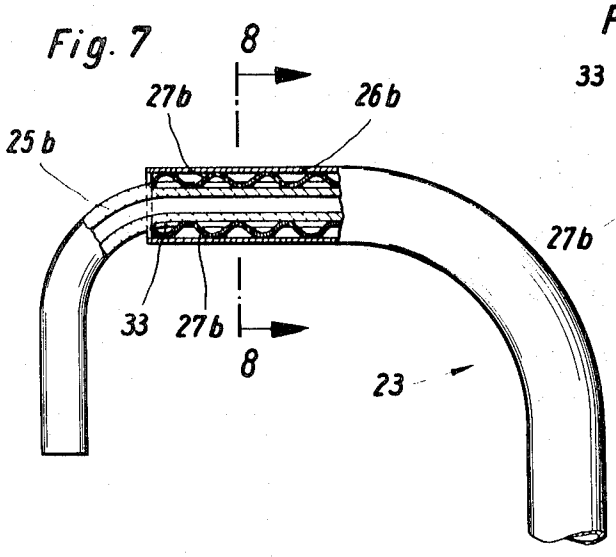
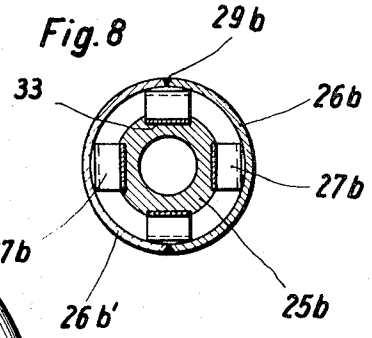


Fig. 8



Inventor:
Alfonso Lange
by Milmore & Cypher
Attorneys

Fig. 9

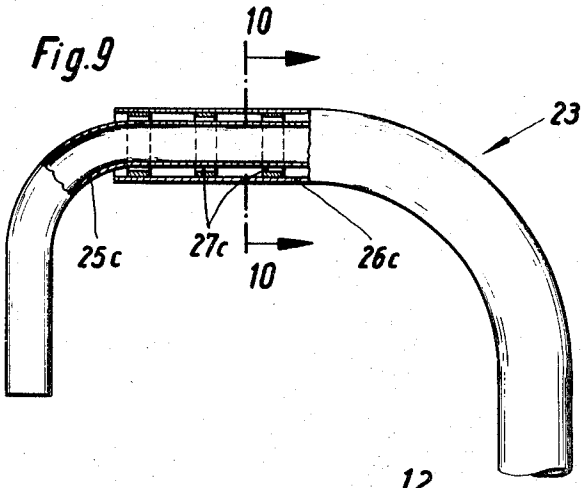


Fig. 10

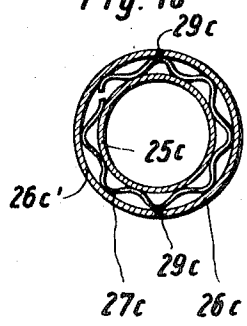


Fig. 11

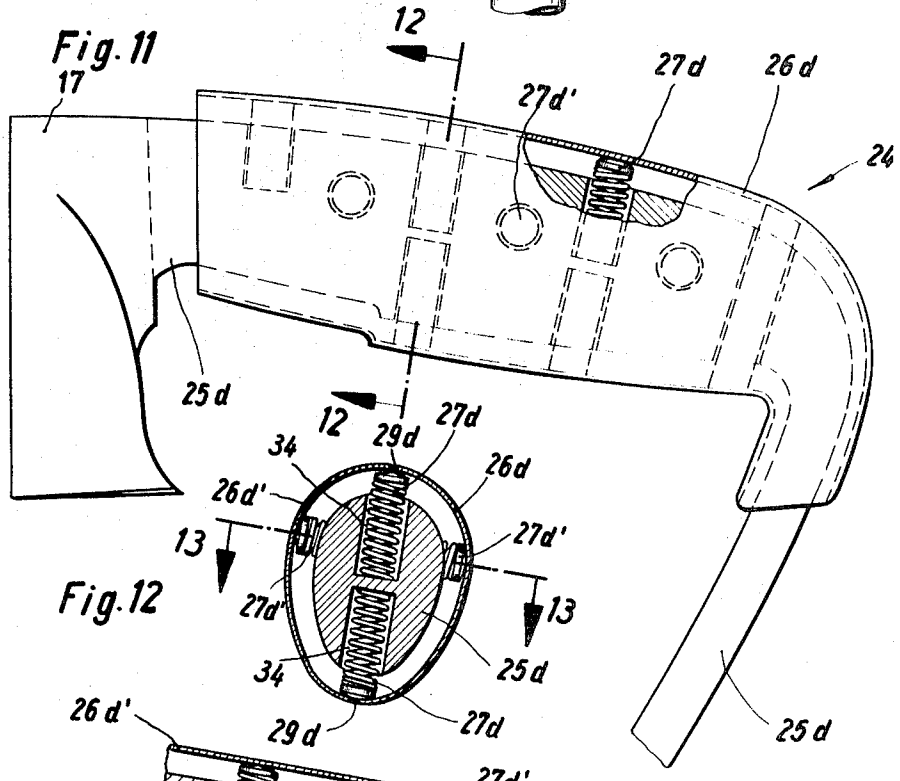


Fig. 12

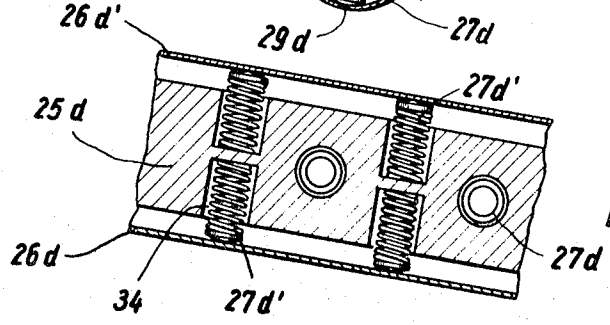


Fig. 13

Inventor:
Alfonso Lange
by Milmore & Cypher
Attorneys

Fig. 14

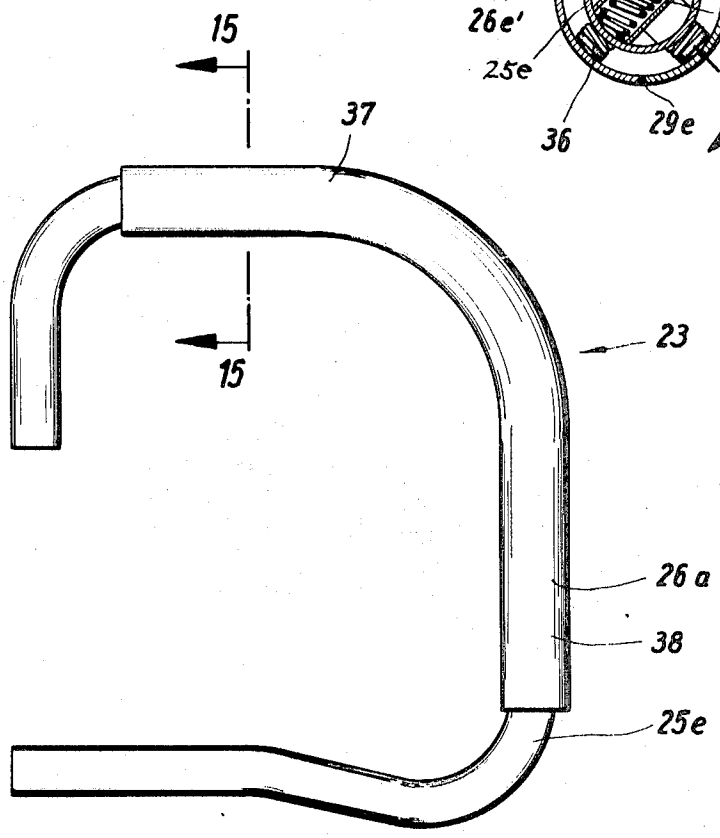


Fig. 15

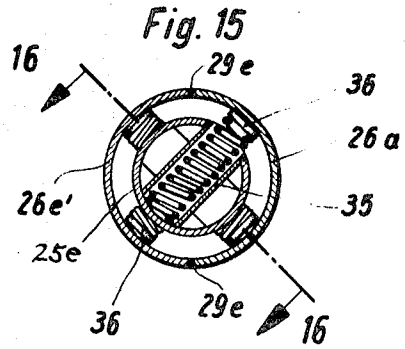
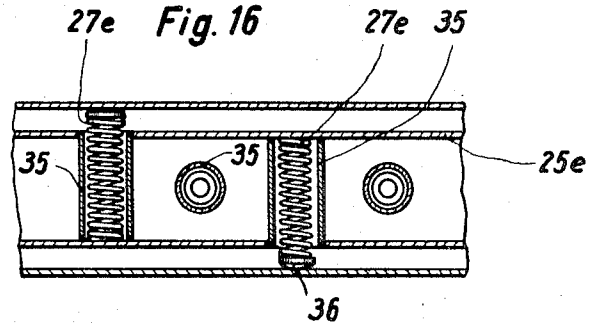


Fig. 16



Inventor:
Alfonso Lange
by Milmore & Cuppler
Attorneys

PORTABLE CHAIN SAW WITH ANTIVIBRATION HANDLE

The invention relates to portable chain saws driven by a motor having a reciprocating piston, and is particularly concerned with a handle, to be grasped by the operator, which is rigidly attached to the body of the chain saw and is constructed to dampen the vibrations from the motor to the operator.

Known handles of such portable, powered chain saws have been provided with cushioning coverings of elastic material. If the dampening of the vibrations is to be effective, a very pliable or soft covering must be used; however, such a covering greatly reduces the transmission of controlling motions from the hands of the operator to the saw. The damping effect of the covering is greatly reduced whenever the operator applies a force or a compression of the covering to hold the saw or to alter the position or direction of the saw. Thus, a compressive force applied in one direction severely reduces damping in that direction. Moreover, such a covering detracts from the capability of guiding the saw, since the forces transmitted by the long supporting and chain-guiding part of the saw body or frame to the covering act to produce vibratory motions which are lateral to the said guiding part and act through a long lever arm, and result in a tilting tendency of the saw relatively to the soft covering grasped by the operator.

It was proposed (U.S. Pat. No. 3,409,056, Nov. 1968) to attach the handle at its ends to the chain saw body by vibration-damping bushings. However, it has not been feasible to obtain a proper balance between the requirements of making such bushings sufficiently flexible to dampen the vibrations effectively and sufficiently stiff to permit the saw to be guided reliably. Further, such bushings are subject to rapid failure by fatigue.

The vibrations transmitted from the motor unit to the operator when cushioning coverings or bushings of sufficient stiffness for effective guidance of the saw are used, according to known constructions, inflict health damages to the operator and greatly reduce his endurance in manipulating the powered chain saw.

The present invention overcomes the above-noted difficulties in providing a handle construction which, while providing an effective damping of the vibrations reaching the hand(s) of the operator, permits the saw to be guided reliably as to position and angle of attack against the workpiece.

In summary, according to the invention, the body of the chain saw (on which the motor unit and chain-guiding parts are fixed) has handle means which includes a core fixed rigidly (at one or preferably both ends) to the body, a sheath which surrounds the core in spaced relation and is movable relatively thereto in all radial directions, and a spacer means of elastic material interposed between and in expansive relation to both the core and the sheath, the latter being adapted to be grasped by the hand of the operator. The term "radial directions" means radial relatively to the axis of the core, which may include several angularly related portions.

The yieldable spacer means acts to absorb a significant part of the vibrations, while positioning the core relatively to the sheath, to permit good guidance of the saw relatively to its workpiece. Such spacer means may take any of or a combination of several forms, such as one or more bodies of elastic, rubber or rubberlike bodies, leaf springs which are corrugated, or radially disposed expansion springs oriented in a plurality of radial directions and acting between the core and the sheath.

The advantage of the construction according to the invention resides principally in that the core, which is rigidly attached to the saw body, is connected to the graspable sheath only by the yieldable spacer means, and that the said spacer means is not pressed or contracted by the hands of the operator, which pressing would cause contraction in certain directions and either affect guidance or increase transmission of vibrations in the direction in which pressure is applied. A firm grasp by the hand(s) on the sheath, therefore, has no effect on the condition of the yieldable spacer means, and these spacer means are affected only by the steering movements and the vibrations of the motor. Moreover, a reliable guidance of the chain saw is insured, because the graspable sheath can be extended in length, whereby torque can be easily transmitted from the sheath to the core and, hence, to the chain saw body, whereby the position and direction of movement of the saw can be controlled by the operator.

One embodiment of the yieldable spacer means is a hoselike, tubular piece formed of rubber or a synthetic, rubberlike material extending substantially the full length of the sheath. In this embodiment the cross sections of the facing surfaces of the core and sheath are preferably circular.

In another embodiment, the spacer means can consist of segments (e.g., elastic rubber or rubberlike material or metallic springs) spaced apart along the length of the sheath.

In another embodiment, the spacer means may be a plurality of continuous or of axially spaced segments of solid or tubular elements positioned within longitudinal recesses formed by radial walls on the sheath or on the core, e.g., longitudinal ribs extending radially outwardly from the core.

In another embodiment, the yieldable spacer means are formed by leaf springs, which may be formed of corrugated sheet metal and extend (in the direction transverse to the corrugations) either parallel to the axis of the core or around it. In either case alternate rugations press against the core and the others press against the sheath. The leaf springs may, especially when they surround the core, be segmented and positioned in axially spaced relation.

Moreover, in still other embodiments, the spacer means can take the form of coiled expansion springs, which extend in different radial direction, each spring pressing outwardly against the sheath and inwardly against the core. The several springs, having axes in different radial directions, are arranged to produce an elastic force centering the axis of the core relatively to that of the sheath, and some of these springs may be displaced along the axis of the core, as when their axes would otherwise lie in the same transverse plane. These coiled springs may be secured in sockets, e.g., formed in the core and providing abutments. When the core is formed of a tubular piece (having a hollow interior) the sockets may be formed by smaller, tubelike guides which are fastened to the wall of the core. Preferably these coiled springs have lengths which are large in relation to the diameter of the core, and therefore deep sockets are preferred.

The coiled springs may be provided with caps which engage the inner surface of the sheath and are slidable along said surface, to accommodate relative axial movements between the core and the sheath, the inner ends of the springs being positioned by the above-mentioned sockets in the core.

The invention will be further described with reference to the accompanying drawings, showing various embodiments by way of illustration, wherein:

FIG. 1 is a plan view of a chain saw according to the invention;

FIG. 2 is a front elevation of the saw of FIG. 1;

FIG. 3 is a front elevation of the principal, transverse handle, to an enlarged scale, parts appearing in section;

FIG. 4 is a transverse section taken on the line 4—4 of FIG. 3;

FIG. 5 is a view, principally in section on the broken section line 5—5 of FIG. 6 and corresponding to FIG. 3, showing a second embodiment of the handle;

FIG. 6 is a transverse section taken on the line 6—6 of FIG. 5;

FIG. 7 is a view corresponding to FIG. 3 of part of a handle, showing a third embodiment;

FIG. 8 is a transverse section taken on the line 8—8 of FIG. 7;

FIG. 9 is a view, partly in section, corresponding to FIG. 3, of a part of a handle, showing a fourth embodiment;

FIG. 10 is a transverse section taken on the line 10—10 of FIG. 9;

FIG. 11 is an elevation of a longitudinal or pistol-grip handle, illustrating a fifth embodiment employing radially acting coiled expansion springs as the yieldable spacer means;

FIG. 12 is a transverse section taken on the line 12—12 of FIG. 11;

FIG. 13 is a section taken on the longitudinal line 13—13 of FIG. 12;

FIG. 14 is an elevation of a handle, corresponding to FIG. 3, showing a transverse handle according to a sixth embodiment, having a tubular core;

FIG. 15 is a transverse section taken on the line 15—15 of FIG. 14; and

FIG. 16 is a section taken on the longitudinal line 16—16 of FIG. 15.

Referring to FIGS. 1 and 2, the portable, powered chain saw comprises a body or frame 17 which includes a projecting part 18, rigidly secured thereto, for guiding a saw chain, indicated by the chained line 19 and having saw teeth. This part includes at its outer end an idling wheel 20 and (not shown), a driving gear which is mounted on the body. This driving gear is coupled to the output shaft of a motor 21, such as an internal combustion engine having a reciprocating piston, movable, for example, on the axis 22. The chain saw has handle means, which includes a principal handle 23, extending more or less transversely to the longitudinal direction of the part 18, usually at a small angle to the perpendicular to the length of the said part 18, and a pistol-grip handle 24 at the rear, more or less parallel to the direction of the said part and either in the same plane or offset therefrom. These handles are rigidly secured to the body 17 by their cores.

As appears in FIGS. 1–4, the transverse handle 23 includes a core 25, such as a solid or, preferably, tubular member as shown, attached rigidly at both of its ends to the body 17. This core is advantageously formed in a plurality, e.g., four, angularly related portions, as shown in FIGS. 2 and 3. A sheath 26, extending over at least two of said portions and the connecting curved part, is situated in radially spaced relation to the core to provide an intervening space within which there is a plurality of axially spaced rings 27 of rubber or synthetic material having elastic properties. These rings press against both the core and the sheath, whereby the sheath is movable relatively to the core in all directions which are radial to the core. The rings 27 can be fixed to the core at intervals to leave intervening spaces 28 and the sheath can be formed as a plurality of longitudinal sections, such as 26 and 26', joined by weldments 29, as appears in FIG. 4. The assembled sheath can thereafter be covered with a suitable gripping material 30, such as synthetic rubber hose which contract when heated and is slipped over the assembled handle before the ends of the core 25 are attached to the saw body.

Instead of the spaced rings 27 it is possible to use a continuous elastic body, also tubular in shape, the spaces 28 being then eliminated; or the spacer means may consist of a plurality of rings situated close together so as to eliminate the spaces 28.

The damping action of the yieldable spacer means can be varied to the desired degree by a choice of the resiliency of the elastic material, of the radial distance between the core 25 and the sheath 26, the lengths of the rings 27, and the lengths of the intervals 28.

According to the second embodiment shown in FIGS. 5 and 6, the handle core 25*a*, which is rigidly secured to the body of the chain saw, is solid and has a cross section that provides a plurality, such as four, radial walls 31 which are angularly related and extend longitudinally, to provide intervening longitudinal recesses. A longitudinal, solid (or tubular, hoselike) spacer body 27*a* is laid into each of these recesses, in abutting relation to both the core 25*a* and a sheath 26*a*, which has a complementary section 26*a*' attached by weldments 29*a*. Advantageously, these elastic spacer bodies 27*a* have dimensions, when not stressed, slightly greater than the spaces containing them, so that they (like the rings 27) are under compression when the sheath 26*a* is attached; however, this is optional.

It is evident that the circle enclosing the walls 31 has a diameter less than the interior of the sheath, whereby these parts are relatively movable in all radial directions.

To facilitate attaching the core to the body of the saw, tubular sections 32 can be attached by sliding them over the ends of the core and welding.

In the third embodiment of FIGS. 7 and 8 the handle core 25*b* and sheath 26*b*, 26*b*', are separated by a plurality of, such as four, longitudinal corrugated leaf springs 27*b*, alternate rugations of which engage the core and sheath. The springs 27*b*, which constitute the yieldable spacer means, may optionally be shaped so as to be slightly deformed when the sheath sections are joined by the weldments 29*b*. To prevent displacement of the springs circumferentially about the core, the latter may be formed with a longitudinal groove 33 for each spring, of width to accommodate one spring. Relative longitudinal motion between the springs and the core is prevented by abutment of the spring ends with the ends of these grooves; however, the springs can slide both circumferentially and longitudinally relatively to the sheath. As shown, the core 25*b* may be tubular. It is understood that the handle is only partly shown in FIG. 7, and the core ends are rigidly secured to the saw body.

The fourth embodiment, shown in FIGS. 9 and 10, differs from the third embodiment principally in that the corrugated leaf springs 27*c* extend circumferentially about the tubular core 25*c* and are bands which are spaced apart along the length of the core. Again, alternate rugations press against the core 25*c* and the sheath, which includes sections 26*c* and 26*c*' joined by weldments 29*c*.

FIGS. 11–13 show a fifth embodiment of the handle, and illustrates it as applied to the pistol-grip handle 24. The handle includes a solid core 25*d*, which is connected rigidly at its ends to the rear of the saw body 17, and a sheath 26*d*, 26*d*' having weldments 29*d* which sheath is spaced radially outwardly from the core. The core and sheath are relatively positioned by a plurality of coiled compression springs 27*d*, 27*d*', which constitute the yieldable spacer means. These springs are suitably positioned; for example, their inner ends can lie within sockets 34 closed at their inner ends to provide abutments. A pair of vertical springs 27*d* can be mounted coaxially at each of several positions along the core, while a pair of transverse springs 27*d*' is mounted coaxially at various other positions. This staggering of the vertical and transverse springs permits the sockets to extend deeply into the core, whereby longer coiled springs can be used then without staggering. Optionally but preferably the springs have length to be under compression when the handle is assembled.

Although only one row of vertical springs 27*d* and one row of transverse or horizontal springs 27*d*' were shown, it is evident that the number of rows and the angular relations can be varied, as by using two or three parallel rows, and/or by inclining the springs at 60° to the direction of another spring.

The sixth embodiment, shown in FIGS. 14–16 as applied to the principal transverse handle 23, also uses coiled springs 27*e* as the yieldable spacer means, but uses a tubular core 25*e*. To provide sockets, there are smaller tubular guides 35, which are secured, as by welding, to the wall of the core at openings therein and extend radially inwards toward an imperforate portion of the opposite core wall. Successive guides 35 along the length of the core have different orientations, e.g., 90° apart as shown. Each guide contains a coiled expansion spring 27*e* which preferably carries at its outer end a cap 36 having a positioning stud extending into the coil and a smooth, preferably rounded outer surface capable of sliding motion along the inner surface of a sheath 26*e*, 26*e*', which includes a weldment 29*e*. The springs 27*e* preferably but optionally have lengths to be in compression when the handle is assembled.

It is evident that the caps 36 permit free sliding motion of the sheath relatively to the axes of the coiled springs. Relative longitudinal motion occurs in one handle portion (e.g., part 37) when relative radial vibrations between the sheath and core occur at another part which is angularly disposed (e.g., the part 38). It may be noted that this relative longitudinal motion is possible by deformation of the spacer body 27, 27*a* or

27*d* and by sliding motion of the sheath relatively to the spacer body 27*b* or 27*c* in the earlier embodiments.

I claim as my invention:

1. In a portable power chain saw which comprises a saw chain, body means including a part for supporting and guiding said chain, a motor unit mounted on said body means and including a reciprocable piston connected to drive said chain, and handle means, the improvement wherein said handle means include:

a. a core rigidly attached to said body means,

b. a stiff sheath adapted to be grasped by hand which surrounds said core in spaced relation to provide an intervening space and which is movable relatively to the core in all radial directions, and

c. yieldable spacer means situated within said space for positioning the core relatively to the sheath, said spacer means comprising a plurality of elongated elastic elements situated at positions spaced along the length of the core and having their axes angularly related, each element being in abutment at one end thereof with the core and at the other end thereof with the sheath,

whereby vibrations from the motor acting on the core are partly absorbed by the spacer means.

2. A chain saw according to claim 1 wherein said core is formed to provide a plurality of sockets having abutments at their inner ends, and each of said elongated elements has one end thereof situated within one of said sockets in abutting relation to the abutment of the respective socket.

3. A chain saw according to claim 2 wherein said core is tubular in form, and each of said sockets includes a substantially radially extending tubular guide which is fixed to the tubular core.

4. A chain saw according to claim 2 wherein each of said elongated elements has a cap interposed between the outer end of the element and the sheath and secured to the element, said caps being slidable relatively to the sheath.

5. A chain saw according to claim 1 wherein said elastic expansion elements are tubular in shape.

6. A chain saw according to claim 5 wherein said tubular expansion elements are coiled springs.

* * * * *