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(72) Inventors:
• **Heywood, Peter**
Stowmarket, Suffolk IP14 1EY (GB)
• **Tulip, Nicholas**
Stowmarket, Suffolk IP14 1EY (GB)
• **Farkas, Attila**
Repuloteri ut 1
3526 Miskolc (HU)

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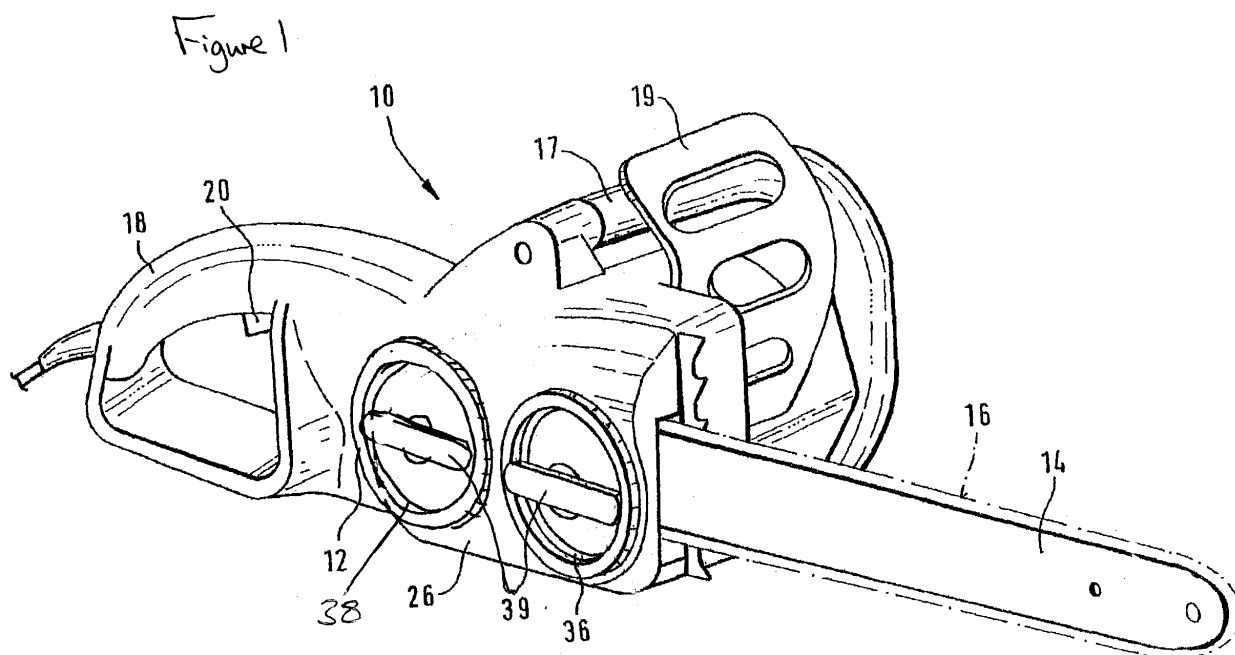
(71) Applicant: **ROBERT BOSCH GMBH**
70469 Stuttgart (DE)

(74) Representative: **Bailey, David Martin**
Brookes Batchellor LLP,
102-108 Clerkenwell Road
London EC1M 5SA (GB)

(54) **Chainsaw with tensioning mechanism**

(57) The present invention relates to a device for adjusting the tension in the saw chain (16) of a chain saw (10). The device comprises a clamping means (36), a tensioning means (38) in the form of a rotatable cam, and elongate rod which interacts with the rotatable cam at a

first end, and a blade, upon which the saw chain is driven, at a second end. The chain is driven by a sprocket and rotation of the cam causes the elongate rod to longitudinally extend or retract, relative to the sprocket, to adjust the tension in the saw chain. The present invention also relates to a chainsaw including such a tensioning device.



Description

[0001] The present invention relates to a chain saw, and in particular a chain tensioning device for a chain saw.

[0002] Conventionally, chain saws are provided with a chain tensioning device to allow the chain saw to operate efficiently and safely. If the cutting chain is not correctly tensioned, for example, if it is too loose, it may jump off the chain bar which may result in an injury to the operator. Conversely, an over-tight chain can lead to overheating problems due to the excessive friction between the chain and chain bar. In the context of the present invention, the skilled person will understand the term 'tension' as conventionally used in the field of chain saws. That is to say, when correctly set, the chain will typically be able to move approximately 2mm from the bar at its mid-point.

[0003] During its lifetime, the tension of a saw chain changes considerably due to wear and tear on the chain. Over time the chain gradually increases in length and the tension held in the chain decreases as a result. These changes are most noticeable after a new chain has been used for the first few times. For safe and efficient use of a chain saw the tension in the saw chain must be maintained and therefore, it is necessary to provide a chain tensioning device.

[0004] DE-A1 21 327 47 discloses a chain saw in which, between a rotational member and a cam, a pre-stressed torsion spring is disposed that seeks to rotate the cam resting against the stop in such a rotational direction that the chain bar is constantly subjected to a displacement force in the longitudinal direction. In this manner, the chain bar is kept at the greatest possible distance from the sprocket. This causes a tension force to constantly act on the saw chain, compensating for an increase in the length of the saw chain resulting from wear and temperature influences during operation.

[0005] During assembly, the torsion spring is tensioned by means of the rotational member, which is embodied as a turning knob, until the cam rests against the stop with sufficient pre-tension, thus achieving the desired chain saw tension.

[0006] In a chain saw with a chain tensioning device described in WO 98/33631, the chain bar is fixed between two securing plates and, together with these plates, is secured in a longitudinally movable fashion to the housing. A bolt, which extends through a bore in one cam and an oblong hole in the housing, is screwed into the one holding plate, which is guided on the housing in a longitudinally moveable manner, and fixes the cam to the housing by means of its bolt head. For the purpose of tensioning the saw chain, the bolt is loosened and the cam is rotated so that the bolt, together with the holding plate, is moved in the direction of the chain bar tip. The rotation of the cam should be stopped once the saw chain has attained the desired tension. The bolt must then be tightened again so that the cam and the holding plates, together with the chain bar, are fixed to the housing in a

frictional, non-positive fashion in the set position.

[0007] The known embodiments for tensioning the saw chain either require the use of tools or are difficult for users to operate due to confusion between the means of setting the tension and clamping the chain bar. This is a particular problem when these functions are controlled by coaxial rotating controls.

[0008] Typically, a saw chain correctly tensioned for working will be set so that at the longitudinal mid-point of the chain bar the chain will have approximately 2mm of lateral play. As a consequence of use of the chain saw there is also a danger that the positional locking of the chain bar may slacken which can result in loss of the correct working chain tension. This increases the danger that the saw chain may fly off the chain bar. This can only be prevented by frequently reclamping and/or retensioning the chain.

[0009] The present invention seeks to overcome at least some of these problems and provide a chain saw in which a position of the chain bar in relation to the sprocket, selected by the chain saw user, can be secured in a form-fitting fashion and only has to be readjusted if the chain has lengthened as a result of wear or if the chain bar and the sprocket have been worn. It is desired that such a chain tensioning device will be simple to use and capable of being operated manually without the use of any tools. For that purpose, operation will be conducted by rotation of two handwheels adjacent to one another with axes substantially parallel to the chain sprocket, one performing a tension setting function and the other a clamping function. Additionally, loss of chain tension is further reliably prevented by positionally locking a tensioning-cam in a form-fitting fashion by means of one of the handwheels which results in the chain bar being held fixed in the set tension position.

[0010] In accordance with an aspect of the present invention there is provided a motorised chain saw comprising a housing, a sprocket mounted thereon, and a chain bar which extends beyond the housing and guides a saw chain engaged with the sprocket in a revolving manner. The chain bar is mounted in a longitudinally adjustable relationship relative to the housing and the sprocket by means of a chain tensioning device. The chain tensioning device comprises a clamping means; a tensioning means in the form of a cam, rotatable by means of a rotational member; and an elongate actuation member intermediately engageable at a first end thereof with said cam. The cam has a circumferential surface contoured for engagement with the elongate actuation member, and the rotational member and clamping wheel rotate about parallel, non-coaxial, axes. Additionally, the chain bar further comprises a complementary elongate actuation member-engaging means, and in which rotation of the rotational member causes the cam to rotate and engage with the elongate actuation member to abut and longitudinally drive the chain bar relative to said sprocket, at a second end thereof.

[0011] Preferably, the chain bar comprises an elongate

gate actuation member-engaging means. Preferably, the elongate actuation member-engaging means comprises a recess in the chain bar. Preferably, the recess comprises a hole passing through the chain bar. Alternatively, the elongate actuation member-engaging means comprises a flange located on the chain bar.

[0012] Preferably, the circumferential surface comprises a plurality of notches or detents to provide defined increments of tension setting.

[0013] Preferably, the cam is coaxially engageable with the rotational member.

[0014] Preferably, the rotational member further comprises a retracting means, engageable with the elongate actuation member and for retraction thereof, for relieving tension held in the saw chain. Preferably, the retracting means comprises a wall of the rotational member, engageable with the elongate actuation member. Preferably, a first end of the elongate actuation member comprises a kink, substantially parallel to the axis of the cam. Preferably, the vertical alignment of the wall of the rotational member is substantially parallel to the cam axis to allow engagement with the kink in the first end of the elongate actuation member. Preferably, the wall is parallel and radially spirals outside of and to the cam circumference, to provide a withdrawing force on the elongate actuation member when the rotational member is rotated such as to reduce tension in the saw chain.

[0015] Preferably, the notches or detents prevent reverse rotation of the cam when load forces transmitted through the elongate actuation member from the chain bar are exerted upon the cam. Preferably, the notches or detents are engageable with the kink in the first end of the elongate actuation member.

[0016] Preferably, the rotational member, for rotating the cam, and the clamping means each comprise a rotatable handwheel.

[0017] Preferably, the rotational member engages the cam in a rotation-transmitting manner. Preferably, the engagement is by way of a peg and socket location. Preferably, a peg of the rotational member engages with a socket located in the cam.

[0018] Preferably, the rotational member for rotating the cam is located on the chain saw housing. Preferably, the chain bar clamping handwheel is mounted for rotation on or in a removable sprocket cover. Preferably, the chain bar clamping handwheel retains the sprocket cover on the chain saw housing. Preferably, the sprocket cover further comprises a hole which allows workable access to the tensioning handwheel when the chain saw is in an assembled configuration.

[0019] The above and other aspects of the present invention will now be illustrated in further detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a first embodiment of a chain saw in accordance with the present invention from the front and a first side,

Figure 2 is a part side view of the chain saw of Figure 1 in the region of the chain tensioning device complete with the protective cover;

5 Figure 3 is a section through the tensioning wheel of the chain saw of Figure 2 along the line B-B;

Figure 4 is a section through the clamp wheel of the chain saw of Figure 1 along the line M-M;

10 Figure 5 is a side view of the chain saw of Figure 1 in the region of the chain tensioning device with the protective cover and tensioning hand-wheel removed, in which cam is in a first position;

15 Figure 6 is a side view of the chain saw of Figure 1 in the region of the chain tensioning device with the protective cover and tensioning hand-wheel removed, in which cam is in a second position;

20 Figure 7 is a perspective side view from below of the chain saw of Figure 5 in the region of the saw chain tensioning device;

25 Figure 8 is a rear plan view of a cam engaged with a rod of the chain tensioning device; and

30 Figure 9 is an above perspective view of the embodiment of Figure 8.

[0020] Referring to Figures 1 and 2, there is shown a chain saw 10 having a housing 12, from the front of which a chain bar 14 protrudes. A saw chain 16 is guided to revolve around the circumferential edge of the chain bar 14. The housing 12 has a handle grip 18, towards the rear of the housing and chain saw 10, with a switch 20 for switching on a motor (not shown). An additional hand grip 17 is located on an upper portion of the chain saw for guiding the chain saw 10 with a user's second hand. Adjacent and forward of the additional hand-grip 17 is a combined hand-guard and kickback brake arrangement 19, for rapid power-cutting to the saw chain drive, in the event of a dangerous kickback from the saw.

[0021] The chain saw 10 supports a sprocket cover 26 on a side thereof that contains a chain tensioning device. The chain tensioning device has a clamping handwheel 36 and a chain tensioning handwheel 38 both with a central wheel grip 39. A sprocket 22 (Figures 5-7) is disposed underneath the sprocket cover 26 on the side of the housing 12, onto which the saw chain 16 is locatingly engaged. The sprocket 22 is drivably coupled to an internal engine or electric motor by way of a transmission (not shown) so that, in use, the chain 16 is driven to revolve when the sprocket 22 is rotated.

[0022] Figures 3 and 4 respectively show sectional views through tensioning handwheel 38 and clamping

handwheel 36. As shown in Figure 3 a snap-fit retention means 61 is provided to fix tensioning handwheel 38 to housing 12. In preferred embodiments sprocket cover 26 is removable and locates over tensioning handwheel 38 which remains fixed to the housing 12. A suitable large clearance hole in sprocket cover 26 provides easy access to the full circumference of tensioning handwheel 38 for simple and convenient tensioning operation. Conversely, as shown in Figure 4 (and which may be further deduced from Figures 5 to 7), clamping handwheel 36 is mounted for rotation on or in removable sprocket cover 26. Sprocket cover 26 is attached to housing 12 by a threaded insert or nut 62 in union with a stay bolt 15 (not shown), and which attachment is conducted through operation of clamping handwheel 36. By means of clamping handwheel 36 exerting a clamping force through washers 63 onto chain bar 14, resting against anchor plate 13, the chain bar 14 is clamped firmly in position.

[0023] In Figures 5 and 6, sprocket cover 26 and tensioning handwheel 38 have been removed, and housing 12 further includes a cam housing 29 located within the body of housing 12, a cam 30, an elongate actuation member in the form of a rod 23, sprocket 22 and a chain bar anchor plate 13. Cam 30 comprises an outwardly spiralling circumference and is further described in relation to Figures 8 and 9 below. Cam 30 engages with and is rotatable through a tensioning handwheel 38 (Figure 2) and is circumferentially engaged with a first end 34 of a rod 23. Rod 23 is kinked and a second end 35 thereof is slidably located within an elongate rod channel of chain bar anchor plate 13 (not shown). It will be recognised that rod 23 maybe straight or may be kinked in a different orientation to that which is illustrated in the embodiments described herein, depending upon the positioning of the other components of the chain tensioning device.

[0024] Chain bar anchor plate 13 further comprises coaxial elongate protrusions 21 and a stay bolt 15 (bolt location is shown for clarity) for engagement with an elongate bar channel 60 of chain bar 14 and clamping handwheel 36 in an assembled configuration. A sprocket 22 is located intermediate the cam housing 29 and chain bar anchor plate 13, such that the axes of sprocket 22 and stay bolt are aligned parallel relative to the elongate bar channel 60. As seen in Figure 6, cam 30 has been rotated clockwise, though about 225 degrees, resulting in rod 23 being engaged and driven such that its second end 35, has moved within elongate rod channel (not shown).

[0025] In use, chain bar 14 is positioned adjacent the housing 12 and laterally pressed against the housing 12. In this configuration, for the purpose of securing the position of the chain bar, stay bolt 15 of chain bar anchor plate 13, on the side of the housing, juts into elongate bar channel 60 of chain bar 14, approximately in the middle and complementary thereto, and reaches past the front flat side of the chain bar 14.

[0026] In an assembled state, clamping handwheel 36 of chain tensioning device concentrically encompasses

the stay bolt 15 and clamps the chain bar 14 by exerting a clamping force through washers 63. In this configuration, the handwheel overlaps the lateral diameter of the elongate bar channel 60 and presses washers 63 down on the chain bar 14 to clamp the chain bar against chain bar anchor plate 13, located on the housing 12. The chain tensioning device, prevents longitudinal movement of the chain bar, relative to housing 12.

[0027] Figures 8 and 9 respectively show an inner-side view and an inner-side perspective view of the cam 30 engaged with an elongate actuation member in the form of a rod 23 and linked to tensioning handwheel 38. As is more clearly illustrated in Figure 9, the circumference of cam 30 comprises a plurality of detents 37 to engage a first end 34 of rod 23. Cam 30 is suitably manufactured as a fine blanked steel component. Alternative constructions will be readily apparent to those skilled in the art.

[0028] As tensioning handwheel 38 is rotated, cam 30 rotates and first end 34 of rod 23 clicks and sequentially locks into detents 37 of the cam 30. The second end 35 of rod 23 locates in the hole situated on chain bar 14 and serves as a coupling means between the rod 23 and chain bar 14. Rotation of tensioning handwheel 38 thus drives rod 23 along a longitudinal axis relative to the housing 12 to adjust the tension in the saw chain.

[0029] The distance between the chain bar 14 and the sprocket 22 can therefore be changed by means of the ability of the chain bar 14 to be longitudinally displaced so that the saw chain 16 can be correctly set. Typically, a working tension will be adjudged by the lateral play of the saw chain at the longitudinal mid-point of the chain bar, and whereby approximately 2mm of play will be suitable. The wheel should be rotated in detent fashion in a controlled manner until the desired chain tension is attained. The clamping handwheel 36 is then screwed axially into place toward the housing 12 on the stay bolt 15. This procedure clamps the chain bar 14 axially into the desired position.

[0030] In an alternative arrangement (not shown) an annular stop plate located on chain bar 14, serves as a coupling means between rod 23 and chain bar 14. The stop plate is secured to the chain bar in a fixed manner, and a tab protrudes laterally from the plate and engages with the second end 35 of rod 23. The cam 30, through its spiral outer circumference, thus determines the position of the stop plate and therefore the position of the chain bar 14.

[0031] The inner-side of tensioning handwheel 38 further comprises a wall 45 parallel to the circumference of cam 30. The outer circumference of cam 30 and the wall 45 thereby create a channel in which the kinked first end 34 of rod 23 can travel, upon rotation of tensioning handwheel 38. The channel is of generally uniform width to provide good location of the first end 34 of rod 23. The channel thereformed extends to allow about 230 degrees of rotation. Cam 30 is rotatable beyond this.

[0032] Both handwheels 36,38 have central wheel grips 39 that protrude axially and permit the handwheel

36,38 to be comfortably gripped and rotated.

[0033] In order to detach the sprocket cover 26, for example, for the purpose of changing the saw chain 16, clamping handwheel 36 is rotated in the slackening direction until the internally threaded section has been completely released from the stay bolt 15. Subsequently, the sprocket cover 26 can be moved axially away from the housing 12. After this, the chain bar 14 can be removed axially from the housing 12 past the stay bolt 15. The chain can be replaced without the user having to dismantle the tensioning mechanism.

[0034] In order to tension the saw chain 16, the reverse of the above process is carried out. In this manner, after the chain bar 14 has been located against chain bar anchor plate 13, engaged with the second end of rod 23 and the saw chain has been engaged with sprocket 22, the sprocket cover is replaced and the clamping handwheel 36 partially tightened. Tensioning handwheel 38 is then rotated to move chain bar 14 away from the sprocket 22 and the saw chain is set to the correct tension. Once the desired saw chain tension is attained, the clamping handwheel 36 is turned until the handwheel 36 cannot be rotated any further.

[0035] In this position, the clamping handwheel 36 of the chain tensioning device secures the sprocket cover 26 without play to the housing 12 of the chain saw 10.

[0036] The configuration of the chain tensioning device allows the saw to be used in "boring" operation, the chain bar 14 and saw chain 16 are pushed longitudinally into the timber being cut so that the nose of the chain bar penetrates the timber. This can lead to a substantial longitudinal force on the chain bar, which could partially overcome the clamping force and tend to push it back toward the drive sprocket. This would cause the tensioning in the saw chain 16 to reduce. The circumferential notches or detents 37 of the cam 30 prevent retrogressive rotation of the cam to prevent slackening of the chain during boring operations. This arrangement also acts to prevent a loss of tension in the event that the clamping wheel 36 is inadequately tightened.

[0037] An important advantage of the arrangement of the present invention is the complete separation of the tensioning and clamping mechanisms, in a manner which is simple to understand and use. As adjustment is made easier, it is more likely that users will adjust the chain saw correctly and as regularly as necessary. Safety of operation is therefore also improved.

Claims

1. A motorised chain saw comprising a housing, a sprocket mounted thereon, and a chain bar which extends beyond the housing and guides a saw chain engaged with the sprocket in a revolving manner; wherein the chain bar is mounted longitudinally adjustably in relation to the housing and the sprocket by means of a chain tensioning device, and the chain

tensioning device comprises:

- i) a clamping means;
- ii) a tensioning means in the form of a cam, rotatable by means of a rotational member; and
- iii) an elongate actuation member intermediately engageable at a first end thereof with said cam,

wherein the cam has a circumferential surface contoured for engagement with the elongate actuation member, and in which the rotational member and clamping wheel rotate about parallel, non-coaxial, axes; and wherein the chain bar further comprises a complementary elongate actuation member-engaging means, and rotation of the rotational member causes the cam to rotate and engage with the elongate actuation member to abut and longitudinally drive the chain bar relative to said sprocket, at a second end thereof.

2. A chain saw as claimed in Claim 1 wherein the elongate actuation member-engaging means comprises a recess.
3. A chain saw as claimed in Claim 1 wherein the elongate actuation member-engaging means comprises a hole passing through the chain bar.
4. A chain saw as claimed in Claim 1 wherein the elongate actuation member-engaging means comprises a flange located on the chain bar.
5. A chain saw as claimed in Claim 1 in which the circumferential surface comprises a plurality of notches or detents to provide defined increments of tension setting.
6. A chain saw as claimed in Claim 5 in which the notches or detents prevent reverse rotation of the cam when load forces transmitted through the elongate actuation member from the chain bar are exerted upon the cam.
7. A chain saw as claimed in any one of claims 4 to 6 wherein the notches or detents are engageable with a kink in the first end of the elongate actuation member.
8. A chain saw as claimed in Claim 7 in which the kink is substantially parallel to the axis of the cam.
9. A chain saw as claimed in any one of claims 1 to 8 in which the cam is coaxially engageable with the rotational member.
10. A chain saw as claimed in Claim 9 in which the rotational member further comprises a retracting means, engageable with the elongate actuation

member and for retraction thereof, for relieving tension held in the saw chain.

11. A chain saw as claimed in Claim 10 wherein the retracting means comprises a wall of the rotational member. 5
12. A chain saw as claimed in Claim 11 in which the wall of the rotational member is vertically aligned substantially parallel to an axis upon which the cam rotates. 10
13. A chain saw as claimed in Claim 12 in which the wall is parallel to and radially spirals outside of the cam circumference. 15
14. A chain saw as claimed in any one of claims 7 to 13 wherein the wall engages with the kink in the first end of the elongate actuation member. 20
15. A chain saw as claimed in any one of the preceding claims in which the rotational member engages the cam in a rotation-transmitting manner.
16. A chain saw as claimed in Claim 15 in which the engagement is by way of a peg and socket location. 25
17. A chain saw as claimed in Claim 16 in which the peg is located on the rotational member and is engageable with a socket located in the cam. 30
18. A chain saw as claimed in any one of the preceding claims wherein the rotational member for rotating the cam is fixedly attached to the chain saw housing. 35
19. A chain saw as claimed in any one of the preceding claims wherein the rotational member, for rotating the cam, and the clamping means each comprise a rotatable handwheel. 40
20. A chain saw as claimed in Claim 19 wherein the chain bar clamping handwheel is located on a removable sprocket cover.
21. A chain saw as claimed in Claim 20 in which the chain bar clamping handwheel retains the sprocket cover on the chain saw housing. 45
22. A chain saw as claimed in Claim 20 or Claim 21 in which the sprocket cover comprises a hole to allow workable access to the tensioning handwheel when the chain saw is in an assembled configuration. 50
23. A chain saw as claimed in any one of the preceding claims in which the elongate actuation member comprises a rod. 55

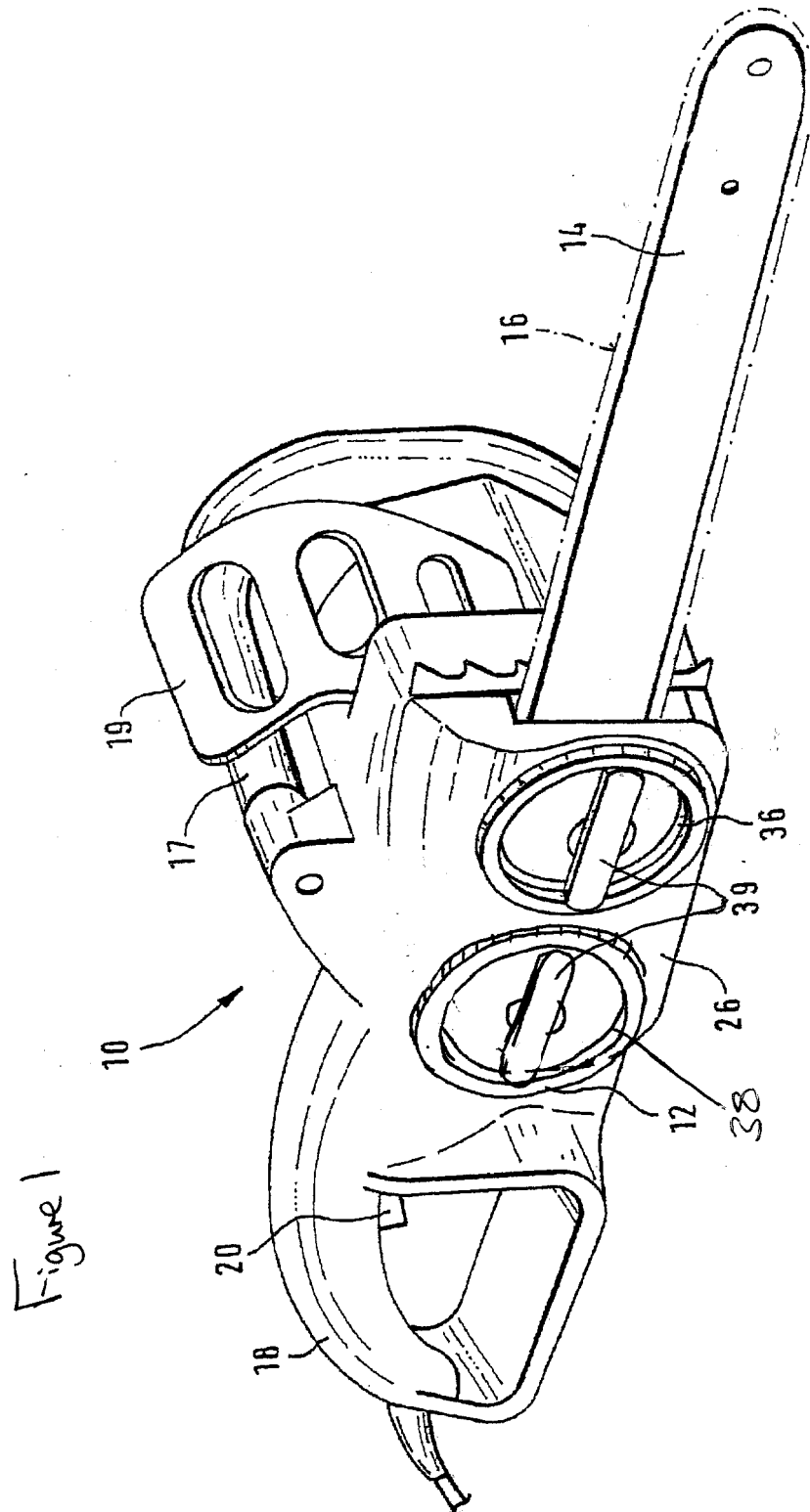


Figure 2

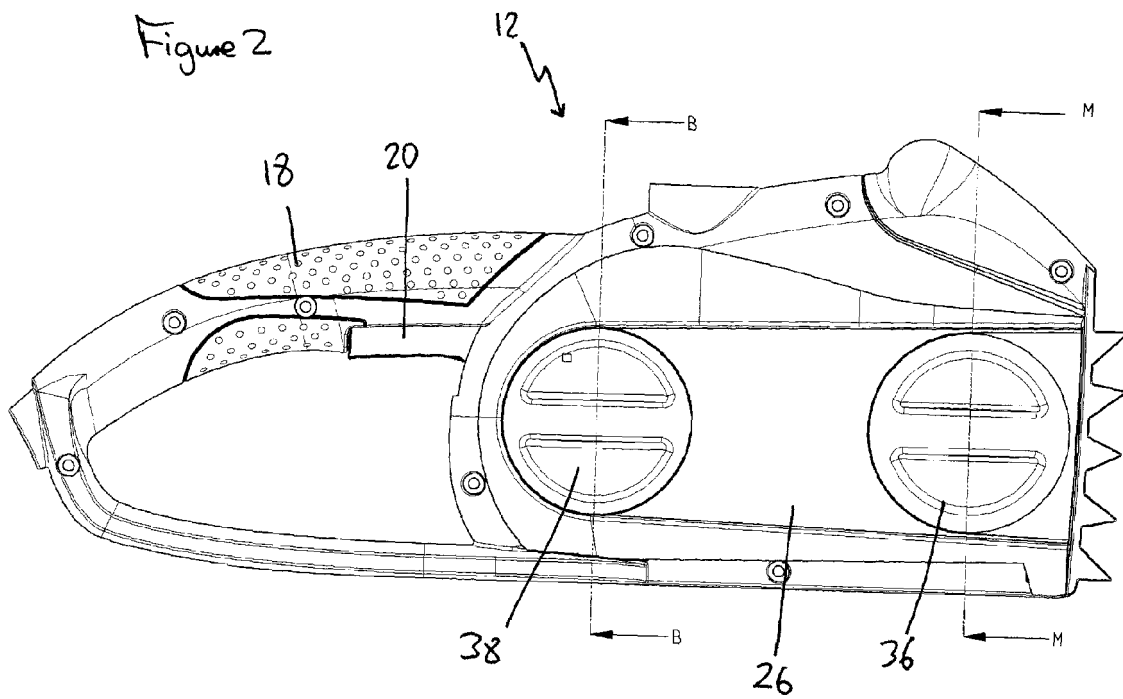


Figure 3

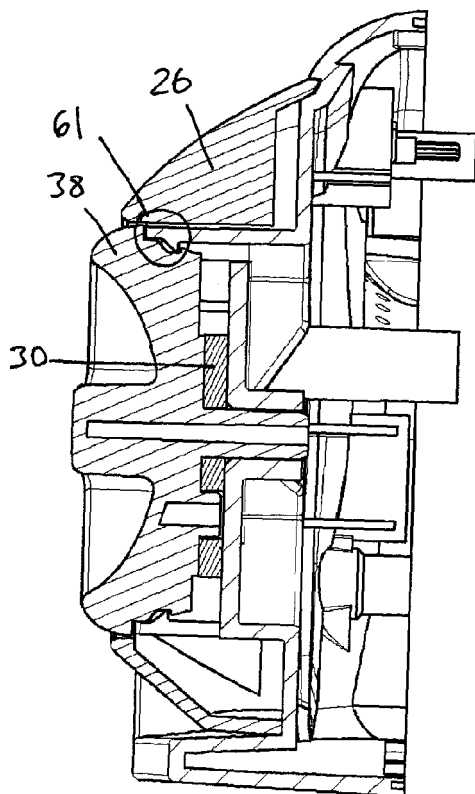


Figure 4

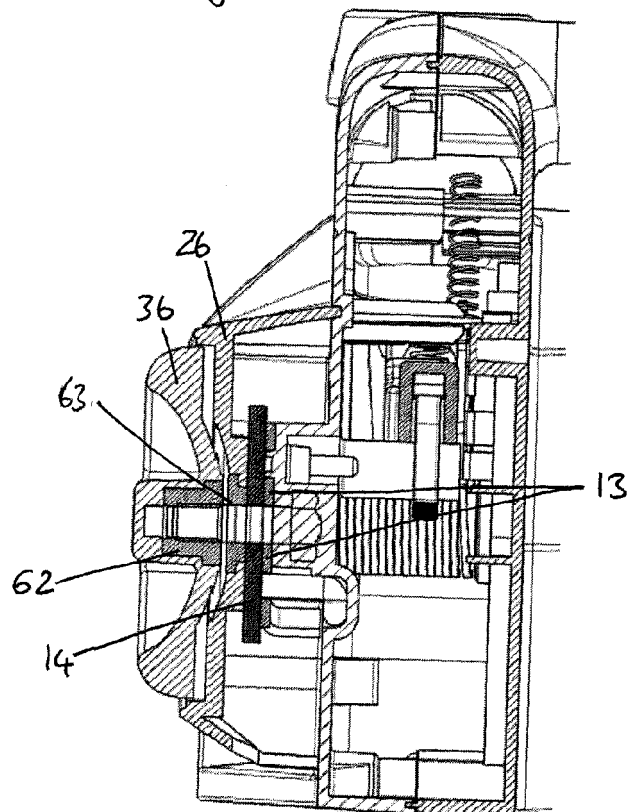


Figure 5

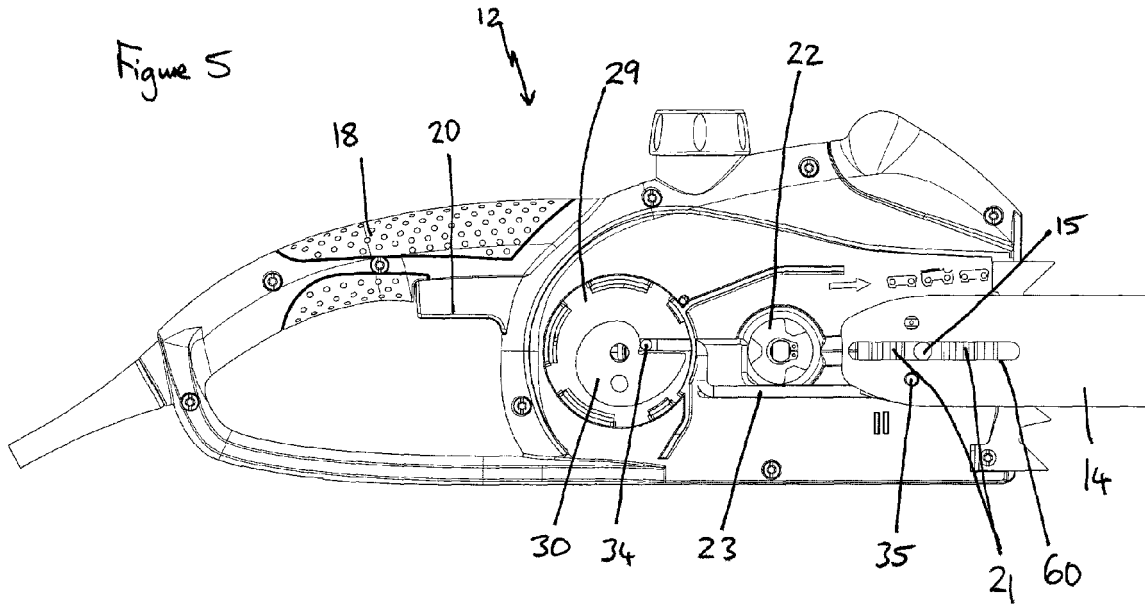
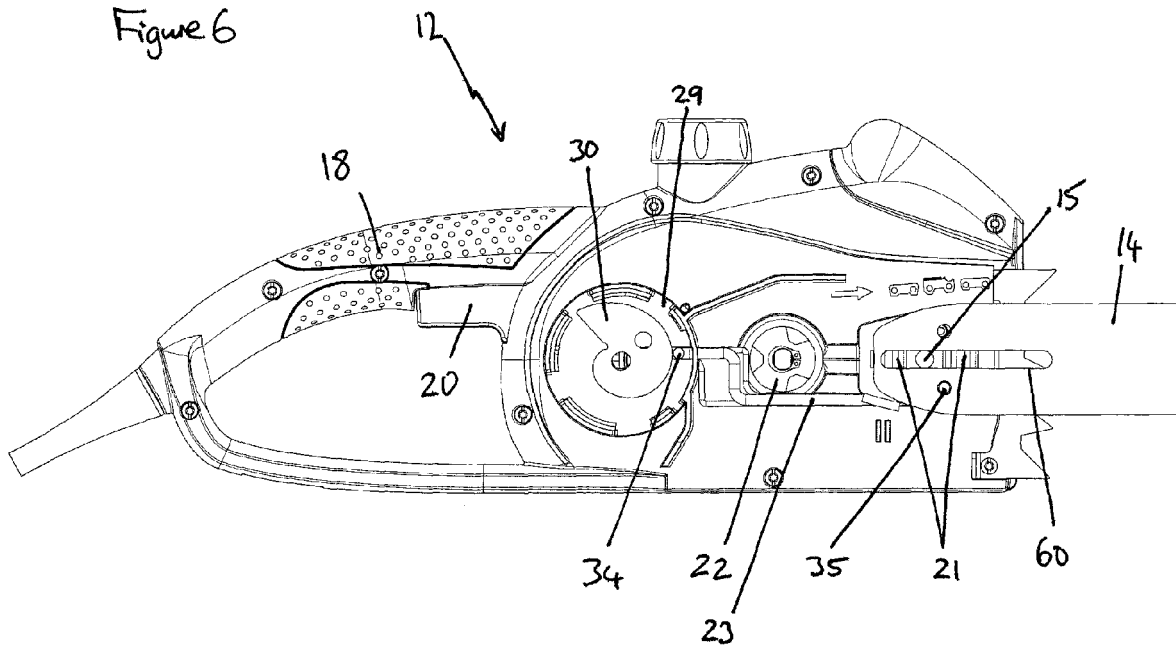


Figure 6



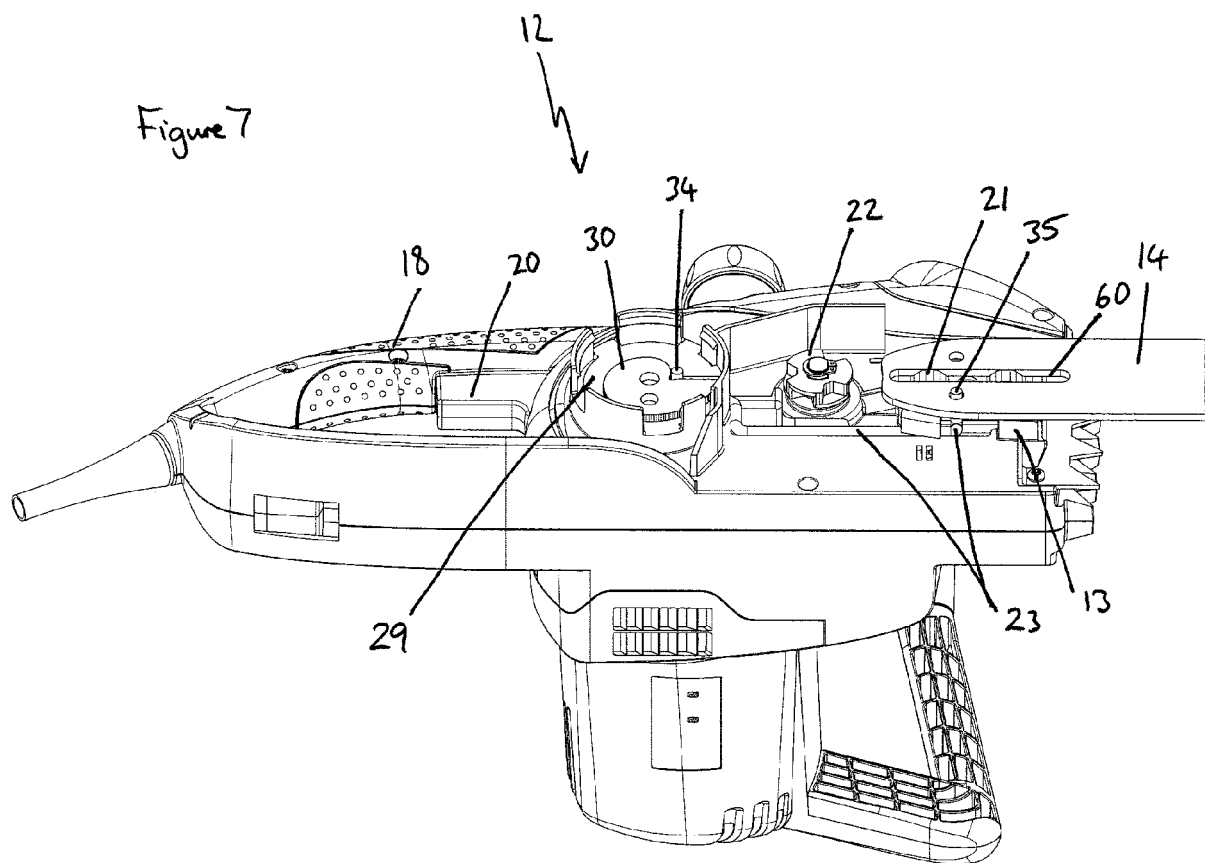


Figure 8

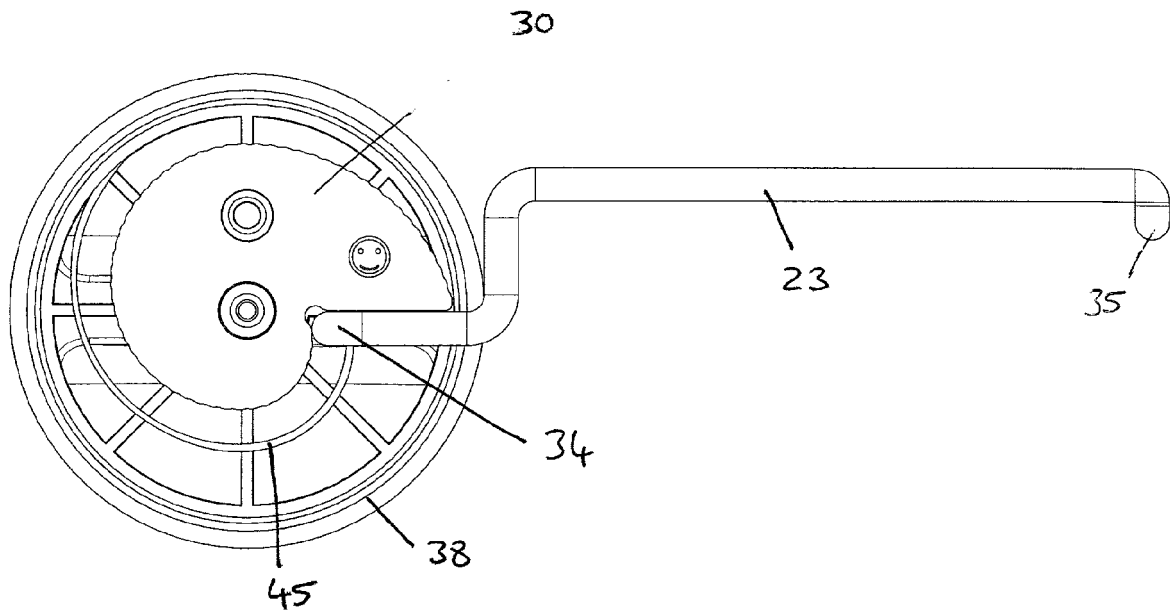
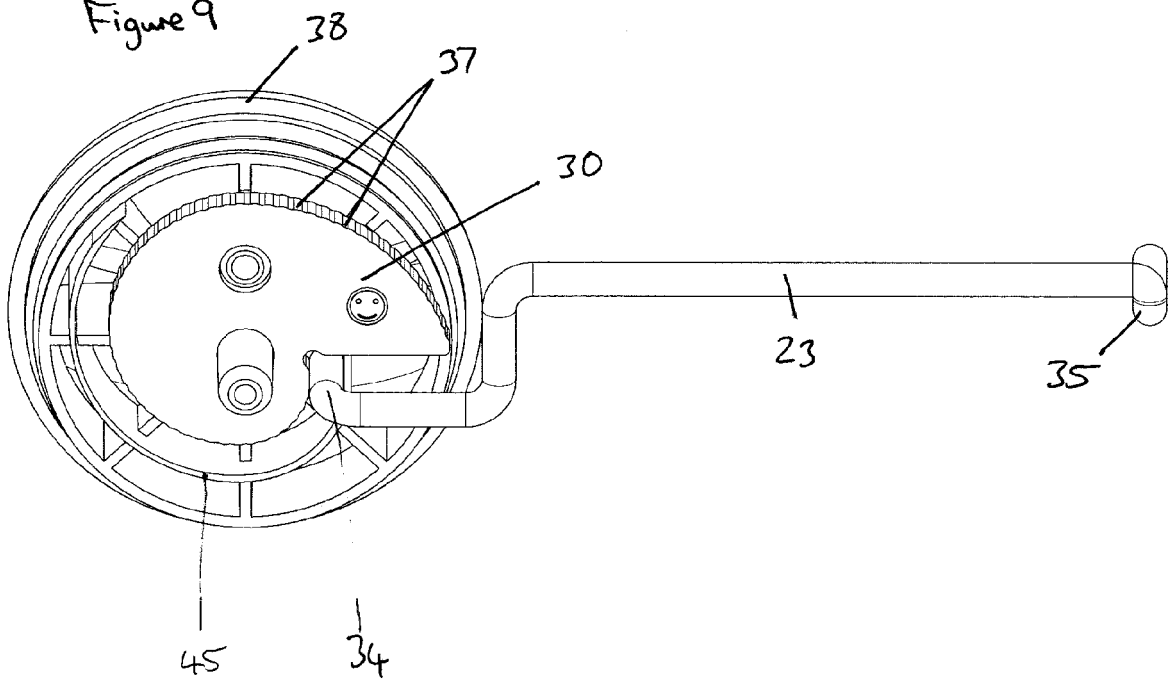


Figure 9



REFERENCES CITED IN THE DESCRIPTION

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