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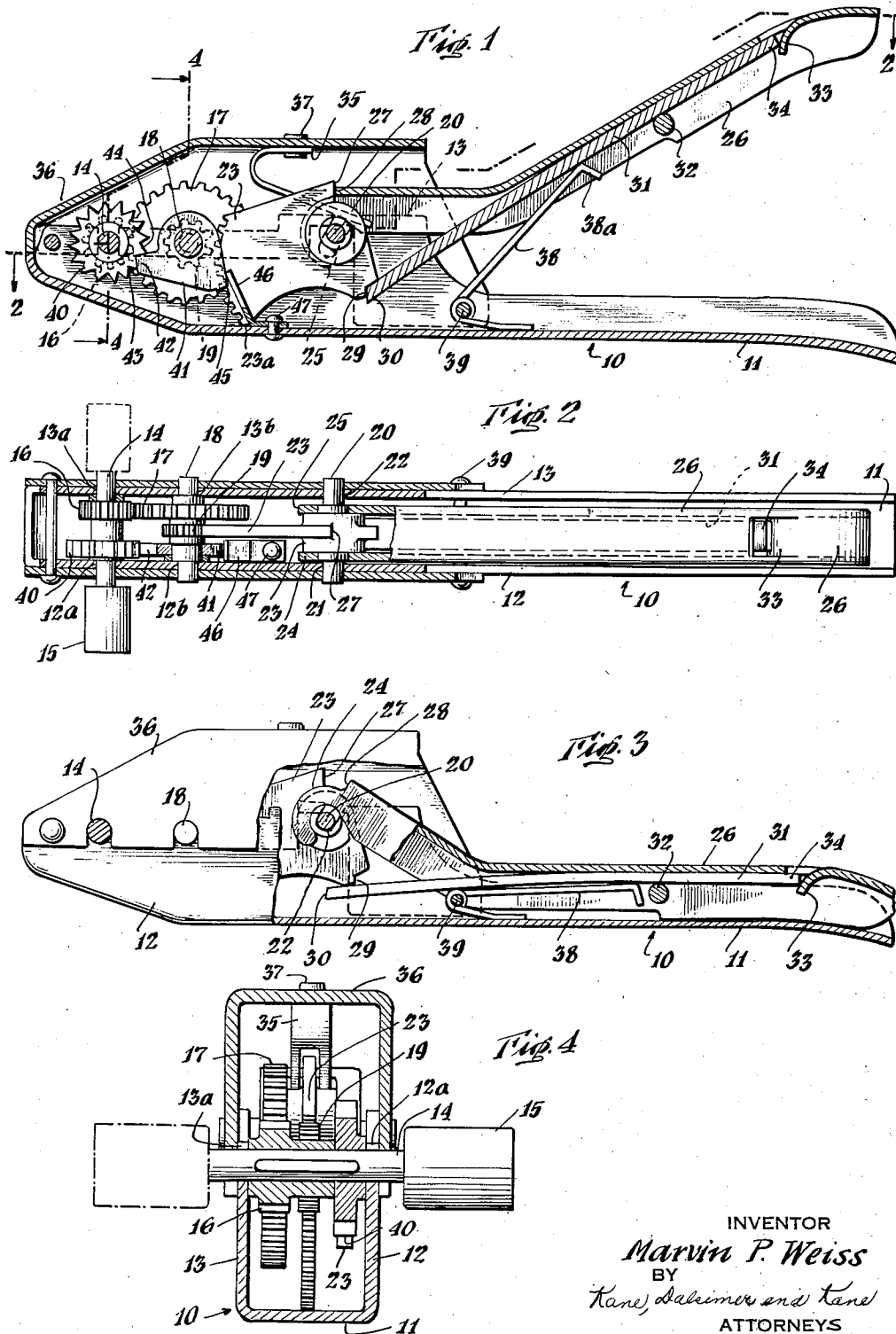
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2,831,384

PLIER-TYPE GEAR OPERATED RATCHET TOOL

Filed June 8, 1956

2 Sheets-Sheet 1



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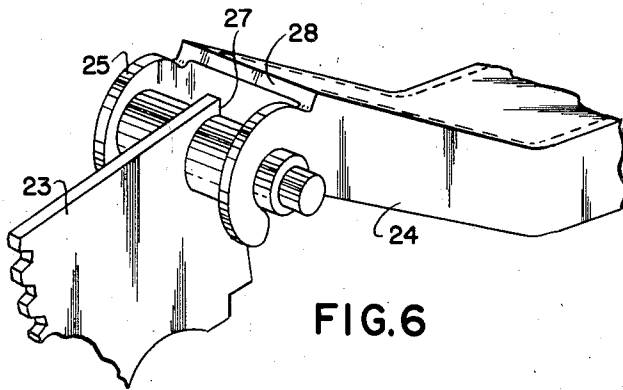


FIG. 6

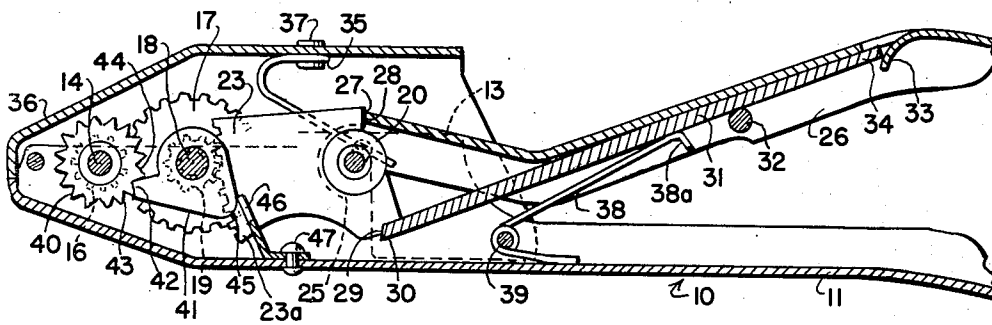


FIG. 5

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PLIER-TYPE GEAR OPERATED RATCHET TOOL

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13 Claims. (Cl. 81—57)

This invention relates generally to ratchet wrenches and more particularly to a plier-type gear operated ratchet wrench.

There are many instances when one using a wrench such as a socket wrench does not have the necessary space to move the handle in lever fashion more than a few inches. When a tool of this type is used the bolt or nut which is being loosened or tightened is rotated with each movement of the handle only a fraction of a complete turn. The result is that a long, fatiguing back and forth movement must be undertaken until the bolt or nut is completely loosened or tightened.

The invention herein disclosed has as its principal object the provision of a socket wrench which will enable the operator to rapidly rotate a bolt or nut which is mounted in such a position that there is little surrounding space wherein a tool may be used.

Another object of the present invention is to provide a socket wrench which has a mechanical advantage so that slight movement of its handle will effect many rotations of the socket portion and which may be used as an ordinary wrench if it is so desired.

A further object of this invention is the provision of a tool having a socket portion which will be rotated when the tool handle is depressed and will be prevented from rotating when the handle is returned to its original position.

Another object of this invention is the provision of a safety means which will prevent the tool from being damaged due to overloading.

Still another object of the present invention is to provide a speed socket tool which is of simple construction and has relatively few parts so that it may be manufactured inexpensively.

The construction of the speed socket tool and manner of using the same is described herein with reference to the drawings in which:

Fig. 1 is a partially sectional side elevation of a tool embodying my invention;

Fig. 2 is a sectional view taken on the drawing shown in Fig. 1 along the line 2—2, showing a socket positioned for rotation in one direction and another socket shown in phantom positioned for opposite rotation;

Fig. 3 is a partially sectional side elevation of my invention showing the handle of the tool in a depressed position; and

Fig. 4 is a front elevation in section showing in detail the interaction of the various gears;

Fig. 5 is a partially sectional side elevation of the tool shown in Fig. 1 with the handle thereof shown partially rotated;

Fig. 6 is a segmentary perspective view of the handle pivotal mounting.

The invention herein is described in terms of a socket wrench, however, it is to be understood that the socket head can be adapted to turn a screw or other form of mechanical component of the type which requires turning about an axis.

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As shown in the figures, the tool consists of a supporting structure designated generally as 10 which is stamped out of metal and folded to form base 11 and sides 12 and 13 which extend for the length of base 11. At one end of the supporting structure each of the sides is restricted in height so that it can be easily grasped in the hand of an operator.

Member 14 upon which is mounted socket 15 is rotatably supported by sides 12 and 13 in slots 12a and 13a respectively formed in the sides. Member 14 is a conventional shaft having a hexagonal cross-section at each of its end portions. This cross-sectional construction is employed so that conventional socket 15 when placed thereon will be restricted from rotary motion relative to member 14. However, member 14 can have a differently shaped cross-section or any other construction by which relative motion between member 14 and socket 15 is prevented.

The teeth of gear 16 which is also mounted on member 14 mesh with the teeth of gear 17 which is mounted on axial member 18. Axial member 18 is rotatably supported at each of its ends in slots in sides 12 and 13 of tool 10. Thus one end of member 18 is supported by side 12 in slot 12b and the other end of member 18 is supported by side 13 in slot 13b. Axial member 18 is thereby supported in a plane parallel to base 11. It will be noted that gear 17 has a greater number of teeth than gear 16 thereby effecting a step-up gear ratio between gear 17 and gear 16. The operation of pinion 19 which is also mounted on axial member 18 will be explained below.

The ends of axial member 20 are fitted in slots 21 and 22 in sides 12 and 13 respectively. Member 20 is a cylindrical shaft forming an axis which supports gear section 23 and about which the gear section can pivot. It will be noted from Fig. 1 that slots 21 and 22 are identical and elongated having their major axes forming the same angle with base 11 of structure 10. Semi-circular members 24 and 25 which are identical and in spaced relation to each other extend from an end of handle 26. Members 24 and 25 partially encircle shaft 20 thereby forming a pivotal mounting for handle 26. Members 24 and 25 are so spaced that section 23 is supported by shaft 20 between them and so that there can be relative rotational motion between section 23 and members 24 and 25.

Section 23 and handle 26 have surfaces thereon designated 27 and 28 respectively which abut against each other when the handle is not completely depressed such as seen in Fig. 1 and section 23 has in addition portion designated 29, which is formed to receive end 30 of leaf spring 31 as seen in Fig. 1.

Leaf spring 31 is maintained on handle 26 by being snugly held between the top handle 26 and pin 32 which is rigidly fastened to the handle. Portion 33 of handle 26 maintains end 34 of leaf spring 31 in position on the handle.

It is seen in Fig. 1 that when the handle 26 is not completely depressed section 23 is held in position by the abutment of surfaces 27 and 28 and end 30 of leaf spring 31 which is engaging portion 29 of section 23. It is also noted that leaf spring 31 is held in such position that it is slightly arcuate. The reason for this will be explained below when the operation of the tool is considered.

The upper surface of axial member 20 is in contact with spring 35 which is mounted on cover 36 at 37 and which yieldingly presses member 20 downwardly in slots 21 and 22. Spring 35 cannot, however, force member 20 from its upper position in slots 21 and 22 when the handle is not depressed. This is because the underlying surface 23a of gear section 23 is so formed that it is in contact with base 11 when the handle is in this position.

When handle 26 is depressed in opposition to the action of coil spring 38 which is mounted about member 39 as it extends through sides 12 and 13, the handle rotates about member 20 in a clockwise direction. Gear section 23 also rotates clockwise and its underlying surface 23a moves out of contact with base 11 thereby allowing spring 35 to force member 20 downwardly in slots 21 and 22. It will be noted that in Fig. 1 where handle 26 is shown in a released position, member 20 is in the upper portion of slots 21 and 22, however, upon depression of handle 26 member 20 will move to the lower portion of slots 21 and 22.

It should be noted also that when member 20 is in the upper portion of slots 21 and 22, the distance between the axis of rotation of gear section 23, which is the center of the cross-section of member 20, and the axis of rotation of gear 19 which is the center of the cross-section of axial member 18, is so great that the teeth of gear section 23 cannot mesh with the teeth of gear 19. However, when member 20 moves to a lower portion of slots 21 and 22 the distance between the axes of rotation of gear 19 and gear section 23 will decrease so that the teeth on gear section 23 mesh with the teeth on gear 19. In Fig. 1 handle 26 is shown in a slightly depressed position such that the gear teeth of section 23 are beginning to mesh with the teeth of gear 19.

Member 14 also has rigidly connected thereto gear 40 the teeth of which cooperate with pawl member 41 to provide ratchet action so that member 14 is rotatable in one direction only. In Fig. 1 it is seen that single tooth 42 of pawl member 41 which is loosely mounted on shaft 18 lies between any pair of teeth on gear 40. In this figure, these teeth are designated 43 and 44 for illustrative purposes. Edge 45 of pawl member 41 is contacted by leaf spring 46 which yieldingly urges pawl member 41 toward gear 40 and tooth 42 between teeth 43 and 44. Leaf spring 46 is fastened to base 11 at 47.

Gear 40 can rotate clockwise (as seen in Fig. 1) since rotation in that direction will cause tooth 44 to push against tooth 42 and pawl member 41 to pivot about shaft 18 in a counterclockwise direction forcing edge 45 against leaf spring 46 which bends a bit due to its resiliency allowing tooth 44 and the other teeth of gear 40 to become free from tooth 42. If, however, it was attempted to rotate member 14 counterclockwise, tooth 43 would be forced against tooth 42. Due to the construction of tooth 42 and pawl 41 the pawl would not pivot about its axis and a wedging action would result, thus preventing further counterclockwise rotation of member 14.

To use my invention to loosen a bolt, socket 15 is placed upon the bolt and handle 26 is depressed by the operator against the action of spring 38 which normally maintains handle 26 in the released position away from base 11 of tool 10.

When handle 26 is depressed in opposition to spring 38, member 20 is guided downwardly in the slots 21 and 22 by the action of spring 35 and the end 38a of spring 38 slides rearwardly in handle 26. As this is done, the teeth of gear section 23 engage the teeth on pinion 19 and as gear section 23 rotates clockwise about member 20, shaft 18 rotates counterclockwise in its mountings. As shaft 18 rotates counterclockwise member 14 and socket 15 are rotated clockwise by gear 17 which is mounted on shaft 18. The clockwise rotation of socket 15 continues until handle 26 is brought into a position wherein handle 26 is flush with base 11.

It will be noted that pawl 41 has allowed gear 40 to rotate clockwise with shaft 14. Gear 16 which is attached to member 14 will continue to rotate clockwise until handle 26 is adjacent base 11. However, upon release of handle 26 spring 38 will force this handle back into a position away from base 11.

Pawl 41, however, will not permit gear 40 to rotate

counterclockwise since counterclockwise rotation of gear 40 will force tooth 42 of pawl 41 into the teeth of gear 40 and prevent further counterclockwise rotation of member 14.

When handle 26 is released member 20 moves upwardly in slots 21 and 22 against the action of spring 35 thereby causing the teeth of gear section 23 to disengage themselves from the teeth of gear 19.

In the present embodiment gear section 23 has the same number of teeth as gear 19. Gear 17 has 32 teeth and gear 16 has 16 teeth giving a ratio of two to one. The gear section 23 moves through an arc of one inch and the handle 24 moves through an arc of four inches. This is a mechanical advantage of four; but with the two to one ratio, the net mechanical advantage is two. The net mechanical advantage may be changed, however, by altering the various ratios.

An important feature of this invention is the overload protection feature. If an operator attempts to use the tool to rotate a bolt which was restricted from rotation the gears of the tool would be stripped were not this safety feature provided.

Considering Fig. 1, it is seen that end 30 of leaf spring 31 is maintained at portion 29 of section 23 by means of friction force. This force is sufficient to keep end 30 in portion 29 during normal operation. If, however, an overload condition is reached member 14 would not turn and section 23 would not rotate but the operator would continue attempting to bring handle 26 in contact with base 11. Since gear 23 is under this condition rigid, the friction which maintains end 30 in portion 29 would be overcome before any of the gears are damaged and end 30 would rotate about shaft 20 until it became flush with base 11 but gear section 23 would not rotate and the condition seen in Fig. 3 would be achieved. Upon release of handle 26, it would return to the released position due to the action of spring 38.

Thus, among others, the several objects in the invention as specifically aforementioned are achieved.

Obviously, numerous changes in construction and arrangement of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. A hand tool comprising in combination a handle member, a rotatable member mounted on said handle member, a gear section pivotally mounted on said handle member, gear means attached to said rotatable member, said gear section having the teeth thereof normally disengaged from said gear means, means yieldingly urging the teeth of said gear section toward engagement with said gear means, means for preventing engagement of said gear section and said gear means in one position of said section and means for varying the position of said gear section.

2. A hand tool comprising in combination a fixed handle member, a rotatable member mounted on said handle member, gear means mounted on said rotatable member, an axial member rotatably mounted on said handle member, second gear means mounted on said axial member and engaging said first gear means, a shaft rotatably mounted on said handle member, a gear section mounted on means yieldingly urging the teeth of said gear section toward engagement with said second gear means, means maintaining said shaft, said axial member and said shaft normally spaced apart so that the teeth of said gear section are disengaged from said second gear means, means for moving said shaft into a position where the teeth of said gear section engage with said second gear means and means for rotating said gear section.

3. A hand tool comprising in combination a fixed handle member, a rotatable member mounted on said handle member, gear means mounted on said rotatable member, an axial member rotatably mounted on said handle mem-

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ber, second gear means mounted on said axial member, a pair of parallel slots formed in said handle member, said slots lying in planes perpendicular to said axial member and having the upper portions of said slots further removed from said axial member than the lower portions of said slots, a shaft rotatably supported by said handle member in said slots, a gear section mounted on said shaft, means for normally maintaining said shaft in the upper portion of said slots whereby the teeth of said gear section are disengaged from said second gear means, means for moving said shaft to the lower portions of said slots whereby the teeth of said gear section engage with said second gear means and means for rotating said gear section.

4. A hand tool in accordance with claim 3 in which the means for maintaining the shaft in the upper portions of the slots consists of a surface on the gear section contacting the handle member.

5. A hand tool in accordance with claim 3 in which the means for rotating the gear section consists of a lever which is attached to the gear section.

6. A hand tool comprising in combination a channel shaped fixed handle member, a base portion of said handle member, a side of said handle member perpendicular to said base portion, a second side of said handle member parallel to said first side, said second side being spaced from said first side, a rotatable member supported by said sides, means for supporting a work piece on said rotatable member, gear means mounted on said rotatable member, an axial member rotatably supported by said sides, second gear means mounted on said axial member, a pair of parallel slots formed in said sides, said slots having the upper portions thereof further removed from said axial member than the lower portions of said slots, a shaft rotatably supported by said sides in said slots, a gear section mounted on said shaft, a lever arm which extends from said gear section, a spring attached to said handle member and yieldingly urging said lever arm away from said base, an underlying surface of said gear section which is in contact with said base thereby maintaining said shaft in the upper portions of said slots and the teeth of said gear section disengaged from said second gear means, and second spring means attached to said mounting and yieldingly urging said shaft toward the lower portions of said slots, whereby upon movement of said lever toward said base to remove said underlying surface from contact with said base said second spring will force said shaft to the lower portions of said slots so that the teeth of said gear section will engage with and rotate said second gear means.

7. A hand tool comprising in combination a fixed handle member, a rotatable member mounted on said handle member, gear means mounted on said rotatable member, second gear means rotatably mounted on said handle member and engaging said first gear means, a gear section pivotally mounted on said handle member with the teeth thereof normally disengaged from said second gear means, means yieldingly urging engagement of the teeth of said gear section with said second gear means, means for preventing engagement of the teeth of said gear section with said second gear means in one position of the gear section, means for rotating said gear section about its pivotal mounting to change its position and ratchet means mounted in relation to said handle member and engaging said rotatable member to allow said rotatable member to rotate solely one way.

8. A hand tool comprising in combination a fixed handle member, a rotatable member mounted on said handle member, gear means mounted on said rotatable member, an axial member rotatably mounted on said handle member, second gear means mounted on said axial member and engaging said first gear means, a shaft rotatably mounted on said handle member, a gear section mounted on said shaft, means for maintaining said axial member and said shaft normally spaced apart so that the teeth

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of said gear section are disengaged from said second gear means, means yieldingly urging said axial member and said shaft toward each other, means for releasing means for maintaining the said axial member and said shaft apart so that said shaft can shift into a position where the teeth of said gear section engage with said second gear means, means for rotating said gear section, third gear means mounted on said rotatable member, a pawl loosely mounted on said axial member, a tooth on said pawl, and means yieldingly urging said tooth to engage said third gear means, said pawl being so constructed and arranged that said third gear means can slip by said tooth solely in one direction of rotation of said rotatable member.

9. A hand tool comprising in combination a fixed handle member, a rotatable member mounted on said handle member, gear means mounted on said rotatable member, an axial member rotatably mounted on said handle member, second gear means mounted on said axial member and engaging said first gear means, a shaft rotatably mounted on said handle member, a gear section mounted on said shaft, means for maintaining said axial member and said shaft being normally spaced apart so that the teeth of said gear section are disengaged from said second gear means, means yieldingly urging said axial member and said shaft toward each other, means for releasing the means for maintaining said axial member and said shaft apart so that said shaft will move into a position where the teeth of said gear section engage with said second gear means, means for rotating said gear section, third gear means mounted on said rotatable member, a pawl loosely mounted on said axial member, a tooth on said pawl, and a spring attached to said handle member and yieldingly urging said tooth to engage said third gear means, said pawl being so constructed and arranged that upon rotation of said rotatable member in a predetermined direction said third gear means can press against said tooth and pivot said pawl about said axial member against the urging of said spring whereby said third gear means can slip by said tooth.

10. In a hand tool a shaft, a gear section mounted on said shaft, a lever mounted on said shaft, a surface on said gear section, a second surface on said lever, a third surface on said gear section, a member mounted on said lever, said member having an end thereof frictionally engaging said third surface whereby said first and second surfaces are maintained in contact.

11. In a hand tool a handle member, a shaft supported by said handle member, a gear section mounted on said shaft, a lever mounted on said shaft, a surface on said gear section, a second surface on said lever near a third surface on said gear section, a leaf spring mounted on said lever, said spring having an end thereof frictionally engaging said third surface and yieldingly urging said first and second surfaces together.

12. A hand tool comprising in combination a channel shaped fixed handle member, a base portion of said handle member, a side of said handle member perpendicular to said base portion, a second side of said handle member parallel to said first side, said second side being spaced from said first side, a rotatable member supported by said sides, means for supporting a work piece on said rotatable member, gear means mounted on said rotatable member, an axial member rotatably supported by said sides, second gear means mounted on said axial member, a pair of parallel slots formed in said sides, said slots having the upper portions thereof further removed from said axial member than the lower portions of said slots, a shaft rotatably supported by said sides in said slots, a gear section mounted on said shaft, a lever arm mounted on said shaft, a surface on said gear section, a second surface on said lever arm, a third surface on said gear section, a member mounted on said lever, said member having an end thereof frictionally engaging said third surface whereby said first and sec-

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ond surfaces are maintained in contact, a spring attached to said handle member and yieldingly urging said lever arm away from said base, an underlying surface of said gear section which is in contact with said base thereby maintaining said shaft in the upper portions of said slots and the teeth of said gear section disengaged from said second gear means, second spring means attached to said mounting and yieldingly urging said shaft toward the lower portions of said slots whereby upon movement of said lever toward said base to remove said underlying surface from contact with said base, said second spring will force said shaft to the lower portions of said slots so that the teeth of said gear section will engage with and rotate said second gear means, third gear means mounted on said rotatable member, a pawl loosely mounted on said axial member, a tooth on said pawl, a third spring attached to said mounting and yieldingly urging said tooth to engage said third gear means, said pawl being so constructed and arranged that upon rotation of said rotatable member in a predetermined direction said third gear means can press against said tooth and pivot said pawl about said axial member against the urging of said third spring, whereby said third gear means can slip by said tooth.

13. In a hand tool a handle member, a gear section

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rotatably mounted on said handle member, gear means supported by said handle member and meshed with the teeth of said gear section, a surface on said gear section, a lever pivotally mounted on said handle member, a second surface of said lever, said second surface abutting said first surface, spring means yieldingly urging said first and second surfaces in abutment during normal rotation of said gear section, and said spring means having a compression force which is overcome when a predetermined force prevents said gear means and said gear section from rotating normally.

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