

[54] **RATCHET-TYPE SPEED WRENCH**

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[51] Int. Cl. **B25b 13/46**

[58] Field of Search 81/119, 121 R, 121 B, 81/90 R, 90 B, 90 D, 186, 426, 425 R

[56] **References Cited**

UNITED STATES PATENTS

584,591	6/1897	Johnson	81/119
2,652,735	9/1953	Wilder	81/119

Primary Examiner—James L. Jones, Jr.

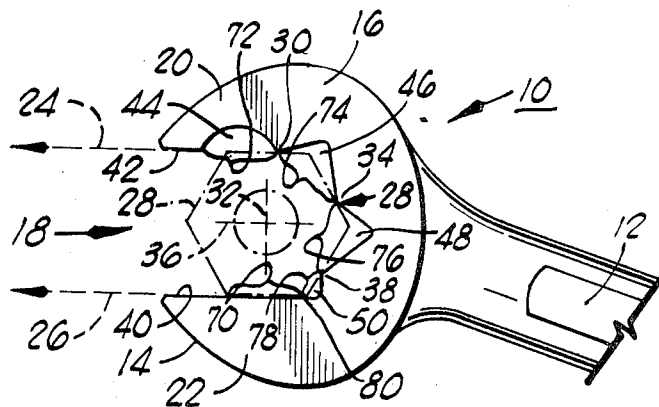
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[57] **ABSTRACT**

An improved open end wrench which is adapted for turning hexagonal head nuts, the wrench being of unitary formation with no moving parts yet having the capability of ratchet-type wrench return between successive power strokes. The wrench consists of a one piece formation of uniform substance having jaw portions which define a recessed wrench surface or configuration of non-symmetrical character which is capable of extending four surfaces into bearing contact with a hexagonal head nut during power stroke, but is capable of unobstructed reverse or return stroke about substantially the same axis of revolution.

9 Claims, 5 Drawing Figures



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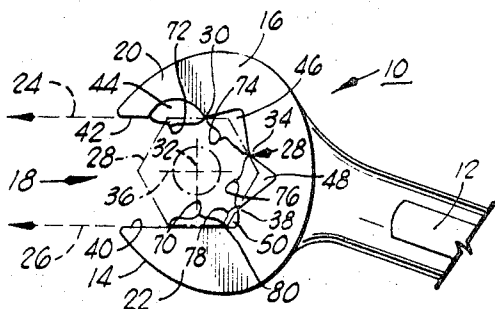


FIG. 1

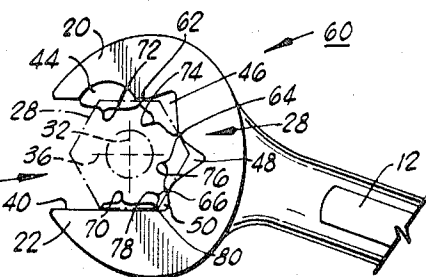


FIG. 2

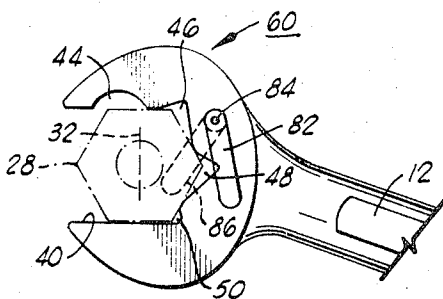


FIG. 3

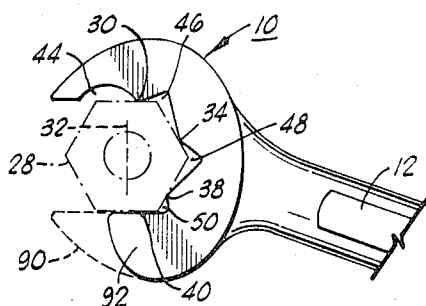


FIG. 4

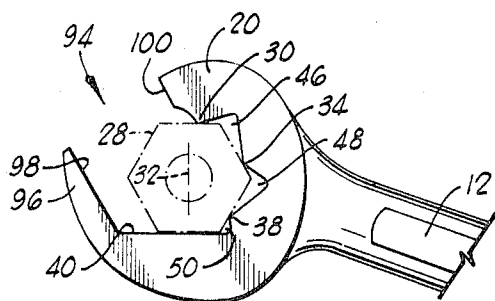


FIG. 5

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RATCHET-TYPE SPEED WRENCH

CROSS REFERENCE TO RELATED APPLICATION

The present invention is related to the subject matter of both of U.S. Pat. application Ser. No. 36,778 filed on May 13, 1970, in the name of James P. Evans and entitled "Speed Wrench", and the U.S. Patent application entitled "Improvements in Speed Wrenches" as filed on June 28, 1971 by the same inventor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to open end wrenches for hex nut operation and, more particularly, but not by way of limitation, it relates to improvements in unitarily formed open end wrenches having the effective capability of a ratchet-type action.

2. Description of the Prior Art

The prior art includes a great many types of wrench design which serve to turn nuts in a way that reduces the applied power required in order to tighten or loosen the nut, and which variations may include still other modifications serving to make the wrench extremely flexible and adaptable relative to the various types and sizes of nuts which may be engaged during use. Still other open end wrench designs have evolved due to the necessity of enabling effective seizure of nuts disposed in restricted or highly inaccessible locations. There have been numerous proposals and wrench designs made heretofore which provide for open end wrenches having engaged jaws at opposite ends of an elongated bar or shaft, and these sockets are formed with a particular configuration enabling effective gripping of selected nuts of varying size; however, such wrenches require removal and rotation of the jaw opening about the nut for the next successive gripping turn.

There have also been earlier designs relating to ratchet-type wrenches having easy-return capability and these are probably best exemplified by U.S. Pat. No. 2,652,735 in the name of Wilder, and U.S. Pat. No. 1,954,141 in the name of Miquelon.

SUMMARY OF THE INVENTION

The present invention provides an improved ratchet-type open end wrench for use with hexagonal heat nuts. In a more limited aspect, the invention consists of a unitarily formed wrench having a uniquely formed, concave jaw opening which is formed to place four points of contact on a hexagonal head nut through the power stroke, but which includes such recess formations inter-placed between the contact points that the wrench is capable of unobstructed return stroke about substantially the same axis of rotation. The interposed recesses between contact points are so formed as to have optimum angular relationship which enables a grip-cleaning function thereby to assure gripping of old, rusted and/or grimy hexagonal heat nuts.

Therefore, it is an object of the present invention to provide a ratchet-type wrench having no moving parts which is effective to reliably grip and turn hex head nuts through repeated power strokes in faster, more efficient manner.

It is also an object of the invention to provide a ratchet-type open end wrench which is freely movable in reverse-turn direction about essentially the same axis of revolution.

It is yet another object of the present invention to provide a one-piece speed wrench having grip-cleaning capabilities to enable more effective gripping of worn and dirty hexagonal heat nuts.

Finally, it is an object of the invention to provide a ratchet-type open end wrench having longer life and greater reliability in intended usage.

Other objects and advantages will be evident from the following detailed description when read in conjunction with the accompanying drawing which illustrates the invention.

FIG. 1 is a fragmentary side view of an embodiment of a wrench according to the invention;

FIG. 2 is a view similar to FIG. 1 showing another embodiment of the invention;

FIG. 3 is a view similar to FIG. 1 showing a further embodiment of the invention;

FIG. 4 is a view similar to FIG. 2 showing a still further embodiment of the invention; and

FIG. 5 is a view similar to FIG. 1 showing still another embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

Referring to FIG. 1, an angular action wrench 10 consists of a handle portion or elongated shaft 12 which is formed to carry at the end a generally circularly shaped flat portion or wrench end 14. In accordance with conventional wrench forming practice, suitable wrench heads may be disposed on each end of elongated shaft 12. The wrench head 14 may include polished, flat side surfaces 16 (as disposed on each side of wrench head 14), and it is further formed with a seizing jaw 18.

The seizing jaw 18 is formed by an upper jaw portion 20 and a lower jaw portion 22, each of which have their contacting surfaces aligned along the respective arrow lines 24 and 26 directed generally parallel to shaft 12. An inner jaw portion 27 contiguous between the interior portions of upper and lower jaw portions 20 and 22 is then formed by particular further critical shaping as will be further described below.

A hexagonal head nut 28 is shown in outline to aid in defining the seizing jaw 18 and proper relationships. Thus, it can be seen that the leading edge portions of upper jaw portion 20 and lower jaw portion 22, as aligned along arrow lines 24 and 26, are parallel to and slightly larger than the dimension between parallel sides of hexagonal head nut 28, this in order to allow endwise placement of wrench 10 in operative position. An upper jaw contact point 30 is formed to extend an apex terminating along arrow line 24 as disposed inwardly (i.e., toward inner jaw portion 27) from vertical center line 32 of nut 28. An inner jaw contact point 34 is formed so that it contacts nut 28 a short distance above nut horizontal center line 36, i.e. as nut 28 is contacted when wrench 10 is in the operative or power stroke position. A third or lower contact point 38 is also formed in inner jaw portion 27 to contact nut 28 below the horizontal center line 36, while the fourth contacting point is formed by a lower jaw surface 40 as aligned along arrow 26.

Upper jaw portion 20 includes a short guide surface 42 as aligned along arrow line 24 as well as a generally arcuately shaped upper recess 44 which leads contiguously into upper jaw contact point 30. An upper angular recess 46 is formed contiguously between contact points 30 and 34 and is formed with bi-planar walls in-

intersecting at an apex angle greater than 60° , e.g., an angle of from 70° to 90° . An inner recess 48 is also formed contiguously between contact points 34 and 38 and, in like manner, has bi-planar walls intersecting at an angle greater than 60° , e.g., an interior angle of approximately 75° . A bottom recess 50 is then formed between contact point 38 and lower jaw surface 40, the depth and shape of bottom recess 50 being variable within wide limits so long as the width of the recess is small thereby maintaining lower contact point 38 a sufficient distance below horizontal center line 36 of nut 28 in order to enable most efficient torque application about the point.

In operation, the angular action wrench 10 is placed in conventional manner about a hexagonal head nut 28 until all of contact points 30, 34, 38 and contact surface 40 are in engagement with respective sides of the hex head nut. Clockwise motion exerted through handle 12, a conventional nut tightening stroke, will provide positive gripping of the nut and proportional rotational movement. The untightening or counterclockwise rotation may be effected in similar manner by simply turning wrench 10 over prior to placement on the hex head nut.

In the tightening stroke as shown in FIG. 1, positive engagement as shown with each of contact points 30, 34, 38 and contact surface 40 will provide more than sufficient gripping force for the turning of all forms of hexagonal head nut, i.e., air craft-type nuts, conventional threads, etc. After a stroke has been completed, the amount in accordance with the freedom or number of obstructions around the nut placement, the movement of wrench 10 can be reversed in a ratchet-type action within the confines of the allowed stroke space without losing placement around nut 28. Thus, upper recess 44 allows freedom of initial movement in the counterclockwise reverse stroke, whereupon contact points 30, 34, and 38 as well as contact surface 40 are allowed to slide around respective corners of the hex head nut with but very little displacement from the center point or rotational axis of the nut 28. The amount of radial displacement relative to nut 28 is hardly discernible to the hand in manipulation, and the wrench is easily reversed to a next succeeding gripping position such as shown in FIG. 1.

The angular recesses 46, 48 and 50 also serve to allow for freedom of movement in the reverse or non-power stroke and, in addition, these recesses are so formed with a straight, square-edged surface adjacent the nut seating surface such that they are effective to cause a cleaning action with respect to deposits of rust, grime, grease or whatever. Such foreign matter can flow freely out of the recesses 46, 48, and 50 without impaction which would otherwise hinder the ability to grip via contact points 30, 34, 38 and contact surface 40. As previously stated, the same action is effective with respect to either the conventional tightening or nut-tightening action, wrench 10 may be properly turned and the power stroke will be made in the direction of rotation toward lower jaw portion 22 and contact surface 40.

The dimensions of wrench opening 18 are relatively critical, especially as to the disposition of contact points 30, 34 and 38. Thus, when the wrench 10 is in the seated position each of contact points 30, 34 and 38 should contact nut 28 sufficiently inside of the nut centerline relative to its point of contact and the re-

spective nut corner relative to the position of wrench turning. As shown in FIG. 1, this may vary within narrow limits so long as contact points 30, 34 and 38 do not contact too close to the respective leading corners of nut 28 such that gripping of worn nuts could become less positive and uncertain in effect. The lower contact surface 40 is of continuous contacting form relative to the nut 28 and thereby serves to provide a positive guide action with respect to all gripping contact points.

It should be understood that the depth and angle of angular recesses 46, 48 and 50 may be varied within relatively narrow limits in order to achieve optimum structural strength of wrench 10 while still maintaining the desirable grip-cleaning attributes. Also, the arcuate recess 44 may be formed to varying size so long as the structural strength of upper jaw portion 20 and contact point 30 are maintained at acceptable level. The optimum point of contact for each of contact points 30, 34 and 38 is about one-third of the distance from respective leading nut corners to respective trailing nut corners, this dimension being essentially as shown in FIG. 1.

ALTERNATIVE EMBODIMENT OF FIG. 2

FIG. 2 illustrates a structural variation or angular-parallel action wrench 60 which is changed in form such that it utilizes four separate contacting surfaces, each parallel to a respective nut side, while still having the ratchet-type reversing capability. Thus, wrench 60 is essentially the same as FIG. 1 except that the contact points are now formed by a contact surface 62 extending from upper jaw portion 20, a contact surface 64 extending from the upper portion of inner jaw portion 27 and a contact surface 66 disposed at the lower portion of inner jaw portion 27. The lower jaw portion 22 still maintains the continuous lower contact surface 40 in complete contact with the respective side of nut 28. Embodied in this configuration is still the arcuate recess 44 within upper jaw portion 20, as well as the respective angular-shaped recesses 46, 48 and 50 as formed within the inner jaw portion 27 of wrench opening 18. The arc-size of recess 44 is essentially the same as that of FIG. 1, while the angular disposition of recess side walls in each of recesses 46, 48 and 50 are generally similar to those of FIG. 1. The primary difference lies in formation of the contacting surfaces 62, 64 and 66 to be flat surface one-sixth to one-eighth-inch in length and formed to lie parallel with the respective sides of nut 28 when in the power stroke engagement position.

Operation of the FIG. 2 embodiment is essentially the same as that of FIG. 1 in that grip-cleaning angular recesses are provided while the contact surfaces 62, 64 and 66 are placed into contact with respective sides of hex nut 28 at similar positions or one-third of the nut side distance disposed from the respective leading corners of nut 28. The power stroke is effected in clockwise (as shown) with gripping engagement at each of contact surfaces 62, 64, 66 and lower contact surface 40. The ratcheting or return stroke is then effected with but little radial movement of wrench 60 from the axis of nut 28, and the recess 44 acting in coaction with angular recesses 46, 48 and 50 allow the handle 12 to be moved counterclockwise to a selected new gripping position wherein the angular parallel wrench 60 will be disposed about nut 28 as shown in FIG. 2; that is, awaiting the next successive power stroke.

In each of the wrench 10 and wrench 60 configurations of FIGS. 1 and 2, the critical dimensions can best be particularly described using relative ratios of the chord and line segments disposed about the interior of seizing jaw 18. Thus, the line segment 70 along lower contact surface 40 is designated as the unity value for purposes of assigning ratios. A chord 72 subtending the inner surface of arcuate recess 44 is disposed in alignment with directional arrow 24 and has a length of ratio one relative to the unit line segment 70. A line segment 74 extending between contact points 30 and 34 at an angle of approximately 140° from chord 72 has a ratio of approximately one relative to unit length line segment 70. A line segment 76 then extends between contact points 34 and 38 at an angle of about 120° from previous line segment 74, and line segment 76 has a ratio of about nine-tenths relative to unit line segment 70. Finally, a line segment 50 extending from contact point 38 to a contact point 78, the inner most extreme of line segment 70, extends at an angle of about 160° from line segment 76 while having a length ratio of about seven-twentieths relative to unit length line segment 70.

The chord 72 and line segments 74, 76, 78 and 70 of the angular parallel wrench 60 in FIG. 2 would have the same ratio of lengths relative to unit length 70, the only difference being that chord and line segment lengths are measured to the mid-point of respective contact surfaces 62, 64 and 66.

FIG. 3 illustrates a ratchet-type wrench, in this case the angular parallel type of wrench 60 as shown in FIG. 2, which includes an attachment of thumb-operated movement to aid in positioning wrench 60 on nut 28 in tight or difficulty accessible spaces, e.g., when nut 28 is suspended on a post or other structure in its tightened position. A retaining tab 82, e.g., a steel tab on the order of one-sixteenth-inch thickness, is rotatably affixed by means of a suitable pin 84 as may be force-fit within side facing 16 of wrench 60. The retaining tab 82 may be secured with a relatively tight affixture so that it will normally remain removed from operative position, but when desired a simple movement by the operator's thumb can place the retaining tab 82 in the position as shown by dash lines 86 whereupon it will carry out its retaining function.

FIG. 4 illustrates another alteration in the wrench configuration wherein the lower jaw portion, normally shown as outlined by dash lines 90, is cut away to form a shortened lower jaw portion 92 which enables easier positioning of the ratchet-type wrench 10 in certain accessibility situations. It may be noted that the functional contacting surfaces of FIG. 4 are similar to those of FIG. 1 and the wrench is in every way operable as is that wrench of FIG. 1; however, the formation of the shortened lower jaw portion 92 aids in the operable insertion of wrench 10 around the nut 28.

FIG. 5 illustrates still another variation of ratchet-type wrench 10 wherein structure is included which prohibits or greatly prevents the possibility of wrench 10 coming loose from nut 28 during a miss-gripping of nut 28 during a power stroke. It may be noted that the functional configurations of the wrench are those of the angular action wrench 10. That is, the dimension and disposition of contact points 30, 34, 38 and lower contact surface 40 remain the same, as do recesses 46, 48 and 50. However, a wrench opening 94 is disposed at an upward angle as formed by a lower jaw extension 96

having an interior surface 98 aligned in parallel with an upper entry surface 100 formed across upper jaw portion 20.

Operation of the FIG. 5 alternative is the same as that for the previously discussed wrenches in that the four point seizure is effective through the power stroke while ratcheting-type action is enabled due to absence of bearing surfaces when counterclockwise rotational force is applied to handle 12. It should be understood that the contacting points of any of wrenches shown in FIGS. 3, 4 and 5 may be either the point contact type as shown in FIG. 1 or the parallel plane or contact surface type as shown in FIG. 2. In any event, the ratcheting type of return action is unhampered.

The foregoing discloses a novel speed wrench having ratchet-type action yet which has no moving parts. The wrenches of the present invention present four distinct contact points or surfaces for positive gripping of a hexagonal head nut, as well as a functional feature, enabled by the wrench jaw configurations, which effects cleaning of foreign material from around the hex nut which is receiving manipulation. The ratchet-type return stroke is able to take place with minimal effort and relatively little required radial movement of the wrench head relative to the axis of rotation of the hex head nut. Such one-piece speed wrenches have advantages over conventional ratchet wrenches in that it is not necessary to inspect or read a dial indication, test, and/or set a ratchet control lever prior to use of the wrench. A simple half turn or turning over of the wrench will give the manipulator either a tightening or an untightening action utilizing a positive grip as effected by four displaced points or surfaces, while still allowing the unhampered return stroke for successive power strokes. Further, a ratchet-type wrench constructed in accordance with the invention is easily inserted or placed on a subject hex head nut such that wrench tightening or loosening is facilitated in those applications where the nut position is in a dark or remote position not accessible by sight, and possibly only alignable by the sense of touch.

Changes may be made in the combination and arrangement of elements heretofore set forth in the specification and shown in the drawings; it being understood that changes may be made in the embodiment disclosed without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A ratchet-type speed wrench of the open end type for use with hexagonal head nuts, which has an elongated shaft and a seizing jaw opening defined by upper and lower jaw portions and an inner jaw portion extending therebetween, said wrench seizing jaw opening comprising:

a flat surface originating at the front edge of said upper jaw portion and extending inwardly of said jaw opening in a direction substantially parallel to the axis of said jaw opening and said elongated shaft;

an arcuate recess having one end intersecting said flat surface, and subtending a chord in alignment with said surface which has a width ratio of approximately one and a depth ratio of approximately four-tenths relative to a selected unit length;

a generally triangular recess defining a line segment along the open side which has one end intersecting said chord and extending at an angle of approxi-

- mately 160° therefrom, said line segment having a length approximately equal to said unit length;
- a second triangular recess defining a second line segment along the open side which has one end intersecting said line segment and extending at an angle of 120° therefrom, said second line segment having a length which has a ratio of approximately nine-tenths to said unit length;
- a third generally triangular recess defining a third line segment along the open side and which intersects said second line segment and extends at an angle about 120° therefrom, said third line segment having a length ratio of about three-tenths relative to said unit length; and
- a lower contact surface formed as part of said lower jaw portion and defining a contact surface which is at least of said unit length, and which contact surface extends at an angle of 120° from intersection with said third line segment, and which contact surface is disposed generally parallel to said first flat surface.
2. A wrench as set forth in claim 1 which is further characterized in that:
- each of said triangular recess and second triangular recess is formed with an angle opposite the respective line segment and second line segment of from 70° to 90°.
3. A speed wrench as set forth in claim 1 which is further characterized in that:
- said triangular recess is formed with an opposite angle from said line segment of approximately 85°; and
- said second triangular recess is formed with an opposite angle from said second line segment of approximately 70°.
4. A speed wrench as set forth in claim 1 which is further characterized in that:
- the intersection point of said chord and arcuate recess with the line segment and triangular recess forms a first contact point for gripping seizure of the hexagonal head nut during power stroke of said wrench;
- the intersection of said line segment and triangular recess with the second line segment and second triangular recess form a second contact point for gripping seizure of the hexagonal head nut during power stroke; and
- the intersection at the line segment and second line segment superpositions a third contact point for gripping seizure of the hexagonal head nut during power stroke.
5. A speed wrench as set forth in claim 4 which is further characterized in that:
- each of said first, second and third contact points is formed as a planar contact surface having a length of about one-fifth of said unit length.
6. A speed wrench as set forth in claim 1 which is further characterized to include:
- retaining tab means having one end rotatably mounted on said speed wrench adjacent said inner

- jaw portion for rotatable movement over said seizing jaw opening to serve as a position retaining member.
7. A speed wrench as set forth in claim 1 which is further characterized in that:
- said lower jaw portion is shortened relative to extension from said inner jaw portion to enable facile insertion of the wrench about a hexagonal head nut.
8. A speed wrench of the open end type for use with hexagonal head nuts which has an elongated shaft and a seizing jaw opening defined by upper and lower jaw portions and an inner jaw portion extending therebetween, said wrench comprising:
- a flat surface (100) originating at the front edge of said upper jaw portion and extending inwardly of said jaw opening at an angle of approximately 140° relative to said elongated shaft;
- an arcuate surface intersecting said flat surface (100) and extending to a nut contact point (30) which contacts the nut when the wrench is in power stroke position;
- a triangular recess (46) extending to a second contact point (34), a line segment extended across said contact points (30) and (34) being of a selected unit length;
- a second triangular recess (48) defining a second line segment which intersects said first line segment at an angle of approximately 120°, said second line segment having a length which is approximately equal to said unit length;
- a third recess (50) defining a third line segment which intersects said second line segment at an angle of approximately 160°, said third line segment having a length which is approximately one-third said unit line segment;
- a contacting surface (40) intersecting the end of said third line segment at an angle of approximately 120° and having a length which is approximately one and one-half times said unit length; and
- a retaining contact surface (98) formed integrally with said lower jaw portion and extending at an angle of approximately 120° from said contacting surface (40), said retaining contact surface (98) being approximately one and one-half times said unit length and extending parallel to said flat surface (100).
9. A speed wrench as set forth in claim 8 wherein:
- the intersection point of said arcuate surface and said triangular recess (46) form a contact point (30) for gripping seizure of the hexagonal head nut during power stroke of said wrench;
- the intersection of said triangular recess (46) and said second triangular recess (48) form a contact point (34) for gripping seizure of the hexagonal head nut during power stroke; and
- the intersection of said second triangular recess (46) and said third recess (50) form a contact point (38) for gripping seizure of the hexagonal head nut during power stroke.
- * * * * *