

INTELLECTUAL PROPERTY OFFICE OF SINGAPORE
PATENT AGENTS QUALIFYING EXAMINATION 2020

PAPER A: PREPARATION OF A PATENT SPECIFICATION
7 December 2020, Monday
1330 – 1730 hrs

Maximum Time: 4 Hours (includes reading time)

Maximum Marks: 100



INSTRUCTIONS TO CANDIDATES

1. This Question Paper consists of 26 pages, including this cover page.
2. Type your answers in English. Answers in any other language will not be marked.
3. You are given one hard copy of the Question Paper. The soft copy of the Question Paper is also provided in the given laptop.
4. Only answers and/or drawings typed or indicated in the Answer Script template provided by the Examination Secretariat will be considered. Candidates should not change the given format of the Answer Script or type in the margin.
5. The information provided in the Question Paper may be obtained from actual situations or modified therefrom for the purpose of this examination. You should accept the facts given in the paper and assume that the prior art given is exhaustive.
6. The documents provided in this Question Paper are:
 - a. Cover Page (1 page);
 - b. Details of Client Requirements (2 pages);
 - c. Document A: New Invention (9 pages including drawings);
 - d. Document B: Prior Art A (6 pages including drawings); and
 - e. Document C: Prior Art B (7 pages including drawings).
 - f. Document D: Prior Art C (1 page)

END

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Details of Client Requirements (1/2)

Your client Peter has been designing tools for many years. He found from customer research that the number of different tools that need to be kept in order to have a suitable stock of tools for attending to ordinary do-it-yourself repairs or constructions is very high, and requires large storage capacity for tool boxes etc. With many people having limited storage space available, in particular in relatively smaller apartments or public housing, it has become impractical to sacrifice storage for tools which are not often used. One example often complained of by customers is the number of wrenches required for different sizes of nuts or bolt-heads.

As a result, wrenches that can work with different sizes have become more popular, since they reduce the number of tools that need to be kept. One popular example is adjustable wrenches like the one in Prior Art A, which has a head with a fixed jaw 12 and an adjustable jaw 10. In addition, the wrench in Prior Art A provides two fixed size engaging sockets 24a, 26a. In practice, the distance between the fixed jaw 12 and the adjustable jaw 10 is adjusted to match the nut or bolt-head to be rotated. Oftentimes, the distance is involuntarily changed during operation, which makes use of the wrench cumbersome, and the torque that can be applied during rotation can be limited due to movement within tolerances.

Prior Art B addresses the problem in Prior Art A of the distance being involuntarily changed during operation. This is achieved from the wrench of Prior Art B having a fixed jaw and a movable jaw that is moved towards the fixed jaw when the wrench is gripped to rotate a nut engaged between the jaws. In practice, such adjustable wrenches in Prior Art B still suffer from general issues with moving parts in adjustable wrenches, such as getting jammed due to dirt or rusting.

Peter believes that his design, for which he has provided you a written description with drawings, overcomes the problems of Prior Art A and Prior Art B. Peter notes that the description may include some statements which are too limiting. Peter asks you to edit such statements and also asks that you incorporate a brief explanation of the advantages of his new design as compared to the existing designs, as appropriate.

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Details of Client Requirements (2/2)

Peter instructs you to prepare and file a Singapore patent application for his invention. To guard against issues with claim fees, he wishes that the application does not have more than
5 10 claims in total, and he does not want to pay any additional search fees or file a divisional application later. Because Peter wants to sell or license his invention to tool manufactures, he wants to have claims both for the wrench as well as for a method of fabricating the wrench included. Peter also asks you to conduct a quick prior art search during the drafting process, and incorporate the differences and advantages of his design over any identified prior art in
10 the specification.

Prior Art C is a picture of a multi-size wrench tool you have identified during the search.

Please proceed to draft a specification for a Singapore patent application in accordance with
15 your client's instructions.

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Document A: New Invention (1/9)

Figure 1 is a schematic drawing of the multi-size wrench 100 for rotating nuts or bolt-heads of different sizes. The wrench includes a head 102 and a handle 104. The wrench 100 is usually made from steel, but other materials may be used depending on the desired quality and cost of the wrench. Details on how to fabricate the wrench 100 will be described below.

The head 102 has an opening 106 formed therein. The opening 106 is fully enclosed by the remaining material of the head 102 in this example, and includes one edge 108 extending along the opening 106 on one side thereof. Opposite the edge 108 is located an edge structure with adjacent edge sections 111-113, each edge section 111-113 being parallel to the edge 108. As shown in Figure 2, a nut or bolt-head 114 can be received between the edge 108 and one of the edge sections 111-113. The size of the nut or bolt-head 114 matches the distance between the edge 108 and the edge section 113 so that opposing parallel walls 116, 118 of the nut or bolt-head 114 mate with the edge 108 and edge section 113, respectively. Accordingly, the nut or bolt-head 114 can be rotated by rotating the head 102 using the handle 104, in typical wrench-type fashion.

As shown in Figure 3, a nut or bolt-head 120 of a different size compared to the nut or bolt-head 114 (Figure 2), can be received between the edge 108 and another edge sections 112. The size of the nut or bolt-head 120 matches the distance between the edge 108 and the edge section 112 so that opposing parallel walls 122, 124 of the nut or bolt-head 120 mate with the edge 108 and edge section 112, respectively. Accordingly, the nut or bolt-head 120 can be rotated by rotating the head 102 using the handle 104, in typical wrench-type fashion. Furthermore, as shown in Figure 4, a nut or bolt-head 126 of yet another different size compared to the nuts or bolt-heads 114, 120 (Figure 2, Figure 3), can be received between the edge 108 and the last edge section 111. The size of the nut or bolt-head 126 matches the distance between the edge 108 and the edge section 111 so that opposing parallel walls 128, 130 of the nut or bolt-head 126 mate with the edge 108 and edge section 111, respectively. Accordingly, the nut or bolt-head 126 can be rotated by rotating the head 102 using the handle 104, in typical wrench-type fashion.

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Maximum Marks: 100

Document A: New Invention (2/9)

As described above, the same wrench 100 can thus be used to rotate nuts or bolt-heads of different sizes by way of the special opening 106 formed in the head 102. Since the opening
5 106 constitutes a fixed structure with no moving parts, its rigidity is high and it is not prone to jamming of moving parts, which limits the utility of some existing adjustable size wrenches. At the same time, the wrench 100 can be used for three different sizes of nuts or bolts, making the wrench versatile compared to typical single size wrenches. Two or more than three different sizes of nuts or bolts can be accommodated in different examples (not shown).

10 In the example shown in Figures 1 to 4, the wrench 100 is configured such that the opening 106 has adjacent sections arranged along the length of the opening 106 in order of the distances between the edge 108 and respective ones of the edge sections 111-113. This is important to facilitate ease of receiving the nuts or bolt-heads in the opening 106. For example,
15 smaller nuts and bolt-heads can be easily received first in the wider section of the opening 106 at the edge section 111, and then the head is moved so that the nut or bolt-head is brought to the relevant narrower section, e.g. at the edge section 112.

20 In the example shown in Figures 1 to 4, the opening 106 includes two opposing side edges 132, 134. The side edge 132 (Figure 2) is contoured to match the shape of the nut or bolt-head 114, which can enhance the grip on the nut or bolt-head 114 during rotation. Similarly, the side edge 134 (Figure 4) is contoured to match the shape of the nut or bolt-head 126, which can enhance the grip on the nut or bolt-head 126 during rotation. This is a significant feature of the wrench 100, but the side edges can be straight in different, inferior examples.

25 Often, nuts or bolt-heads are not easily accessible. For example, there may be a limited space above the nuts or bolts. Figure 5 is a schematic drawing of another multi-size wrench 500. The wrench again includes a head 502 and a handle 504. The wrench 500 is again usually made from steel, but other materials may be used depending on the desired quality and cost
30 of the wrench. Details on how to fabricate the wrench 500 will be described below.

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Document A: New Invention (3/9)

The head 502 has an opening or slot 506 formed therein. The slot 506 is open at one end and includes one edge 508 extending along the slot 506 on one side thereof. Opposite the edge 508 is located an edge structure, with adjacent edge sections 511-513, each edge section 511-513 being parallel to the edge 508. Also shown in Figure 5 is a nut or bolt-head 514, which can be received between the edge 508 and the edge sections 511-513. Specifically, the size of the nut or bolt-head 514 matches the distance between the edge 508 and the edge section 513. In that way, opposing parallel walls 516, 518 of the nut or bolt-head 514 can mate with the edge 508 and edge section 513, respectively. While the head 502 is moved in the direction indicated by arrow 519, the nut or bolt-head 514 will move along the slot 506 until it is received between the edge 508 and edge section 513. Accordingly, the head 502 does not have to be lifted over the nut or bolt-head 514 and lowered down to engage the nut or bolt-head 514, which is an advantage if space above the nut or bolt-head 514 is limited. In the example shown in Figure 5, the wrench 500 is configured such that the slot 506 has adjacent sections arranged along the length of the slot 506 in order of the distances between the edge 508 and respective ones of the edge sections 511-513 from the largest distance near the open end of the slot 506 to the smallest distance at the closed end with side edge 532 of the slot 506. The side edge 532 is contoured to match the shape of the nut or bolt-head 514, which can enhance the grip on the nut or bolt-head 514 during rotation.

The wrenches 100, 500 can be fabricated using a press cutting machine applied to a sheet of steel or metal, using a suitable cutting die for cutting the opening or slot 106, 506 and the shape of the head 102, 502 and handle 104, 504. While the shapes of the heads 102 and 502 and the handles 104, 504 are the best, other shapes can be used but may lead to less suitable results. In order to enhance the strength of the edges 108, 508 and edge sections 111-113, 511-513, a hardening processing may be performed after the press cutting, for example using a laser beam for heat hardening the edges 108, 508 and edge sections 111-113, 511-513. Instead of being straight, the edges 108, 508 can also include different sections, similar to the edge sections 111-113, 511-513. This can increase a range of the different sizes of nuts or bolt-heads than can be accommodated, i.e. between respective opposing edge sections on

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Maximum Marks: 100

Document A: New Invention (4/9)

either side of the slot 106, 506. Having to press cut only one opening can reduce the complexity of the cutting die and can preserve the structural integrity of the wrench.

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Also, often wrenches are provided in the form of small gadgets, such as multi-purpose tools. In such versions, the head may take on the function of the handle, for example in a multi-purpose tool in the shape of a credit card for easy storage in a wallet. The head in such a multi-purpose tool example may include other tools such as a bottle opener cut out, and/or an opening with a magnifying lens inserted, and/or a measuring scale imprinted along the periphery of the head. In addition, instead of making the opposing walls of the edge sections 111-113 and the edge sections 511-513 straight, they can be slightly concave.

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Document A: New Invention (5/9)

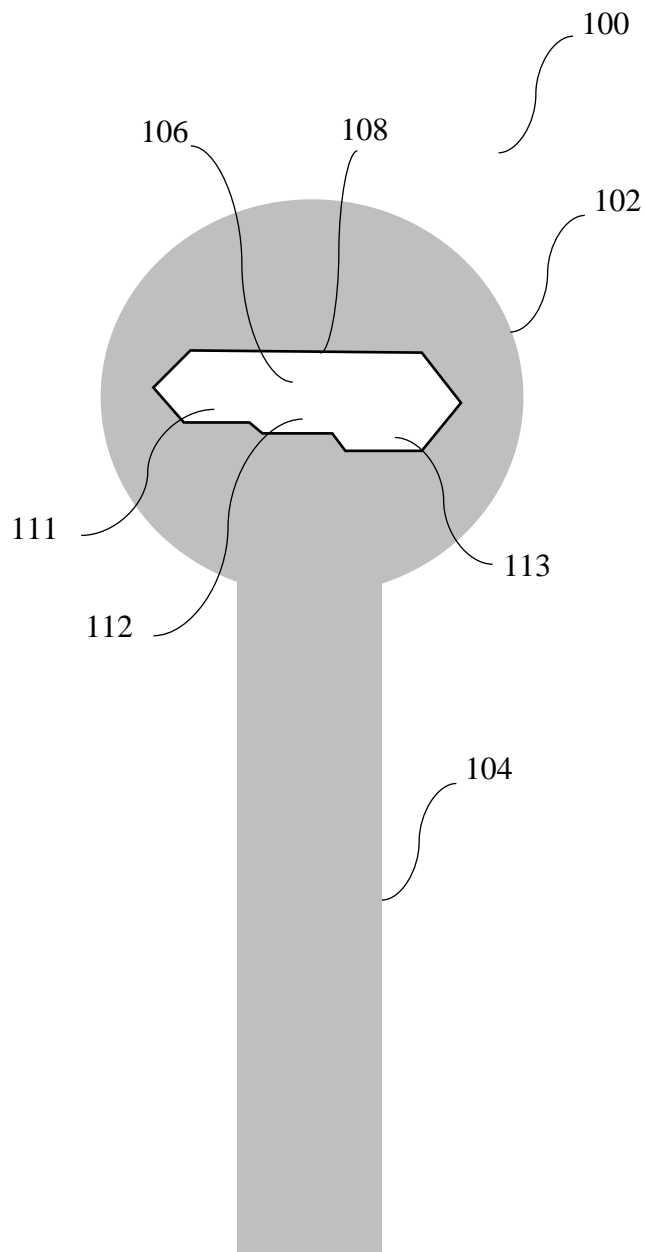


Figure 1

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Document A: New Invention (6/9)

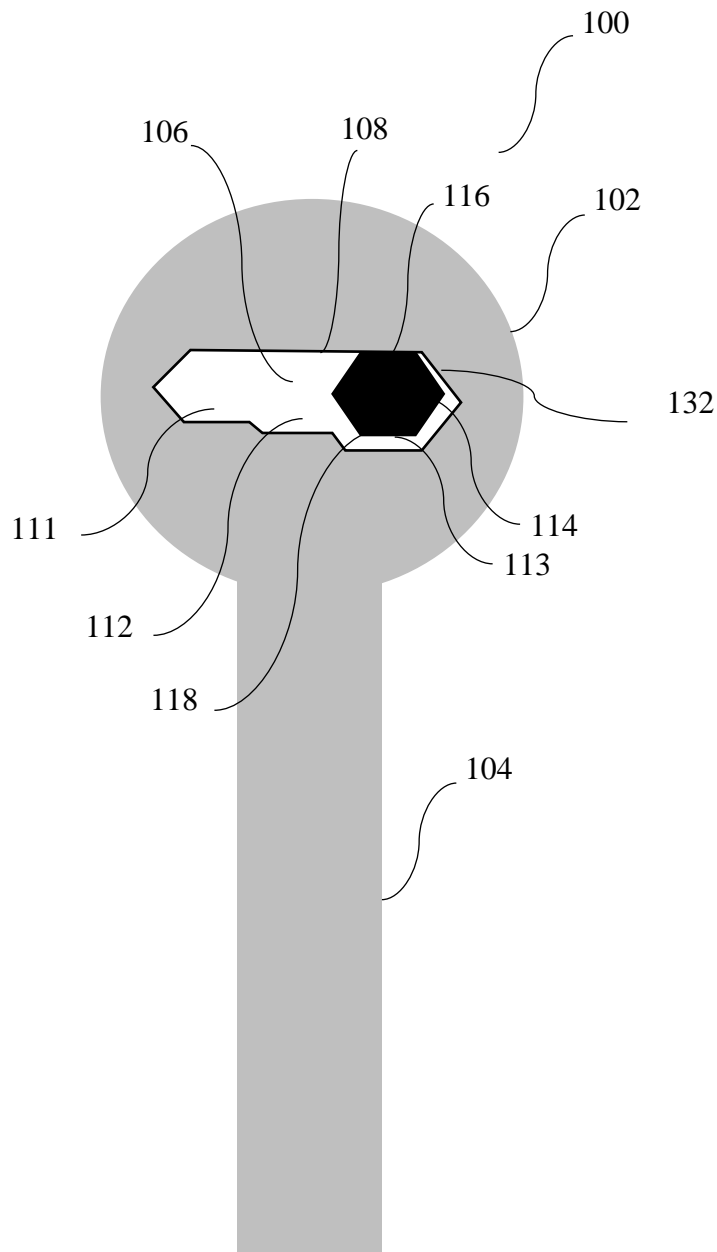


Figure 2

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Document A: New Invention (7/9)

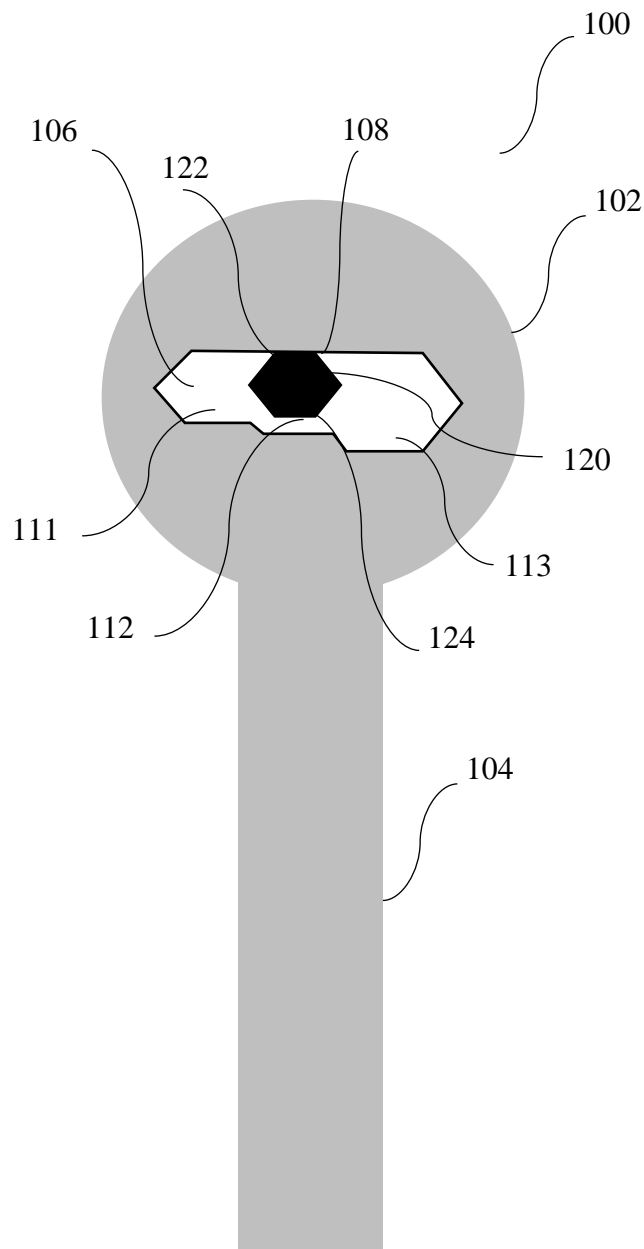


Figure 3

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Document A: New Invention (8/9)

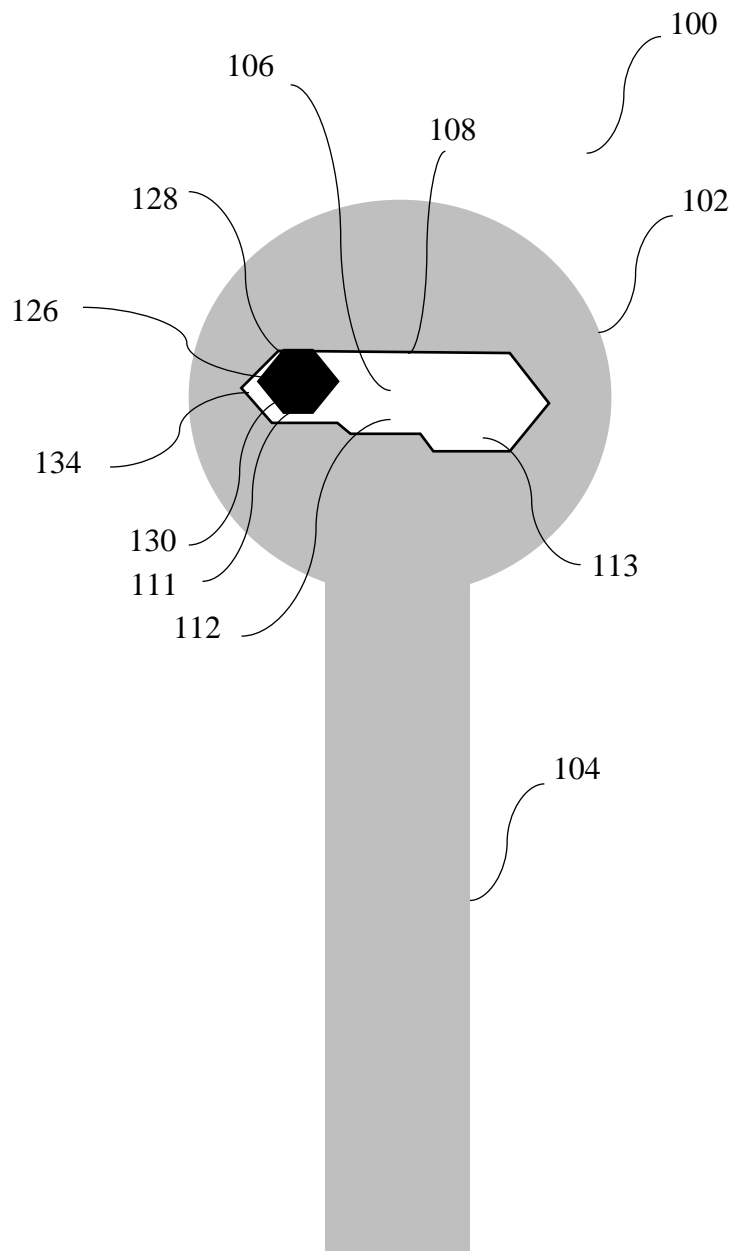


Figure 4

(12) **United States Patent**
Patti

(10) **Patent No.:** **US 7,246,543 B1**
(45) **Date of Patent:** **Jul. 24, 2007**

(54) **MULTI-FUNCTION ADJUSTABLE WRENCH**

(76) Inventor: **Frank Richard Patti**, 5550 Lobos La.,
Atascadero, CA (US) 93422

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: 11/401,796

(22) Filed: **Apr. 11, 2006**

Related U.S. Application Data

(60) Provisional application No. 60/741,340, filed on Nov.
30, 2005.

(51) **Int. Cl.**
B25B 13/00 (2006.01)

(52) **U.S. Cl.** **81/124.5; 81/124.4; 81/125.1;**
81/177.1; 81/177.7

(58) **Field of Classification Search** 81/124.4,
81/124.5, 125.1, 177.1, 177.7
See application file for complete search history.

(56) **References Cited**

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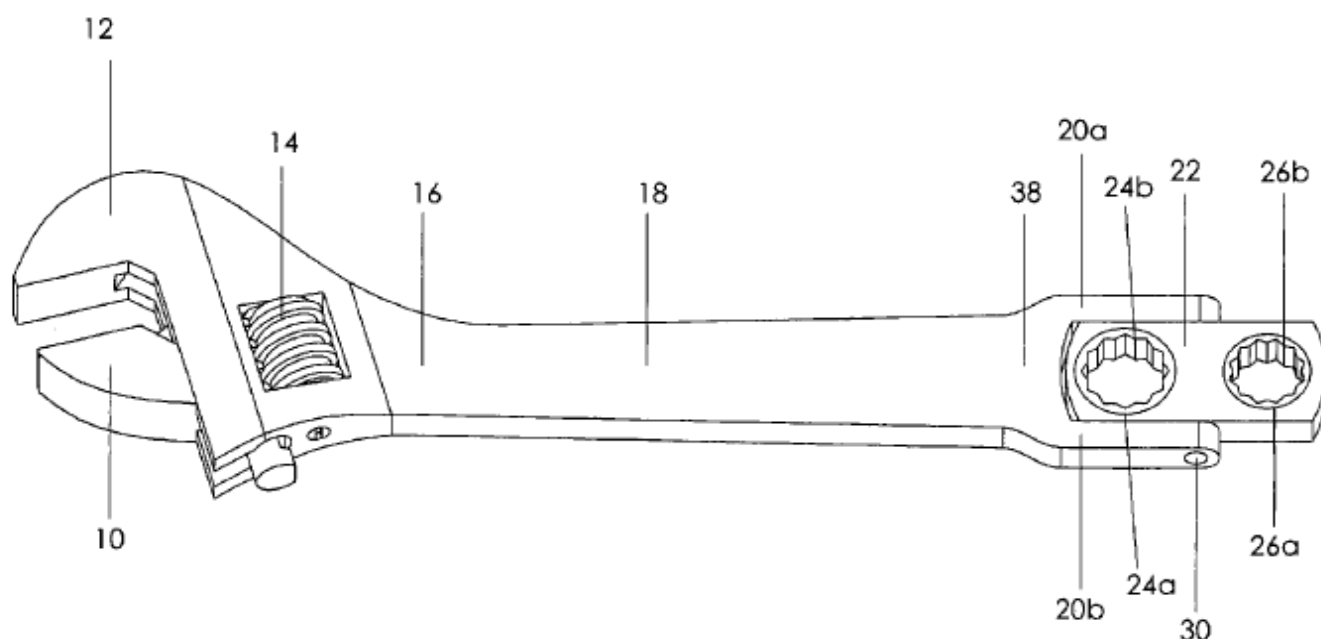
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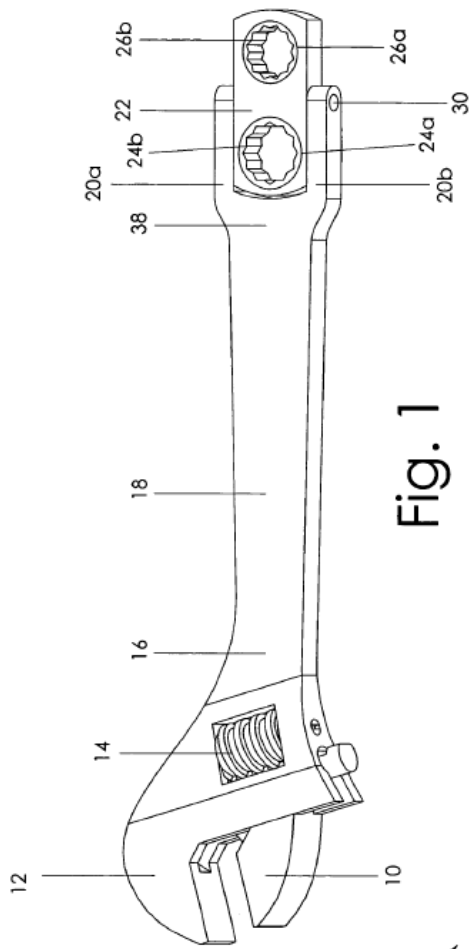
Primary Examiner—Joseph J. Hail, III
Assistant Examiner—Shantese McDonald

(57) **ABSTRACT**

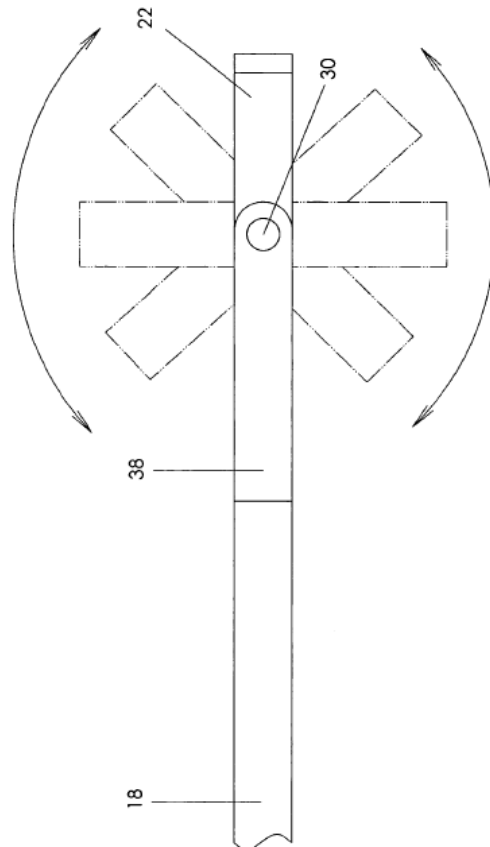
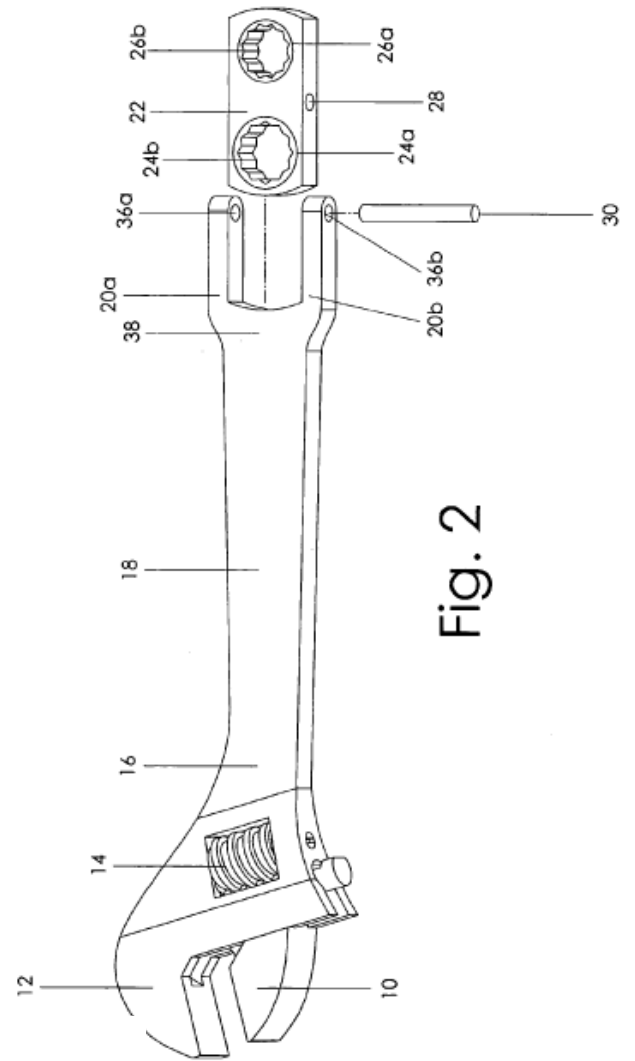
A multiple function adjustable wrench comprising: a shank 18 having a first end 16 with a fixed jaw 12, a adjustable jaw 10, and an adjusting screw 14. The adjusting screw 14 moves the adjustable jaw 10 toward and away from the fixed jaw 12. Two arms 20a, 20b extend from the second end 38 of the shank 18. A ratchet box 22 includes a first engaging socket 24a that is rotatably engaged with a first engaging hole of the ratchet box 22. The ratchet 22 also includes a second engaging socket 26a having a different inner diameter is rotatably engaged with a second engaging hole of the ratchet box 22. The first engaging socket, and the second engaging socket have a engaging hole defined therethrough. The engaging hole can be toothed so as to form a 12-point engaging socket or square so as to form a square engaging socket. Ratchet mechanisms (not shown) are received in the ratchet box 22 and are cooperated with each engaging socket. The ratchet box 22 is rotatably connected within the two arms 20a, 20b with a engaging member such as a pin 30.

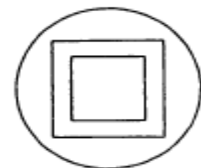
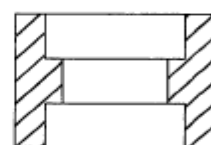
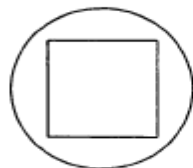
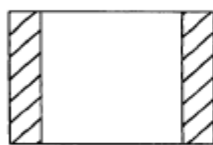
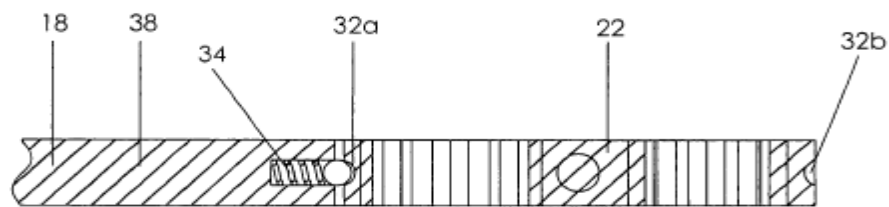
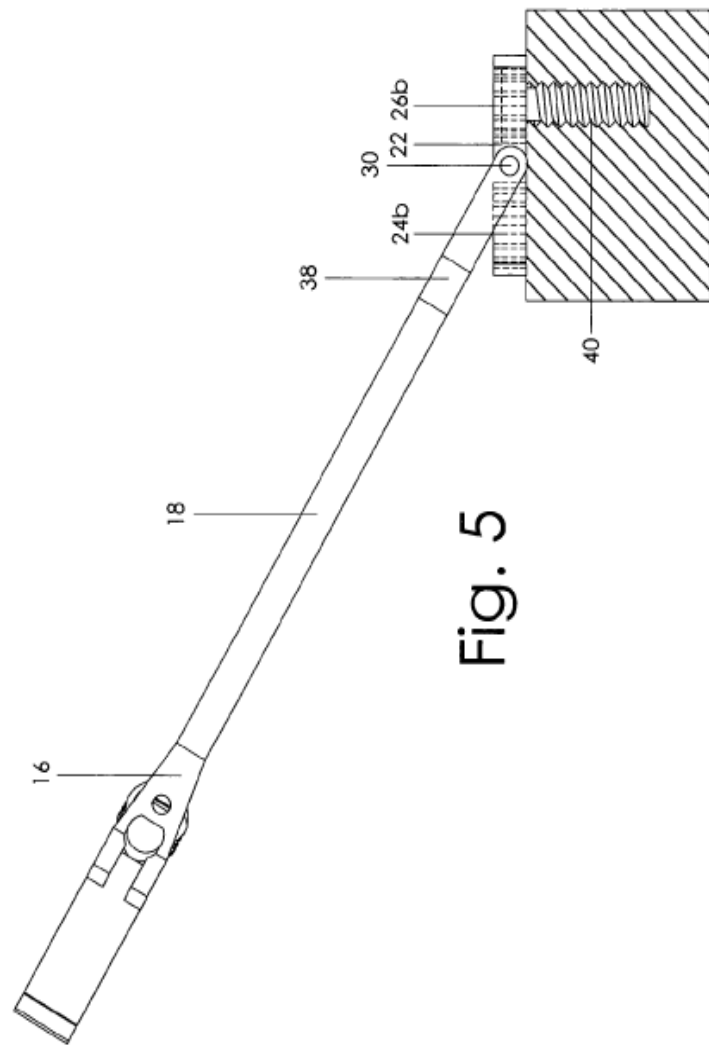
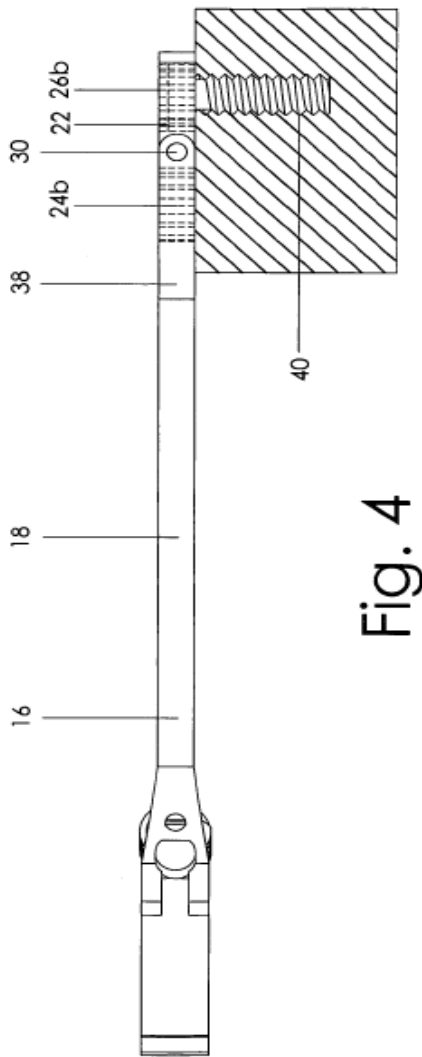
5 Claims, 6 Drawing Sheets





Art A (3/5)





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MULTI-FUNCTION ADJUSTABLE WRENCH

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of disclosure document 580921 filed on 2005 Jun. 27, disclosure document 590478 filed on 2005 Nov. 23, and provisional patent application Ser. No. 60/741,340 filed on 2005 Nov. 30 by the present inventor.

FEDERALLY SPONSORED RESEARCH

Not Applicable

SEQUENCE LISTING OR PROGRAM

Not Applicable

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates to wrenches, more specifically to a multi-function adjustable wrench.

2. Prior Art

Adjustable wrenches have been in use for over 100 years and are manufactured in a variety of lengths, 4-inch thru 24-inch. These wrenches are very simple and useful to use. The capacity of adjustment depends on the length of the wrench.

A adjustable wrench includes; a shank, a fixed jaw, and a adjustable jaw. A adjusting screw moves the adjustable jaw toward and away from the fixed jaw. There is a wide range of adjustment between the fixed jaw and the adjustable jaw to meet a wide range of different diameter fasteners to be tightened or loosened. The range of adjustment depends on the length of the wrench. This wrench does require the user to release the wrench from the fastener after the first stroke, or turn, and reposition the wrench on the fastener at a convenient angle for the second stroke.

Boxed ratchet wrenches have been in use for over 50 years and are very popular. This wrench includes a shank and a ratchet box with a engaging socket rotatably engaged with the ratchet box. A ratchet mechanism is received in the ratchet box and cooperated with the engaging socket. This wrench allows the user to tighten or loosen in one direction, and ratchet the shank back in the opposite direction. This wrench does not require the user to remove the wrench from the fastener for repositioning. These wrenches come in a variety sizes and styles. Sizes range from 1/4" through 1" diameter open-end socket, and metric sizes. The styles include a flat, a fixed offset, and a pivot. The pivot allows the user to create any angle of offset. Further they are available with, or without reversing levers. The non-reversing lever type requires the user to flip the wrench over for reverse operation.

A patent search revealed that one other individual has thought to incorporate these two wrenches together. The said individual filed two patent applications. The following is representative of the prior art.

U.S. Patent Application 20040025646 filed by Hsien on 2004 Feb. 12 describes an adjustable wrench with one multiple sized socket rotatably engaged within the handle end of the wrench.

U.S. Patent Application 20040060398 filed by Hsien on 2004 Apr. 1 describes an adjustable wrench having one

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multiple sized socket rotatably engaged within a pivotable ratchet box mounted on the handle end of the wrench.

I originally invented three ways of incorporating a adjustable wrench and a boxed ratchet wrench. My first two ideas turned out to be too similar to the prior art. The present invention is my third idea.

The present invention intends to provide a adjustable wrench at the first end of a shank, and a ratchet box that is rotatably connected at the second end of the shank. The ratchet box includes two different inner diameter engaging sockets.

BACKGROUND OF THE INVENTION: OBJECTS AND ADVANTAGES

Several objects and advantages of the present invention are:

- (a) To provide a multi-function wrench with the ability to tighten or loosen a wide variety of different diameter fasteners with the adjustable end of the shank, and the time saving convenience of having a ratchet box with two different inner diameter engaging sockets at the other end of the shank.
- (b) A wide variety of size combinations are possible utilizing different sized adjustable wrenches combined with a ratchet box with two different inner diameter engaging sockets.
- (c) Ideal for the professional tradesperson who carries a tool bag with limited space.
- (d) The ratchet box utilizes 12-point and square engaging sockets. Further they can be single or double sized type. Two 12-point single sized engaging sockets are shown for example.
- (e) The novice to the professional can use the ratchet box utilizing 12-point engaging sockets.
- (f) The ratchet box utilizing square sockets would be ideal for the HVAC-R tradesperson. These tradespeople work with service valves on most if not all equipment being worked on. These service valves are used to close off a line or connect service gages. Each service valve consists of a removable cap to connect service gages and a different diameter removable cap to expose a valve stem post with a male square head. Most if not all fellow tradespeople use an adjustable wrench to remove the two different diameter caps, and then use a boxed ratchet wrench with square sockets to move the valve stem. It takes two separate wrenches to perform this task. Combining these two wrenches together would be very convenient. Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

SUMMARY

In accordance with the present invention, a multi-function adjustable wrench includes; a shank having a first end with a fixed jaw, and a adjustable jaw. A adjusting screw moves the adjustable jaw toward and away from the fixed jaw. Two arms extend from the second end of the shank. A ratchet box is rotatably connected within the two arms with a pin. The ratchet box includes two different inner diameter engaging sockets. Each socket is rotatably engaged with the ratchet box. Each engaging socket has a engaging hole defined therethrough.

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DRAWINGS: FIGURES

FIG. 1 shows a perspective view of the present invention.

FIG. 2 shows another perspective view of the present invention.

FIG. 3 shows a plan view of the second end of the shank of the present invention.

FIG. 4 shows a plan view of the present invention with engaging teeth attached to a fastener.

FIG. 5 also shows a plan view of the present invention with engaging teeth attached to a fastener.

FIG. 6 shows a cut plan view of the present invention with an optional spring and ball mechanism and female half circle catches.

FIGS. 7A, 7B, 8A, 8B show additional engaging sockets.

DRAWINGS: REFERENCE NUMBERS

10 adjustable jaw
12 fixed jaw
14 adjusting screw
16 first end
18 shank
20a arm
20b arm
22 ratchet box
24a first engaging socket
24b teeth
26a second engaging socket
26b teeth
28 interior passage
30 pin
32a female half circle catch
32b female half circle catch
34 spring and ball mechanism
36a interior passage
36b interior passage
38 second end
40 fastener

DETAILED DESCRIPTION: FIGS. 1, 2, 3, 4, 5
PREFERRED EMBODIMENT

Referring to FIG. 1 of the present invention, a multi-function adjustable wrench includes; a shank 18 having a first end 16, a fixed jaw 12, and an adjustable jaw 10. The adjusting screw 14 moves the adjustable jaw 10 toward and away from the fixed jaw 12. This enables the user to tighten or loosen a wide variety of different diameter fasteners. The range of adjustment depends on the length of the wrench.

Referring to FIG. 1 of the multi-function adjustable wrench, two arms 20a, 20b extend from the second end 38 of the shank 18. A ratchet box 22 is rotatably connected within the two arms 20a, 20b with an engaging member such as a pin 30.

Referring to FIG. 1 of the multi-function adjustable wrench, a ratchet box 22 includes; a first engaging socket 24a is rotatably engaged with a first engaging hole of the ratchet box 22. A second engaging socket 26a having a different inner diameter is rotatably engaged with a second engaging hole of the ratchet box 22. The first engaging socket 24a and the second engaging socket 26a have an engaging hole defined therethrough. Teeth 24b form a toothed engaging hole of the first engaging socket 24a. Teeth 26b form a toothed engaging hole of the second engaging socket 26a. Two single sized 12-point engaging sockets are shown for example. Ratchet mechanisms (not shown) are

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received in the ratchet box 22, and are cooperated with the first engaging socket 24a and the second engaging socket 26a. The user is required to flip the wrench over for reverse operation of the socket being used.

Referring to FIG. 2, this shows how the ratchet box 22 is rotatably connected within the two arms 20a, 20b. The pin 30 passes through interior passage 36b, of the arm 20b, through interior passage 28 of the ratchet box 22, and through interior passage 36a of the arm 20a for a stiff fit.

Referring to FIG. 3, this shows the second end 38 of the shank 18. The ratchet box 22 can rotate 360 degrees in either direction. With this ability, any angle of offset can be created when using the second end 38 of the shank 18 as the functional end. Rotating the ratchet box 22 would also be done to interchange socket locations. When the ratchet box 22 is rotated, it will be stiff and tight. This will give ease of use when using the second end 38 of the shank 18 as the functional end in a offset position.

Referring to FIG. 4, this shows the multi-function adjustable wrench using the second end 38 of the shank 18 as the functional end. For example, I illustrate teeth 26b engaged to a fastener 40 with the shank in the flat position relative to the work piece.

Referring to FIG. 5, this shows the multi-function adjustable wrench using the second end 38 of the shank 18 as the functional end. For example, I illustrate teeth 26b engaged to a fastener 40 with the shank 18 in a offset angle relative to the work piece.

ADDITIONAL EMBODIMENTS: FIGS. 6

Referring to FIG. 6 this shows a optional spring and ball mechanism 34 and female half circle catches 32a, 32b. The spring and ball 34 may be incorporated into the second end 38 of the shank 18. Female half circle catches 32a, 32b also may be incorporated into each end of the ratchet box 22. This would be used to lock the ratchet box 22 in the flat position.

FIG. 7A shows a side cut view of a single sized square engaging socket.

FIG. 7B shows a top view of a single sized square engaging socket.

FIG. 8A shows a side cut view of a double sized square engaging socket.

FIG. 8B shows a top view of a double sized square engaging socket.

The preferred engaging sockets to be used are 12-point and square types. The square engaging sockets are single and double sized. A 12-point engaging socket has a toothed engaging hole defined therethrough so as to form a 12-point engaging socket. A square engaging socket has a square engaging hole defined therethrough so as to form a square engaging socket. A single sized square engaging socket has a single sized square engaging hole defined therethrough so as to form a single sized square engaging socket. A double sized square engaging socket has a double sized square engaging hole defined therethrough so as to form a double sized square engaging socket.

OPERATION: FIGS. 1, 3, 4, 5

In operation, when the user desires to use the multi-function adjustable wrench with the first end 16 of the shank 18 as the functional end, the user would hold the second end 38 of the shank 18 in one hand. Place a fastener to be tightened or loosened between the fixed jaw 12 and the adjustable jaw 10. Adjust the adjusting screw 14 to a tight fit

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with a fastener. At the end of the first stroke, the user is required to release the fixed jaw 12 and the adjustable jaw 10 from the fastener to re-position the wrench at a convenient angle for a second stroke.

In operation, the user when desires can use the multi-function adjustable wrench with the second end 38 of the shank 18 as the functional end. The user would now hold the first end 16 of the shank 18 in one hand, engage engaging socket 26a, or 24a to a fastener 40. The user would tighten or loosen in one direction, and at the end of the first stroke, ratchet the shank 18 back in the opposite direction to a convenient angle for the second stroke.

In operation, when using the multi-function adjustable wrench with the second end 38 of the shank 18 as the functional end, the user can use as a flat style FIG. 4, or rotate the ratchet box 22 to create any angle of offset FIG. 5.

In FIGS. 4, 5 for example, I illustrate the multi-function adjustable wrench with the second end 38 of the shank 18 as the functional end. The user would hold the first end 16 of the shank 18 in one hand. Further in FIGS. 4 and 5, I illustrate the preferred location to put the desired socket for use, such as teeth 26b shown engaged to a fastener 40. The reason for this location is, when tightening or loosening the rounded shape of the fixed jaw 12 will apply pressure to the hand. This is true for right or left handed users, and is quite comfortable to hold. If the user desired to switch socket locations, the ratchet box 22 would simply be rotated. Keeping in mind that either socket can be used in any location. The user would be required to flip the wrench over for reverse operation for the socket being used.

SCOPE, RAMIFICATIONS, CONCLUSION

The present invention, a multi-function adjustable wrench would appeal to anybody who uses wrenches, especially the professional who carries a tool bag with limited space. The novice to the professional would use the multi-function wrench with 6-point, 12-point, or spline engaging sockets. The use of square engaging sockets would appeal to the HVAC-R tradesperson. When using an engaging socket to tighten or loosen a fastener, the shank can be in a flat position or an offset position relative to the work piece.

The following is a list of preferred size combinations for the present invention.

1. 6-inch adjustable wrench having a ratchet box with $\frac{5}{16}$ ", and $\frac{3}{8}$ " 12-point single sized open-end engaging sockets.
2. 8-inch adjustable wrench having a ratchet box with $\frac{7}{16}$ ", and $\frac{1}{2}$ " 12-point single sized open-end engaging sockets.

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3. 10-inch adjustable wrench having a ratchet box with $\frac{9}{16}$ ", and $\frac{5}{8}$ " 12-point single sized open-end engaging sockets.
4. 12-inch adjustable wrench having a ratchet box with $\frac{11}{16}$ ", and $\frac{3}{4}$ " 12-point single sized open-end engaging sockets.
5. 8-inch adjustable wrench having a ratchet box with $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ " square engaging sockets. These sockets are double sized open-end types (not shown).
6. 10-inch adjustable wrench having a ratchet box with $\frac{3}{8}$ ", and $\frac{1}{2}$ " square engaging sockets.

While I have shown and described the preferred and additional embodiments in accordance with the present invention, it should be clear to those skilled in the art that further embodiments may be made without departing from the scope of the present invention. Thus the scope of the invention should be determined by the appended claims rather than by the examples given.

I claim:

1. A multiple function adjustable wrench comprising:
a shank having a first end and a second end, said first end including a fixed jaw, an adjustable jaw and an adjusting screw,
two arms extending from said second end,
a ratchet box, rotatably connected within said two arms,
said ratchet box including a first engaging socket, said first engaging socket having a first engaging hole defined therethrough,
said first engaging socket is rotatably engaged with respect to said ratchet box,
said ratchet box further including a second engaging socket, said second engaging socket having a different diameter second engaging hole defined therethrough,
said second engaging socket is rotatably engaged with respect to said ratchet box.
2. The wrench of claim 1 wherein said first engaging hole of said first engaging socket is a toothed 12 point engaging hole.
3. The wrench of claim 1 wherein said second engaging hole of said second engaging socket is a toothed 12 point engaging hole.
4. The wrench of claim 1 wherein said first engaging hole of said first engaging socket is a square engaging hole.
5. The wrench of claim 1 wherein said second engaging hole of said second engaging socket is a square engaging hole.

* * * * *

Document C: Prior Art B (1/7)

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Juieng

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(45) **Date of Patent:** **Mar. 25, 2008**

(54) **AUTOMATIC ADJUSTABLE HEAD WRENCH**

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(52) **U.S. Cl.** **81/129.5; 81/418**

(58) **Field of Classification Search** 81/126,
81/129.5, 186, 418

See application file for complete search history.

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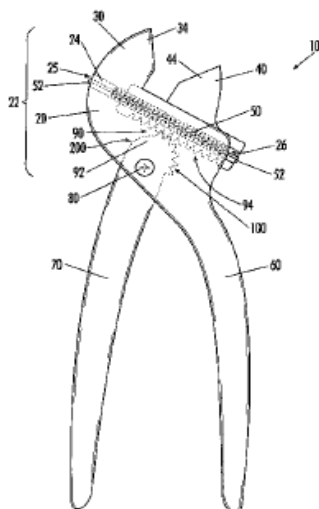
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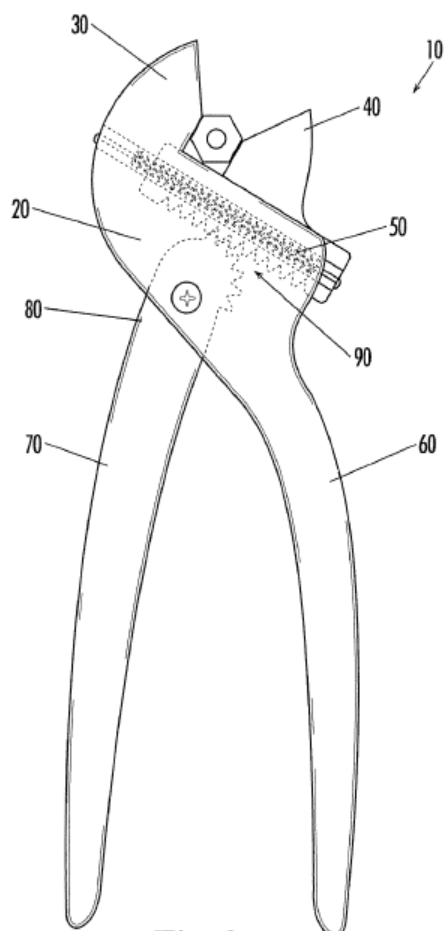
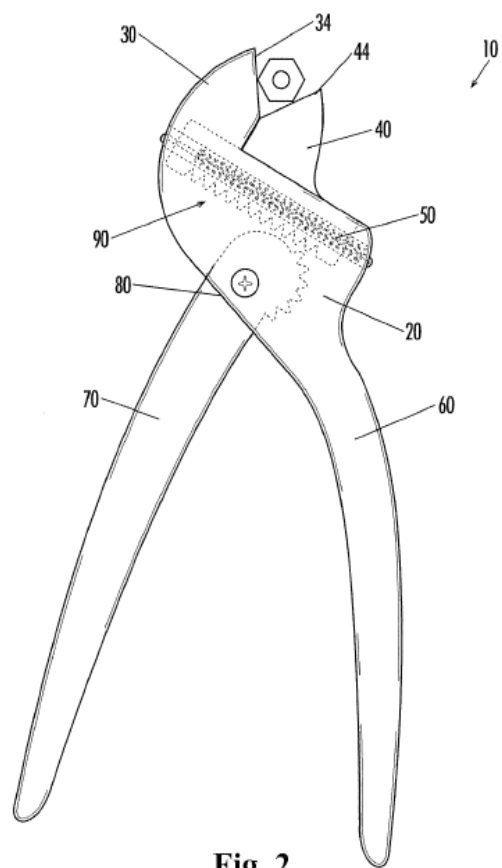
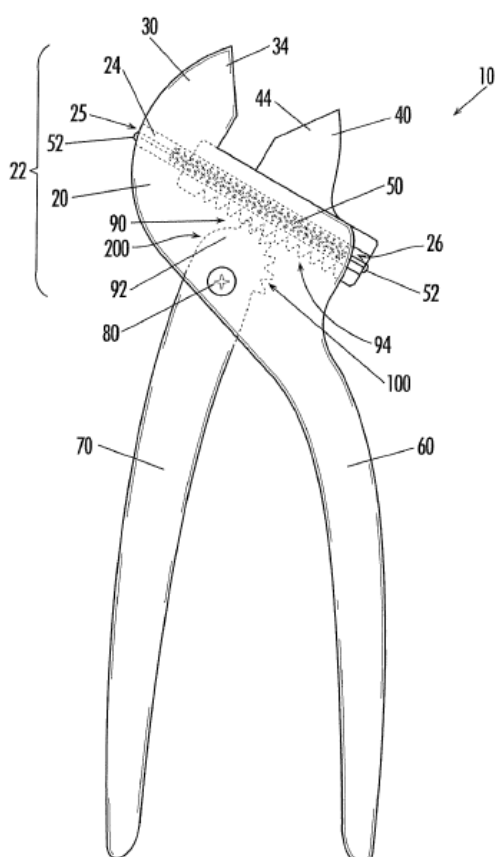
(57) **ABSTRACT**

An adjustable wrench including a head having parallel jaws. The parallel jaws include a first fixed jaw and a movable second jaw. The second jaw is mounted to the head for parallel, sliding movement relative to the first jaw. The wrench also includes a first handle rigidly coupled to the first jaw, and a second handle pivotally mounted to the first handle and coupled to the second jaw. The second handle is coupled to the second jaw such that movement of the handles relative to each other causes the parallel jaws to open and close.

21 Claims, 8 Drawing Sheets



Document C: Prior Art B (2/7)



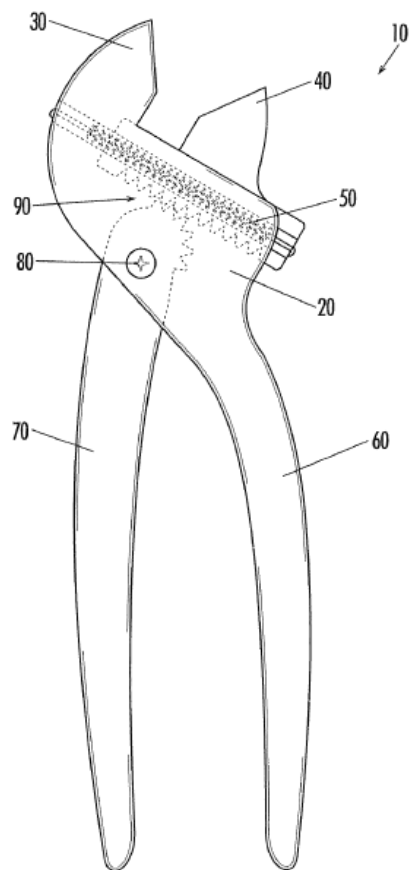


Fig. 4

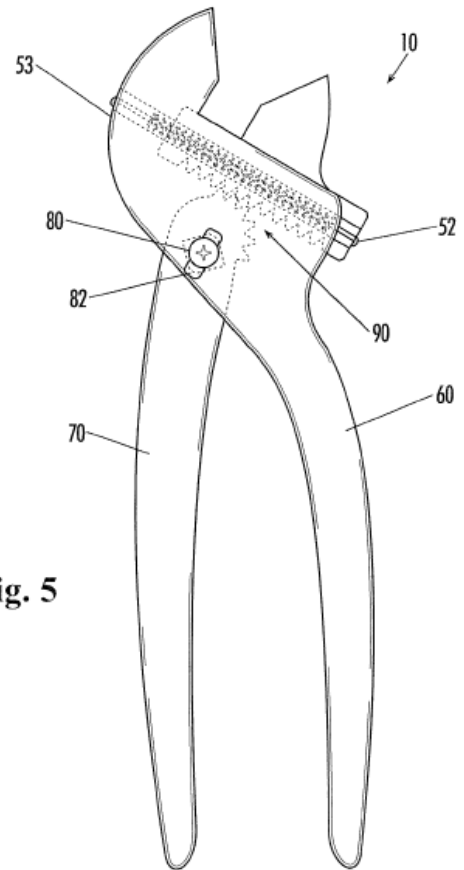


Fig. 5

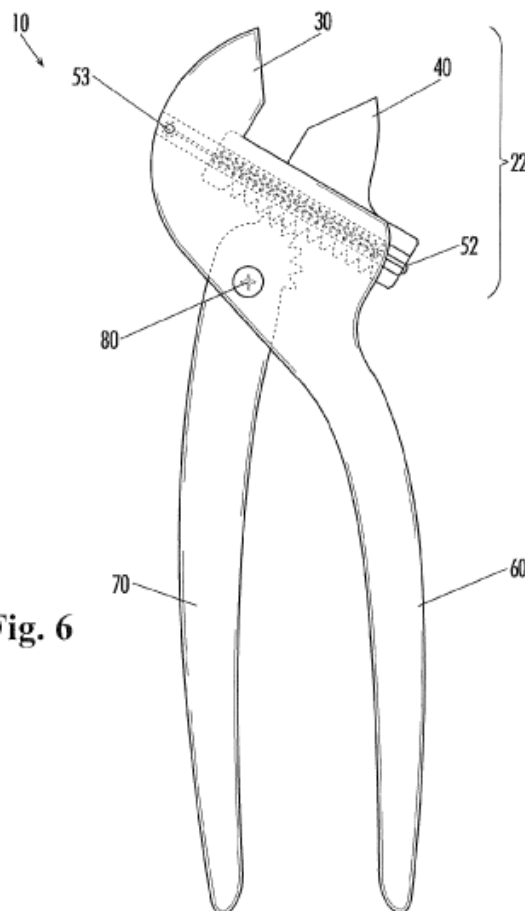


Fig. 6

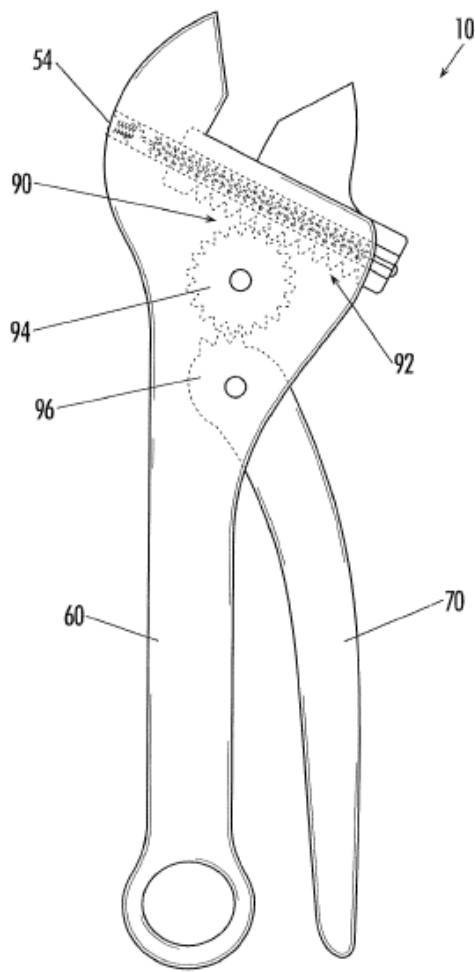


Fig. 7

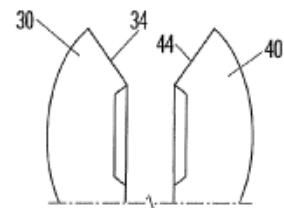


Fig. 8A

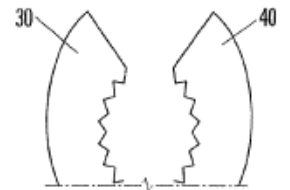


Fig. 8B

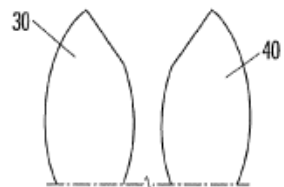


Fig. 8C

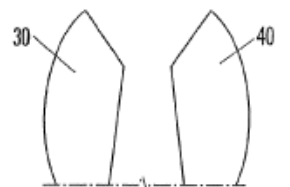


Fig. 8D

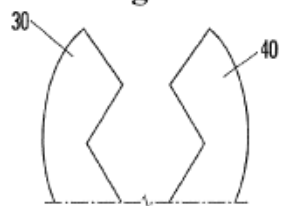


Fig. 8E

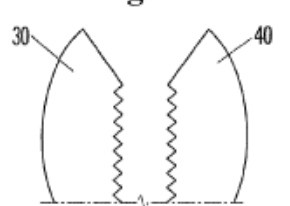


Fig. 8F



Fig. 8G

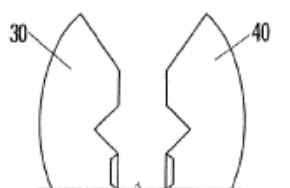


Fig. 8H

AUTOMATIC ADJUSTABLE HEAD WRENCH

TECHNICAL FIELD

The present invention relates generally to the field of tools, and more particularly, to a wrench having an automatic adjustable head.

BACKGROUND OF THE INVENTION

Adjustable head wrenches are well known in the art and typically have one adjustable jaw and one stationary jaw for engaging objects of different dimensions within the adjustment range of the wrench. In many wrenches having an adjustable head, a worm gear member is fixed to the body of the wrench and is geared to corresponding teeth in the jaw to be moved. In many instances, the worm gear is rotated with the user's thumb. As the worm gear is rotated, the movable jaw's teeth are engaged by the gear and carry the movable jaw over the worm gear to adjust the distance between the stationary jaw and the movable jaw.

When in use, a user must manipulate the worm gear each time the user wishes to engage a different sized object, such as a nut or bolt, to adjust the size of the wrench head accordingly. When sequentially engaging nuts or bolts of varying dimensions, it may be commonly required for a user to adjust the wrench head size for each individual nut or bolt. Having to repeatedly adjust the distance between the two jaws of the wrench can be inconvenient to a user, especially when the user is working with multiple nut and bolt sizes. Additionally, when using an adjustable head wrench, a user is often required to remove the wrench head from the nut or bolt, reposition the wrench head, and reengage the wrench head with the nut or bolt when making a series of partial turns to tighten or loosen the same. Repeatedly having to engage in such steps can be inconvenient to a user.

Pliers-type wrenches are also well known in the art and typically include two handles attached to a set of jaws, wherein each handle is coupled to a separate jaw, and a pivot point in proximity with the jaws. Typically, the leverage provided by the handles of such wrenches increases as the proximity of the pivot point to the jaws increases, and as such, so does the mechanical advantage that is provided to a user. However, because the handles and jaws act as levers, the ends of the handles are generally spread apart farther than the opening between the jaws. For example, if the handles are four times longer than the jaws (generally a mechanical advantage of four), then the handles will need to be spread apart four times farther than the desired opening between the jaws. Because the space in which a user may operate pliers-type wrenches is often limited due to spatial constraints such as hand size or available work space, traditional pliers-type wrenches may only be able to provide a user with a very limited amount of leverage in such instances.

Accordingly, it can be seen that needs exist in the art for an automatic adjustable head wrench that permits a user to forego repeatedly adjusting the wrench head size and does not require a user to reposition the wrench head on a nut or bolt when making consecutive turns to tighten or loosen the same. Additionally, needs exist for an adjustable head wrench that foregoes the leverage problems associated with pliers-type wrenches. Therefore, it is to the provision of these needs and others that the present invention is primarily directed.

SUMMARY OF THE INVENTION

Briefly described, in one preferred form the present invention comprises an automatic adjustable head wrench for adapting to objects having varying dimensions. In one aspect, the present invention is an adjustable wrench having an adjustable head with a fixed jaw and a movable jaw. The movable jaw is mounted for sliding movement in relation to the fixed jaw, with the fixed jaw and movable jaw having substantially parallel jaw faces. The wrench also includes a pliers-style handle mechanism with first and second handles coupled to the fixed jaw and the movable jaw. The handle mechanism is operated to draw the jaws tightly together when the first and second handles are squeezed together.

Optionally, the second handle is coupled to the movable jaw with a gear mechanism. Further still, the present invention may include a biasing mechanism, such as a spring, for urging the jaws toward a closed position. Additionally, the jaws may have tapered distal ends to allow the jaws to be eased over a nut.

In another aspect, the invention is a hand tool comprising a head having parallel jaws. The parallel jaws include a fixed first jaw and a movable second jaw, wherein the second jaw is mounted for parallel, sliding movement relative to the first jaw. The invention also includes a first handle rigidly coupled to the first jaw and a second handle pivotally mounted to the first handle. The second handle is also coupled to the second jaw such that movement of the handles relative to each other causes the parallel jaws to open and close.

One advantage of the present invention is that a user is able to engage nuts and bolts having varying dimensions without manually adjusting the distance between the wrench's jaws for each nut or bolt. Another advantage of the present invention is that a user is able to draw the jaws tightly against a nut or bolt being engaged. A still further advantage of the present invention is that the user can apply leverage after the jaws have already been positioned around an object.

These and other aspects, features and advantages of the invention will be understood with reference to the drawing figures and detailed description herein, and will be realized by means of the various elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following brief description of the drawings and detailed description of the invention are exemplary and explanatory of preferred embodiments of the invention, and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of an automatic adjustable head wrench according to an example embodiment of the present invention.

FIG. 2 is a front view of the automatic adjustable head wrench of FIG. 1 showing the jaws in a substantially closed position.

FIG. 3 is a front view of the automatic adjustable head wrench of FIG. 1 showing the wrench engaging a nut.

FIG. 4 is a front view of an automatic adjustable head wrench according to another example embodiment of the present invention.

FIG. 5 is a front view of an automatic adjustable head wrench according to another example embodiment of the present invention.

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FIG. 6 is a front view of an automatic adjustable head wrench according to another example embodiment of the present invention.

FIG. 7 is a front view of an automatic adjustable head wrench according to still another example embodiment of the present invention.

FIGS. 8A-8H are front views of a variety of example wrench head designs in accordance with the present invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

The present invention may be understood more readily by reference to the following detailed description of the invention taken in connection with the accompanying drawing figures, which form a part of this disclosure. It is to be understood that this invention is not limited to the specific devices, methods, conditions or parameters described and/or shown herein, and that the terminology used herein is for the purpose of describing particular embodiments by way of example only and is not intended to be limiting of the claimed invention. Also, as used in the specification including the appended claims, the singular forms "a," "an," and "the" include the plural, and reference to a particular numerical value includes at least that particular value, unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" or "approximately" one particular value and/or to "about" or "approximately" another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent "about," it will be understood that the particular value forms another embodiment.

With reference now to the drawing figures, FIGS. 1-8 show an automatic adjustable head wrench 10 according to example embodiments of the present invention. The wrench 10 generally comprises a body 20, fixed jaw 30, movable jaw 40, biasing member 50, fixed handle 60, and movable handle 70. The wrench 10 may vary in size depending on the intended use and needs of a user, although generally the wrench is intended to be handheld. However, it is conceivable that the size of the wrench 10 may be much larger or smaller as necessary. The wrench 10 of the present invention allows a user to engage objects having varying dimensions, such as different sized nuts or bolts, without having to manually adjust the head size of the wrench.

In example embodiments, the automatic adjustable head wrench 10 has a rigid fixed body 20 comprised of steel, iron, or any other suitably rigid material(s). The body 20 includes a head portion 22 and a fixed handle 60 formed at opposing ends of the body. A fixed jaw 30 extends at one end of the head portion 22. A second, parallel movable jaw 40 is slidably mounted to the head portion 22 of the body 20, whereby the two jaws are adapted to receive an object between them. The jaws 30 & 40 have tapered ramps/cams 34, 44 respectively, for allowing the jaws to easily receive and slide over a nut or bolt. Additionally, the jaws preferably have flat faces for engaging nuts and bolts; however, in alternative embodiments, the jaws can be cutter style jaws (see FIG. 8A) for cutting wire, tree limbs, rope, etc. Other possible types of jaws include concave or convex jaws, inwardly sloping jaws, 120-degree recess jaws (see FIG. 8E), grooved jaws, a combination of one or more of the aforementioned jaw types (see FIGS. 8A-8H), or the jaws can be interchangeable. The head portion 22 of the body 20

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further includes a biasing member 50 for urging the two jaws towards a closed position. As seen in the drawing figures, the biasing member 50 is an extended coiled spring, however, in alternative embodiments other biasing mechanisms may be used, such as leaf springs, torsion springs, compressed springs, or any other suitable biasing mechanism.

A cavity or recess 24 is present in example embodiments for enclosing the coiled spring biasing member 50 within the head portion 22 and has openings 25, 26 at distal ends of the cavity. However, one or both openings can be omitted or the cavity 24 can be omitted altogether in embodiments using alternative biasing mechanisms. As depicted in the drawing figures, there are a multitude of options for connecting the biasing member 50 to the jaws 30, 40. Hooks 52 extending from the distal ends of the coiled spring 50 can be used to secure the spring to the body 20 and the movable jaw 40 as seen in FIG. 1. In alternative embodiments, the biasing member 50 can be secured with a combination of hooks 52, pins 53 (see FIG. 5) and/or screws 54 (see FIG. 7).

The handle configuration of the present invention can be described as a "pliers" style configuration in which a user engages both handles to operate the wrench 10. As such, the movable handle 70 is rotatably mounted to the body 20 with a coupling mechanism 80, such as a shouldered axle screw or a nut and bolt, which permits the handle to pivot about the mechanism 80. The movable handle 70 is geared to the movable jaw 40 with a rack and pinion gear 90. As best seen in FIG. 1, the movable handle 70 has geared teeth 100 in the form of a pinion gear 92, extending from a distal end of the handle for engaging a complementary row of geared teeth in a rack gear 94, along a bottom portion of the movable jaw 40. Portion 200 of the pinion gear 92 does not have teeth, but rather is preferably smooth. Axial rotation of the movable handle 70 away from the fixed handle 60 and body 20 causes the geared teeth 100 of the pinion gear 92 to cease to engage the complementary rack gear 94. Once the geared teeth 100 no longer engage the rack gear 94, the spring-like mechanism 50 forces the jaws 30, 40 together. Conversely, axial rotation of the movable handle 70 towards the fixed handle 60 and body 20 causes the teeth portion 100 of the pinion gear 92 to engage the complementary rack gear 94 and move the corresponding movable jaw 40 longitudinally towards the fixed jaw 30. It is preferred that the movable handle 70 and rack and pinion gear 90 be manufactured from steel, iron, or any other suitably rigid material.

In operation, a user engaging a nut, bolt, or other object can slide the ramps/cams 34 & 44 of the jaws over the nut or bolt as seen in FIG. 2. Because the biasing member 50 urges the jaws towards a closed position, the ramps 34 & 44 serve to allow the jaws to receive a nut or bolt therein by prying the movable jaw 40 away from the fixed jaw 30 to accommodate the nut or bolt as seen in FIG. 3. In order to begin tightening or loosening the nut or bolt, a user would then hold the jaws tight against the nut or bolt. This can be accomplished by squeezing the movable handle 70 towards the fixed jaw 60, which engages the rack and pinion gear, forcing the movable jaw 40 towards the fixed jaw 30. The closer the coupling mechanism 80 is located in relation to the rack and pinion gear 90, the higher the mechanical advantage becomes, such that less leverage force is required by the user to tighten and secure the jaws against the nut or bolt. FIG. 1 depicts an example embodiment having a lower mechanical advantage than the example embodiment shown in FIG. 4. Additionally, FIG. 5 depicts an additional example embodiment showing a wrench 10 of the present invention that allows a user to change the pivot point of the movable handle 70 to adjust the amount of leverage force applied to

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the nut or bolt as needed. In such an embodiment, the coupling mechanism 80 has a channeled slot 82 for positioning the mechanism closer or farther away from the rack and pinion gear 90. In another example embodiment, as seen in FIG. 6, the head portion 22 of the wrench 10 can be angled in the opposite direction as depicted in FIGS. 1-5 to allow for more comfortable use of the wrench depending on the preferences of the user.

In still another alternative embodiment, the wrench 10 of the present invention can comprise a comfortable and more traditional "adjustable wrench" style handle configuration having a more substantial, centrally fixed handle 60 as seen in FIG. 7. In contrast to earlier described embodiments, a user may concentrate a greater percentage of the rotational force needed to tighten or loosen a nut or bolt on the fixed handle in the embodiment seen in FIG. 7, rather than dispersing the force among the pliers style handles shown in FIGS. 1-6. However, in order to tighten the jaws against a nut or bolt, a motion reversing gear set is used including a rack and pinion gear 90 (having a rack 92 and pinion 94) and an actuator gear 96. By squeezing the movable handle 70 towards the fixed handle 60, the pinion 94 is rotated counterclockwise, carrying the rack 92 and the movable jaw towards the fixed jaw. By allowing a user to concentrate the rotational force required to tighten or loosen a bolt or nut on the fixed handle 60, the longevity of the rack and pinion gear 90 may be prolonged.

While the invention has been described with reference to preferred and example embodiments, it will be understood by those skilled in the art that a variety of modifications, additions and deletions are within the scope of the invention, as defined by the following claims.

What is claimed is:

1. A self-adjustable wrench comprising:

an adjustable head having a first fixed jaw and a second movable jaw, the movable jaw being mounted for sliding movement in relation to the fixed jaw, the fixed and movable jaws having substantially parallel jaw faces and tapered ramps at the distal ends thereof to allow the jaws to receive a nut, the tapered ramps being at least as long as the jaw faces;

a pliers-style handle mechanism with first and second handles and coupled to the fixed jaw and the movable jaw, the handle mechanism being operated to draw the jaws tightly together when the first and second handles are squeezed together; and

a biasing spring for urging the jaws towards a closed position, the spring having a first end and second end, the first end being coupled to the fixed jaw, and the second end being coupled to the movable jaw.

2. The adjustable wrench of claim 1, wherein the second handle is coupled to the second jaw with a gear mechanism.

3. The adjustable wrench of claim 2, wherein the gear mechanism comprises rack and pinion gears.

4. The adjustable wrench of claim 1, wherein the biasing spring for urging the jaws toward a closed position is a pulling spring.

5. The adjustable wrench of claim 1, wherein the handles are pivotally mounted to each other about a pivot axle which

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is movably mounted to the head so as to allow for adjustment of leverage exerted by the handles.

6. The adjustable wrench of claim 1, wherein the first handle and the first jaw lie along one longitudinal side of the wrench, while the second handle and the second jaw lie along an opposite longitudinal side of the wrench.

7. The adjustable wrench of claim 1, wherein the first handle and second jaw lie along one longitudinal side of the wrench, while the second handle and the first jaw lie along an opposite longitudinal side of the wrench.

8. The adjustable wrench of claim 1, wherein the wrench has an adjustable wrench-style head and pliers-style handles.

9. The adjustable wrench of claim 1, wherein the jaws are cutter style jaws.

10. A hand tool comprising:

a head having parallel jaws, with a fixed first jaw and a movable second jaw, the second jaw mounted for parallel, sliding movement relative to the first jaw;

a first handle rigidly coupled to the first jaw;

a second handle pivotally mounted to the first handle and coupled to the second jaw such that movement of the handles relative to each other causes the parallel jaws to open and close; and

a biasing member for urging the jaws towards a closed position, the member having a first end and second end, the first end being coupled to the fixed jaw, and the second end being coupled to the movable jaw.

11. The hand tool of claim 10, wherein the second handle is coupled to the second jaw with a gear mechanism.

12. The hand tool of claim 11, wherein the gear mechanism comprises rack and pinion gears.

13. The hand tool of claim 10, wherein the biasing member comprises a spring.

14. The hand tool of claim 13, wherein the spring is a pulling spring.

15. The hand tool of claim 10, wherein the jaws have tapered distal ends to allow the jaws to be eased over an object.

16. The hand tool of claim 10, wherein the handles are pivotally mounted to each other about a pivot axle which is movably mounted to the head so as to allow for adjustment of leverage exerted by the handles.

17. The hand tool of claim 10, wherein the first handle and first jaw lie along one longitudinal side of the tool, while the second handle and the second jaw lie along an opposite longitudinal side of the tool.

18. The hand tool of claim 10, wherein the first handle and second jaw lie along one longitudinal side of the tool, while the second handle and the first jaw lie along an opposite longitudinal side of the tool.

19. The hand tool of claim 10, wherein the tool has an adjustable wrench-style head and pliers-style handles.

20. The hand tool of claim 10, wherein the parallel jaws are cutter style jaws.

21. The hand tool of claim 10, wherein the parallel jaws are 120-degree recess style jaws.

* * * * *



Multi-Size wrench tool for bicycles

END OF PAPER