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A. G. DAY

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ADJUSTABLE, SLIDABLE JAW, OPEN-END WRENCH

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2 Sheets-Sheet 1

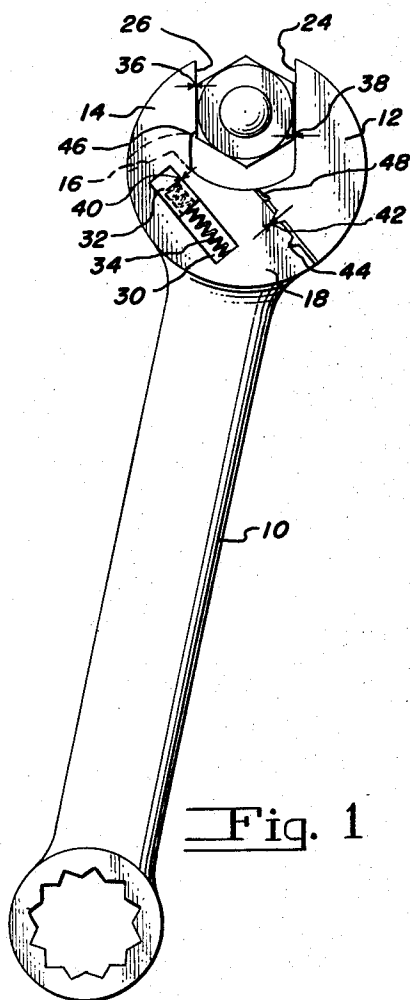


Fig. 1

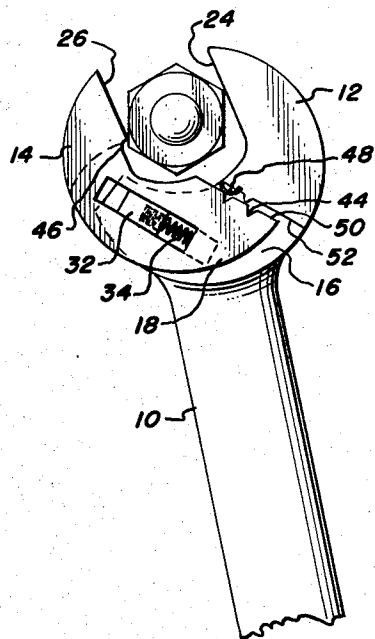


Fig. 2

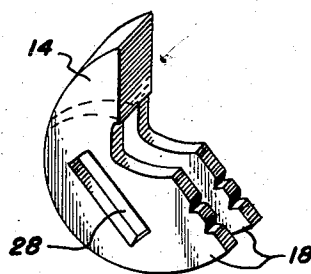


Fig. 3

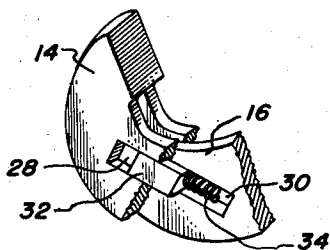


Fig. 4.

INVENTOR.
ALAN G. DAY

BY

O. Walter Covell Jr.

AGENT

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A. G. DAY

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2 Sheets-Sheet 2

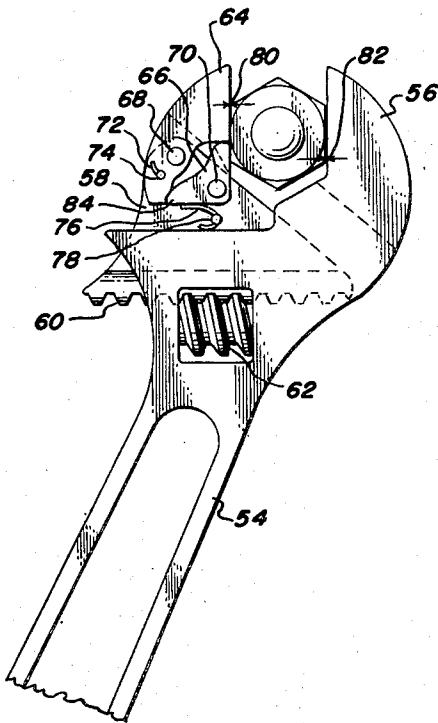


Fig. 5

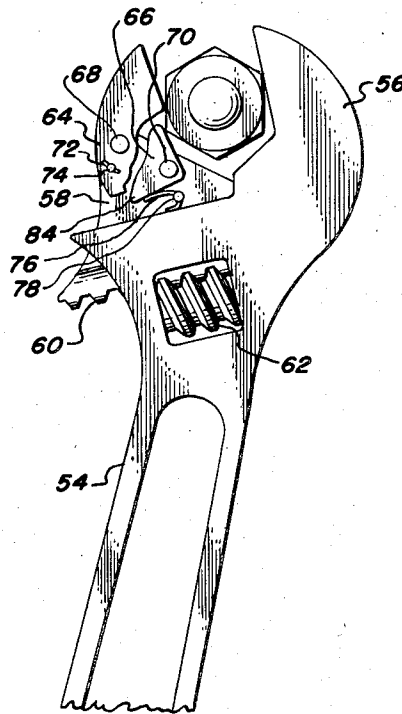


Fig. 6

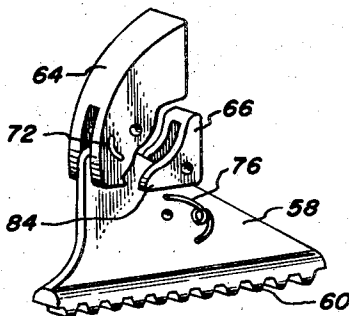


Fig. 7

INVENTOR.
ALAN G. DAY

BY *O. R. Carter*

AGENT

2,846,912

ADJUSTABLE, SLIDABLE JAW, OPEN-END WRENCH

Alan G. Day, Fairfield, Conn.

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7 Claims. (Cl. 81-179)

This invention relates to open-end wrenches which are adjustable and more particularly to an adjustable open end wrench having a nut-gripping jaw which is movable by reverse movement of the wrench to pass to other faces of the nut without turning it.

To accomplish this, this invention provides a wrench having a movable jaw mounted in relationship to the fixed jaw so that the space therebetween when in a gripping or neutral position may be adjusted to accommodate a variety of sizes. This space will be firmly maintained when torque is being applied, and when in the positioning or reverse stroke, the jaws will open a sufficient additional distance to allow the wrench to rotate around the nut. During this stroke the space setting is maintained so that additional torquing and return strokes will be possible without further adjustment.

A feature of this invention is to provide a wrench of improved construction wherein the wrench retains its hold on the nut or hex during its backward stroke instead of being detached therefrom as is usual, considerably speeding up the process of torquing a nut in an application where it is desirable to use an open end wrench.

Another feature of this invention is to provide on such a wrench means whereby the wrench may be adjusted to fit nuts or hexes of various sizes and shapes, thereby eliminating the need for a multitude of fixed wrenches. To accomplish this, a movable jaw is provided mounted in relation to the fixed jaw so that the space when in gripping or neutral position therebetween may be adjusted.

A still further feature of this invention is to provide a wrench which will be strong and efficient and yet be compact to operate in small spaces to take advantage of its ratchet action to quickly tighten or loosen nuts which would otherwise be an extremely tedious operation.

Other features and advantages of this invention will be apparent from the following specification taken in connection with the accompanying drawings in which:

Fig. 1 is a plan view of a wrench embodying this invention shown in position for the torque stroke,

Fig. 2 is a view similar to Fig. 1 but shows the wrench in the return stroke,

Fig. 3 is an isometric view of the movable jaw of the wrench,

Fig. 4 is a detail of the relationship between the fixed and movable jaws with the movable jaw partially broken away,

Fig. 5 shows a plan view of a wrench embodying a modification of this invention,

Fig. 6 shows a plan view of the modified wrench in the return or repositioning stroke, and

Fig. 7 is an exploded isometric view of the movable jaw of the modified wrench.

As seen in the drawings, an open end wrench is provided with a handle portion 10 terminating in a fixed jaw 12 which cooperates with a movable jaw 14. While the wrench as shown herein is provided at its opposite end with a simple box opening, it is to be understood that

any suitable type opening could be used, or the wrench could be provided with any suitable handle.

Fixed jaw 12 is provided with a usual gripping surface 24 which cooperates with a like gripping surface 26 on the movable jaw 14 in a manner to be described hereinafter.

As seen most clearly in Fig. 2, the fixed jaw 12, in addition to a gripping surface, is provided with a projecting tongue 16 which is slidably received in bifurcated arms 18 of the movable jaw 14. The movable jaw has a slot 28 passing through both of the bifurcated arms 18, and the fixed jaw has a similar slot 30 in its projecting tongue 16. When the jaws are assembled in their proper relationship, all three slots are aligned, and a guide block 32 is inserted in the slot 30 of the fixed jaw to guide the movement of the movable jaw relative to the fixed jaw. The block is provided with a small bore in which one end of a compression spring 34 rests, the other end of the spring acting on the opposed end of the slots 28 to continually urge the movable jaw to occupy a position as shown in Fig. 1. While the guide block provides a base for this spring, its additional function is to cooperate with the slots 28 of the movable jaw so that the movable jaw may only reciprocate along the long axis of the guide block. As shown herein the guide block is press fitted into the slot in the tongue, but it is to be understood that any suitable method of attachment could be used as long as the block is fixed to one jaw so that it allows controlled movement of the other jaw. By press fitting the guide block into the tongue, it can be seen that the wrench need be no thicker than the distance across the bifurcations of the movable jaw, thereby enhancing its use in restricted areas.

The jaws are so designed that when the movable jaw is positioned by spring 34 at the end of its stroke, its surface 50 will abut mating surface 52 of the fixed jaw. These surfaces may be notched or knurled as will be explained below.

In operation, when a torque force is applied at the end of the wrench, clockwise as seen in Fig. 1, the resulting forces on the nut are as shown by the opposing arrows at point 38 and point 36. Reaction forces take place at points 42 and 40, with point 40 acting mostly as a fulcrum. Some forces are also present at point 42 which will tend to move movable jaw 14 outboard in relation to the guide block and against the compression spring force. Friction of the surfaces 50 and 52 at point 42 may be increased sufficiently to compensate for this by knurling one or both surfaces. If knurling is not found to be adequate, one or more notches and tongues such as 44 may be used. Only one notch would be needed if the wrench were designed for only one hex size, and a series of notches would be needed if the wrench were designed to accommodate a series of different nut sizes, the notches being spaced to correspond to the nut sizes. One of the features of this invention is that by always keeping the working face of the movable jaw parallel to the fixed jaw face the wrench may apply torque properly to more than one hex size.

When it becomes necessary to reposition the wrench to the next position on the nut, the reaction forces will reverse, and the adjacent corner of the nut will catch in relief 46 of the movable jaw. As the repositioning force is applied counter-clockwise as seen in Fig. 2, the movable jaw, guided by the block 32 in the slots 28, will move against the force of the compression spring, thus opening the wrench jaws to permit passage of the points of the nut between the jaws. The force of the compression spring will then return the movable jaw to a position with the working face of its jaw snug against the next hex flat as seen in Fig. 1. Thus, the wrench is automatically positioned and ready for the

next application of the torque force. The spring strength of the compression spring should be fairly stiff if it is desired to obtain snappy return action of the movable jaw.

If knurling or notches are necessary between the surfaces 50 and 52, a leaf-type spring 48 assembled in a groove in either jaw will be necessary to separate these surfaces when no load exists and permit relative motion between these surfaces. When loads are applied the leaf spring is depressed into a groove of the jaw and has no effect. Guide 32 should be crowned somewhat on its opposite sliding surfaces. This will insure that the guide block acts only as a fulcrum point, and no twisting forces will be exerted. The crown should be only slight, however, so that the block will continue to act substantially as a guide.

If notches are used as shown between surfaces 50 and 52, by designing to load the notch in its groove on one side, slight variations in the dimensions of a hex can be overcome and a snug fit of the working jaws on the hex flats regardless of minor variations in nut size will be assured. In any event, the size across the nut hex will determine into which notched position the jaws will return on the return stroke before starting the torquing stroke. Thus, for every size of nut on which the wrench is expected to operate, a notch must be provided, so that at the end of the repositioning stroke, the movable jaw, under the urging of the spring 34, will automatically seat itself in the correct notch.

In Figs. 5 to 7, a modification of my wrench is shown wherein is provided an adjustable wrench which is adjustable to operate on a number of hex sizes in a well known manner but which includes in addition means to allow automatic repositioning without disengagement. This wrench includes the usual handle 54 and fixed jaw 56 which cooperates with the adjustable movable jaw 58.

The movable jaw 58 is received in a slot in the handle 54 and is provided with a rack 60 on its lower surface which engages and is controlled by a knurled worm wheel 62 also mounted in the handle. The upper part of the jaw is of reduced cross-section and is received by the bifurcated arms of a working jaw 64 and a toggle 66 which cooperate in a manner to be described.

Working jaw 64 is pivotally mounted on the reduced section of movable jaw 58 by pin 68 and toggle 66 is pivotally mounted in close proximity to the working jaw by a pin 70. The distance through which the working jaw may travel is limited by a pin 74 carried by the movable jaw which rides in a small slot 72 in the working jaw.

When force is applied to the underside of the toggle as viewed in the drawings, the working jaw is forced by the toggle against the limit of slot 72 in which position the fact of the jaw is parallel to the face of the fixed jaw. Spring 76, mounted on the movable jaw by pin 78 to react against the handle, is provided to exert such a force. When force is applied to the vertical face of the toggle, it trips the working jaw, allowing it to move about its pivot out of parallel relationship with the fixed jaw, opening the distance therebetween.

When torque force is applied, clockwise, the normal reaction of the jaws of the wrench against the hex is as shown by the arrows 80 and 82. Under this condition, the toggle and the working jaw are located as shown in Fig. 5. When it is necessary to reposition the wrench to the next flat on the hex, the repositioning force, counter-clockwise, is exerted. When this occurs, the corner adjacent the vertical face of the hex trips the toggle which lowers its outboard end and permits working jaw 64 to pivot about its pivot 68, thus moving it out of the way to permit the corners of the hex to pass between the jaws. When the wrench reaches the next position on the hex and the repositioning force ceases, spring 76 forces the toggle jaw back to its original position, which in turn forces working jaw 64 back to its original position. When in this position, a

lock is created between the toggle and the working jaw so that the wrench is ready for the application of the next torque force is to be applied. The lock mentioned above is created whenever the outboard nose 84 of the toggle engages a mating recess on the working jaw, and remains engaged until the nut trips the toggle.

Thus, it can be seen that my invention provides a wrench which offers the desirable combination of being adjustable to operate on various size nuts and which is able to at the same time reposition itself automatically so that it need not be taken off the nut for each new stroke.

Although the now preferred embodiments of the invention have been described and shown herein, it is to be understood that the invention is not to be limited thereto, for the invention is susceptible to changes in form and details within the scope of the appended claims.

I claim:

1. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue received by bifurcated arms of the other jaw for sliding movement therebetween, a slot in said tongue, mating slots in said bifurcated arms, a guide block in said tongue slot on which the other jaw may slide so that the gripping portions will be parallel in all positions of the jaws but may alter their spaced relationship, and spring means between the jaws to bias said movable jaw into said nut gripping position.

2. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue received by bifurcated arms of the other jaw for sliding movement therebetween, a slot in said tongue, mating slots in said bifurcated arms, a guide block in said tongue slot on which the other jaw may slide so that the gripping portions will be parallel in all positions of the jaws but may alter their spaced relationship, and spring means disposed in said tongue slot between said jaws.

3. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue forming a shoulder with the wrench, the other of said jaws having a pair of bifurcated arms which are slidably received by said tongue, a slot in said tongue parallel to said shoulder, mating slots in said bifurcated arms also parallel to said shoulder, a guide block in said slots to control relative movement of the jaws so that the gripping portions of the jaws will be parallel in all their positions but may alter their spaced relationship, and spring means disposed in said tongue slot between said jaws to bias said movable jaw into said spaced parallel relationship.

4. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue forming parallel shoulders with the wrench, the other of said jaws having a pair of bifurcated arms which are slidably received by said tongue, said bifurcated arms having ends parallel to and adapted to cooperate with said shoulders, a slot in said tongue parallel to said shoulder, mating slots in said bifurcated arms also parallel to said shoulder, a guide block in said slots to control relative movement of the jaws so that the gripping portions of the jaws will be parallel in all positions of the jaws but may alter their spaced relationship, and spring means disposed in said tongue slot between said jaws to bias said movable jaw into said spaced parallel relationship.

5. A wrench having spaced jaws with gripping portions

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which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue forming a shoulder with the wrench, the other of said jaws having a pair of bifurcated arms which are slidingly received by said tongue, a slot in said tongue parallel to said shoulder, mating slots in said bifurcated arms also parallel to said shoulder, a guide block in said slots having its long axis parallel with said shoulder to control relative movement of the jaws so that the gripping portion of the jaws will be parallel in all positions of the jaws but may alter their spaced relationship, and spring means disposed in said tongue slots between said jaws to bias said movable jaw in said spaced parallel relationship.

6. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue forming parallel shoulders with the wrench, the other of said jaws having a pair of bifurcated arms which are slidingly received by said tongue, said bifurcated arms having ends parallel to and adapted to cooperate with said shoulders, a slot in said tongue parallel to said shoulder, mating slots in said bifurcated arms also parallel to said shoulder, a guide block in said slots to control relative movement of the jaws so that the gripping portion of the jaws will be parallel in all positions of the jaws but may alter their spaced relationship, spring means disposed in said tongue slot between said jaws to bias said movable jaw into said spaced parallel relationship, and second spring means between the ends of said bifurcated arms and said shoulders.

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7. A wrench having spaced jaws with gripping portions which are in a spaced parallel relationship with each other when the wrench is in a nut gripping position, one of said jaws being fixed to the wrench and having a projecting tongue forming parallel shoulders with the wrench, the other of said jaws having a pair of bifurcated arms which are slidingly received by said tongue, engaging means on said shoulders, said bifurcated arms having ends parallel to and adapted to engage said engaging means, a slot in said tongue parallel to said shoulder, mating slots in said bifurcated arms also parallel to said shoulder, a guide block in said slots to control relative movement of the jaws so that the gripping portions of the jaws will be parallel in all positions of the jaws but may alter their spaced relationship, spring means disposed in said tongue slot between said jaws to bias said movable jaw into said spaced parallel relationship, and second spring means between the ends of said bifurcated arms and said shoulders to disengage said engaging means.

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