March 24, 1964 A. KAVALAR 3,125,910

WRENCH

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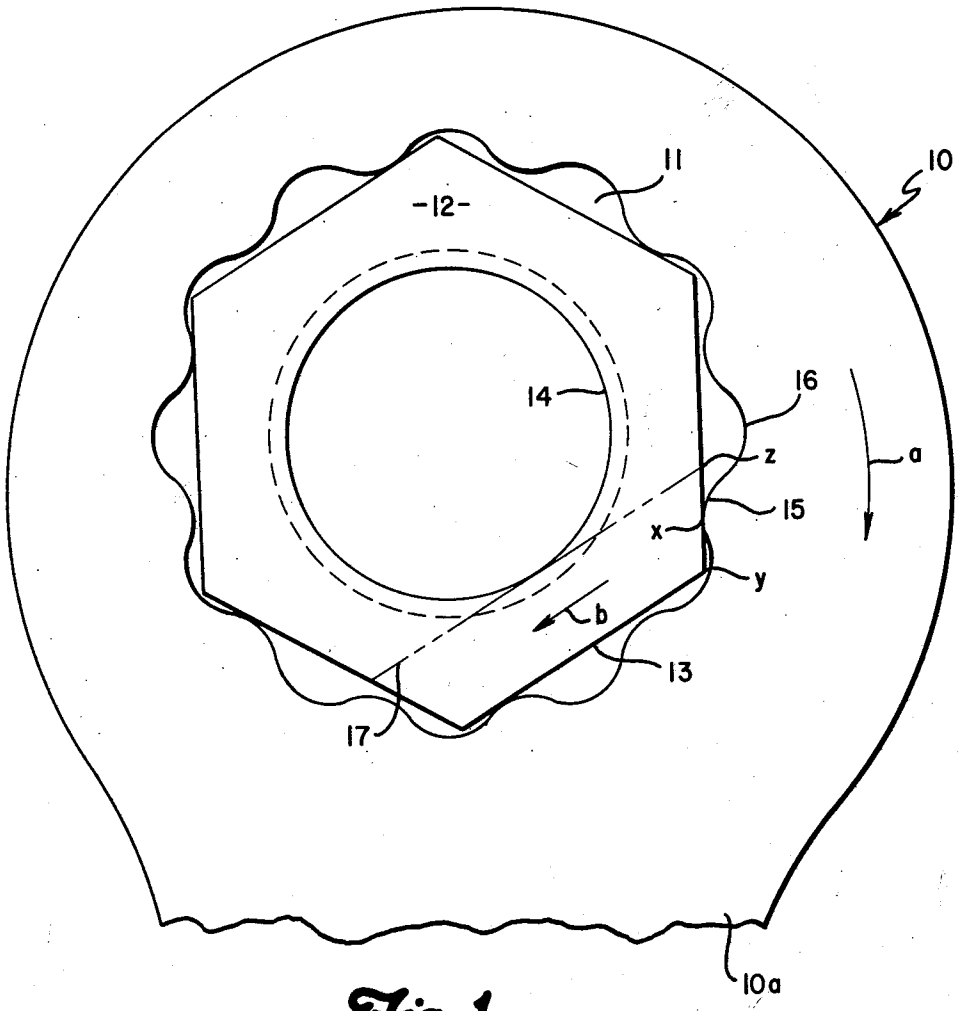

Fig. 1

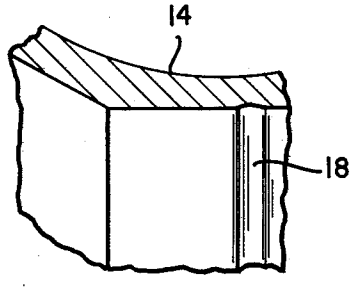

Fig. 2

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WRENCH

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This invention relates to tools but more particularly to wrenches for use with nuts, bolts or the like of polygonal or flat sided shapes.

Heretofore wrenches have been made to a shape similar to the nut or bolt they are intended to fit. However due to size tolerances it has been necessary to make the wrench oversize in order to fit such shapes. This oversize condition causes a change in angles when pressure is applied to the wrench for tightening purposes. As a consequence the wrench was caused to slide up the nut and to burr or distort the metal at the tips or corners of the nut. Burring of this character not only makes it difficult to remove the wrench from the nut but also to apply a wrench later on to loosen the nut.

It is found that when conventional wrenches are used for tightening fittings, such for example as those used in fluid lines, they not infrequently distort them, actually extruding and bending the metal into an oveal shape, resulting in leakage. Such distortion of the fitting during tightening also produces erroneous torque readings because the excess friction resulting from binding and crushing increases the torque by as much as seventy-five percent.

An object is to produce a simple and efficient wrench which overcomes the above difficulties and objections.

Another object is to produce a wrench which applies pressure on the flat surface of the polygonal nut-like member instead of on the corners thereof.

A further object is to produce a wrench which exerts substantially equal torque circumferentially of the member to which it is applied.

A still further object is to produce a wrench-nut-like reduces distortion or disfigurement of the nut or the like.

A still further object is to produce aw rench-nut-like member assembly wherein one member is polygonal and the other has alternating inwardly and outwardly projecting lobes so designed that substantially equal torque is applied circumferentially of the pressure-exerting member and pressure is so applied that the flat surfaces of the polygonal member receive same in the regions away from the corners thereof.

Other objects and advantages of the invention will hereinafter appear and, for purposes of illustration, but not of limitation, an embodiment of the invention is shown on the accompanying drawing, in which

FIGURE 1 is an enlarged plan view of the wrench applied to a nut, the handle being broken away; and

FIGURE 2 is an enlarged fragmentary sectional view of a portion of the nut showing a groove formed therein by the force exerted by the wrench.

The illustrated embodiment of the invention comprises a closed end wrench of suitable metal having a head **10** and a handle **10***a*, only a portion of which is shown. Within the head is an opening **11** for the reception of a flat sided or polygonal nut **12**, bolt or the like. In this instance the nut **12** is shown of hexagonal shape providing six flat faces **13** and having a central screw threaded circular hole **14**. The hole **14** is bounded by a series of alternating inwardly projecting lobes or jaws **15** and outwardly projecting lobes **16**. The lobes are arcuately formed and are of the same size and shape. For a selected nut-like member to which the wrench is applied there are four times as many lobes as there are flat faces or sides of the member.

Each of the flat faces **13** of the nut-like member is engaged by one of the inwardly projecting lobes **15** effecting a line contact in the region spaced from the adjacent corner portion of the member. Assuming that pressure is applied to the wrench in the direction of the arrow *a*, then each of the lobes **15** engaging a flat face **13** exerts a force in the direction of the arrow *b* or parallel to the respective face of the nut. Upon exertion of sufficient pressure each of the lobes **15** engaging a flat face of the nut-like member forms an elongate shallow cureved indentation **18**. On the drawing one of the lobes **15** has been selected for illustrative purposes but manifestly each of the face-engaging lobes operates similarly.

Optimum results are achieved if the face-engaging lobe **15** impinges on the nut at a specific location. This is best illustrated by establishing an imaginary line **17** which is drawn parallel to the adjacent face of the member **12** and approximately tangent to the circular hole **14**, thus providing a trapezoid. The lobe **15** at the right of this figure should preferably engage the adjacent side midway of its length or at the point *x*. Should the lobe **15** engage at about the point *y*, not only would the corner portion of the nut-like member be distorted but the lobe would slip off. On the other hand should the lobe **15** engage at about the point *z*, the nut member would be crushed, particularly if it were a relatively thin wall fitting, such as is used in hydraulic lines or the like. Crushing results in an out-of-round condition of the member and militates against a leak-proof joint. As a matter of practice the point *x* may vary about five degrees in either direction and still achieve satisfactory results.

Each of the lobes **15** and **16** is a part of a circle and it is important the radii of such circle be properly chosen because if the radius is too large, clearance is diminished at the corners of the nut-like member, and if the radius is too small a chisel action results unduly defacing the nut.

From the above, it will be manifest that I have provided a wrench which may be of the open or closed end type or in the form of a socket and which applies pressure against the flat faces of the nut-like member instead of against the corners. It is found effective in reducing if not eliminating distortion of the nut-like member. Another advantage resides in equalizing the torque exerted and minimizing the draw on threads of the nut-like member thereby reducing variations in torque reading.

Numerous changes in details of construction, arrangement and choice of materials may be effected without departing from the spirit of the invention especially as defined in the appended claims.

What I claim is:

1. A wrench for nuts, bolts, fittings and like members of hexagonal cross-section, comprising a body portion having at least ten integral substantially equal size cylindrical lobes each defining a member-engaging surface of arcuate cross-section, the centers of curvature of all of said surfaces lying along the same circle and positioned at points thereon spaced apart one-twelth the entire circumference of said circle, each of said surfaces facing generally toward the center of said circle and diametrically opposed surfaces being spaced apart a distance greater than the distance between the opposite flats of the member and a distance less than the diameter of the member between its opposite corners by an amount sufficient to enable each of said surfaces to engage a flat side of the member along a line spaced from the corner thereof.

2. A wrench as claimed in claim 1 for use on members having a threaded opening therethrough, wherein

said line of engagement lies substantially midway between a first plane defined by the next most adjacent face of the member and a second plane parallel thereto and tangent to the most adjacent portion of the threaded opening.

3. A wrench as claimed in claim 1, wherein arcuate clearance surfaces are disposed between adjacent member-engaging surfaces, the direction of curvature of said arcuate surfaces being opposite to that of the adjacent member-engaging surfaces.

References Cited in the file of this patent

UNITED STATES PATENTS

376,584	Cone	Jan. 17, 1880
2,023,832	Fisher	Dec. 10, 1935
2,550,010	Kavalar	Apr. 24, 1951
2,623,418	Vaughn	Dec. 30, 1952
2,685,219	Diebold	Aug. 3, 1954

FOREIGN PATENTS

1,033,792	France	Apr. 8, 1953