WRENCH SOCKETS, SOCKET DRIVES AND SIMILAR COUPLERS
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This invention relates to socket drives and more particularly to wrench sockets of improved configuration to provide side drive functions in driving standard fasteners such as hexagon nuts with substantially improved torque transmission characteristics over standard hexagon and especially double hexagon corner drives that are in general use.

It contemplates more especially the improved hexagon and double hexagon drives for standard hexagon fastener nuts and the like which impart the torque transmission load to the sides rather than to the corners thereof, whereby improved torque transmission characteristics are provided, greater stress withstanding socket configurations are attained, and both the hexagon fastener nuts and particularly the double hexagon-type drives therefor are rendered more effective to turn greater torque tightening loads without increasing the present thin-wall socket thicknesses.

The trend has for many years been in the direction of reducing wall thicknesses of driving sockets and particularly in double hexagon or the so-called twelve-point socket which affords a double bite in half the arc of movement for tightening and loosening nut fasteners. This is particularly important in the automobile industry by reason of the design of engines which are provided with many nut fasteners in relatively inaccessible places so that twelve-point wrench socket drives and increasingly thinner wrench socket walls are requirements that pose many problems. It is generally known that because of these requirements and the use of tighter fasteners with the higher compression engines, the thin-wall double hexagon or twelve-point wrench socket is vulnerable in the sharp corners. This is true even though wrench socket materials have been strengthened greatly in the last decade or more so that improvement must now come in providing a more effective torque transmitting wrench socket design. This has been accomplished with the teaching of the present invention by utilizing a design that constitutes a complete side drive socket with curved rather than sharp corners to relieve the stress therein and increase the resistance to stress with improved torque transmitting characteristics and longer life to both the wrench sockets and the nut fasteners.

One object of the present invention is to provide an improved side drive wrench sockets for hexagon nut fasteners and the like.

Another object is to provide a more effective side drive wrench socket design which will vastly improve the torque transmitting characteristics of thin wall wrench sockets and particularly thin wall wrench sockets of the twelve-point or double hexagon type.

Still another object is to provide a wrench socket or its complemental male drive with a hexagon or double hexagon configuration that more fully sustains the nut sides rather than the nut corners to accomplish nut turning with increased torque loads and less stress.

A further object is to provide an improved wrench socket drive design which imparts increased side torque transmission to the fasteners and totally relieves the corner contact stresses in the socket so that improved torque transmitting characteristics result with less deformation to the reacting surfaces of both the fasteners and the wrench socket drives.

A still further object is to provide an improved hexagon or double hexagon wrench socket drive that provides maximum side torque transmitting turning on hexagon nuts or their counterparts and totally eliminates corner loads thereon to improve the efficiency of nut turning therefrom.

Still a further object is to provide a wrench socket or a male drive counterpart thereof having improved nut turning torque transmitting characteristics of maximum side drive and zero corner engagements to improve the life and the load bearing limits thereof without increasing wall dimensions to accomplish this end.

Other objects and advantages will appear from the following description of an illustrated embodiment of the present invention.

In the drawing:
FIGURE 1 is a perspective view of a wrench socket embodiment of the present invention, parts thereof being broken away and shown in section to clarify the showing.
FIGURE 2 is a plan view of a wrench socket embodying features of the present invention, the nut fastener being shown in dotted outline to illustrate the torque transmitting side drive characteristics thereof.
FIGURE 3 is an enlarged fragmentary plan view similar to FIGURE 2 and illustrating the side drive characteristics of the socket design without any corner engagement with the nut fastener.

The structure selected for illustration is not intended to serve as a limitation upon the scope or teachings of the invention, but is merely illustrative thereof. There may be considerable variations and adaptations of all or part of the teachings depending upon the dictates of commercial practice. The present invention is exemplified by a wrench socket 10 preferably though not essentially provided with a reduced cylindrical base 11 having a polygonal axially positioned bore therethrough, in this instance a square-shaped bore 12 for receiving a correspondingly shaped but slightly smaller drive shaft in registry therewith for detachable association in the customary manner for impairing rotation thereto and the fastener in registry with the wrench socket to be hereinafter described.
The base 11 of the socket 10, merges in a somewhat enlarged cylindrical body 13 that is broached or otherwise polygonally shaped from the opposite end 14 thereof to present a definite and precise polygonal socket 15 which shall be presently described. The socket 15 usually communicates with the drive bore 12 so that the chips resulting from the broaching of the socket 15 will find their way through the bore 12. In the present embodiment, a socket 15 is provided for a hexagon nut and it affords a double bite thereon because of its twelve-point or so-called double hexagon broaching which is specially configured to provide a side drive relative to
a hexagon nut that are most always used in engines and in most devices held assembled therewith.

The standard hexagon or double hexagon socket usually comprises a series of equidistantly and alternately disposed relatively inward and outward corners to correspond with and afford exact registry over the fastener nut sized therefor and in the case of a double hexagon socket, the nut can be fitted therein every thirty degree turn rather than sixty degree to afford a double bite thereon in half the arc for greater accessibility in restricted spaces or locations. These advantages are somewhat offset by the reduction in wall thickness due to equidistantly spaced outer curved flutes which are substituted for the usual outer corners in standard twelve-point sockets. The radial lines to the inner corners 16 and the alternate bisectors of the curved flutes 17 which intersect and converge at the axial center of the socket 15, form fifteen degree angles. In alternate adjacent peripheral formations 16-17.

In the preferred embodiment, the outside angles formed by the straight surfaces 18-19 to define the inner corners 16 measure one hundred forty four (144) degrees and these load bearing surfaces 18-19 constitute the side drive engaged by the fastener nuts sized to fit therebetween with the corners 20 disposed within the curved outer flutes 17 with a minimum of clearance therewith. Thus the fastener nut corners 20 and their load bearing sides 21 (FIGURE 3) constituting the outline for the fastener nut 22, and the turning moment is imparted to the straight side walls 21 thereof by the wrench socket surfaces 18-19 in one direction and the wrench socket surfaces 19-18 in the opposite direction of rotation. While the nut 22 and its wrench socket 15 are stationary and under no turning torque load, the nut corners 20 and nut sides 21 are free from direct stress but during the application of a turning moment by the wrench socket 15 to the fastener nut 22 in either direction, only the straight and extensive sides 21 thereof are under a torque load as are the alternate converging socket sides 18-19 which are in the thinnest regions of the wrench socket wall 13, are never under direct stress so that the torque transmission for tightening or loosening the fastener nuts 22 are always carried by the strongest portions of the wrench sockets 10.

By the formation of loading stress in conventional wrench sockets of both the single hexagon and the double hexagon standard design. In the latter especially there is the greatest load in the corners where the wall thickness is minimum and comparatively thin owing to the twelve cornered configuration which eliminates considerable load, therefore, curvatures are insufficiently weakened and less able to sustain repeated heavy loads over extended periods of time. With the teachings of the present invention and design, the greatest torque sustaining load is borne by the comparatively large side surfaces of both the wrench socket 15 and the fastener nut 22 in the thickest and strongest regions of the socket 10 whose corners have curved flutes 17 to minimize stress, increase strength, and provide a side drive through the straight surfaces 18-19 that are in the thinnest regions reinforced by the inner corners 16. The fastener nut corners 20 are not, therefore, the engaging abutments for the socket 10-15 so that the torque transmitting characteristics of the wrench socket 10 are substantially increased without increasing the thickness of the socket wall 13 that in accordance with the dictates of commercial practice are made as thin as possible in order to render them more accessible in restricted nut locations.

The curvature of the flutes 17 is not critical but should provide minimal clearance for the nut corners 20 and may vary widely. A double hexagon socket 10 for the wrench socket 10 in the critical regions of the socket recess 15 thereof. However, the greatest advantage with the improved torque transmitting characteristics are attained by transferring the turning moment stresses to the sides surfaces 18-19 and interior corners 16 where the wall thicknesses are the greatest rather than the least as in standard sockets, and the torque load is applied to the side surfaces 18-19 of considerable expense so that the unit area load is minimum and both the wrench socket 10 and the fastener nuts 22 are the strongest. In the region of minimum strength and thickness which in standard wrench sockets is at the outside corners as indicated where the wrench socket 10 is relieved of all corner contact stress and strain by providing curved flutes 17 that are non-load bearing at all times. The maximum advantages have been attained with the teachings of the present invention without any increase in cost of material or production costs.

Important too is the fact that these advantages can be experienced without changing the shape, sizes, or design of hexagon nut fasteners which have been standard for so long that it would scarcely be possible to expect any change therein, except for special situations and purposes which would not command any general acceptance among nut manufacturers and dealers. From the invention it is imperative to improve the design and structure of the wrench sockets and tools utilized for nut turning to tighten as well as loosen such threaded fasteners.

While I have illustrated and described a preferred embodiment of the invention, it must be understood that my invention is capable of considerable variation and modification without departing from the spirit of the invention. Therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

We claim:

1. A wrench or the like having a peripherally closed socket defined by a plurality of equidistantly spaced peripherally and radially disposed protruberances presenting angularly related straight surfaces extending for the depth of engagement with complementarily sized and peripherally disposed straight sided and sharp-cornered geometric fasteners or the like in alignment with the longitudinal axis of said wrench, and outwardly disposed curved concavities radially disposed to project oppositely to said first named straight surfaces and alternately therewith to merge therewith for defining a continuous threading member engaging nut members. For the turning moments to fasteners in registry therewith, said outwardly disposed curved concavities having a radius sufficiently greater than the sharp corners of the complemental geometric fasteners to avoid contact therewith.

2. A wrench structure defined in claim 1 wherein the angularly related straight surfaces define pointed corners that extend inwardly and the curved protruberances form
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concavely shaped flutes extending outwardly to face the axis of the wrench to define a socket for registry with geometric nut fasteners.

4. A wrench structure defined in claim 3 wherein the angularly related straight surfaces engage the sides of a geometric nut fastener and the concavely curved flutes provide full clearance with the nut fastener corners.

5. A wrench structure defined in claim 3 wherein the inward corners of the geometrical socket with their straight sides constitute the side driving contact with the geometric nut fastener to impart a turning moment thereto and the outwardly disposed flutes are sufficiently curved to provide full clearance with the sharp nut corners of complementary geometric nut fasteners.

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