JOINT FOR AN ANGULARLY ADJUSTABLE WRENCH HEAD

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1. Claim. (Cl. 81—177.9)

This invention relates generally to wrenches, and more particularly has reference to a wrench which, by reason of the formation, relative arrangement, and connections between the components of the wrench, is adapted for performing a large variety of operations not capable of being accomplished by wrenches heretofore devised.

A continuing problem, in the field of hand-tool design and in particular in the field of wrench design, is to provide a wrench which will be adapted for turning nuts, studs, etc., in relatively inaccessible locations, or in cramped quarters, where it is difficult to reach and to properly engage the work that is to be rotated.

Heretofore, it has been proposed to provide a number of wrenches, and it is not uncommon to find a very substantial number of wrenches, all in a single set, so that selected wrenches can be used for selected situations. This obviously is relatively expensive, since it increases the number of wrenches that must be kept, as well as the storage space required for the wrench set. In addition, wrenches of different basic types must ordinarily be kept, as for example, standard open-end lever wrenches, used for rotating a nut or stud in a situation in which the handle of the wrench extends radially of and is perpendicular to the axis of rotation of the work; second, wrenches of the type wherein the handle has a length extended to a prolongation of the axis of rotation of the work, and is in coaxial alignment with the work; and third, wrenches of the type wherein the head of the wrench extends around a corner, to rotate a work piece the axis of which may be either parallel to or angularly related to the wrench handle.

Heretofore, wrenches have been devised, that include handles to which wrench heads are pivotally connected. However, these have been adapted for the performance of certain operations, but not for others, and the object of the present invention is to provide a wrench of the type including an elongated handle to which a head is pivotally connected, which wrench will be especially designed to increase to a marked degree the number of situations in which the wrench is usable.

More specifically, it is an object of the invention to provide a wrench which will be useful in at least the following situations:

First, where the stud or nut is accessible only by extension of the wrench around the corner of the work, and is rotatable on an axis parallel to the length of the wrench handle;

Second, where the nut is positioned in a relatively small space around a corner of the work, and rotates on an axis perpendicular to the length of the wrench handle;

Third, where the nut or stud is positioned in back of a corner of the work in a relatively cramped area, and the wrench handle must extend at an acute angle to the axis of rotation of the stud or nut;

Fourth, where the stud or nut is at the inner end of an elongated, narrow space into which the wrench handle must extend lengthwise, with the nut turning on an axis coaxially aligned with the length of the wrench handle;

Fifth, where the nut is in a relatively narrow, cramped space, as for example in contact with the web of a deep channel member, said nut or stud turning on an axis obliquely related to the length of the wrench handle; and

Sixth, where the nut rotates on an axis perpendicular to the length of the wrench handle, with the wrench handle being disposed in the plane of the nut or stud head.

It is a further important object to provide a wrench that will be adapted not only for use in each and every one of the situations described above, but also, will be usable in other situations, too numerous to mention here, whereby a single wrench can be employed to advantage in almost every conceivable work situation that may be encountered when nuts or studs are to be turned.

Other objects will appear from the following description, the claim appended thereto, and from the annexed drawings, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a perspective view of a wrench formed according to the present invention;

Figure 2 is an enlarged longitudinal sectional view through the head of the wrench handle, the head being shown in full lines in one position to which it is adjustable, and in dotted lines in a number of other positions to which it may be adjusted;

Figure 3 is an end elevation of the wrench, looking at the open end of the head; and

Figure 4 is an elevation of the wrench on a reduced scale, showing in dotted lines a work structure to which said wrench is applicable, the wrench being illustrated in one work situation in which it can be advantageously employed.

Referring to the drawings in detail, an elongated, rigidly constituted handle generally designated 8 is straight from end to end, and includes a body portion 10 integral at one end with a socket 12 enlarged in diameter in respect to the body portion and formed with an axial recess 14 which in the illustrated example, though not necessarily, is of rectangular cross section. The recess 14 is adapted to receive a mating, axial projection 16 of an extension handle 18 (Figure 4). The extension handle 18 can of course be of any desired form and shape, and can be either manually or motor driven. The purpose of the socket 12 and recess 14, thus, is merely to permit the effective length of the handle means of the wrench to be extended, as for example when a nut must be removed at the inner end of an elongated, narrow passage the length of which is greater than the length of the handle 8.

In any event, at its opposite end, the body portion 10 is integral with a collar 20, said collar being formed with a circumferential, flat shoulder 21 lying in a plane normal to the length of the wrench handle, at the base of an axial extension 22 of the handle. The extension 22 is rectangular in cross section in the illustrated embodiment of the invention and at its outer end, that is, the extension remote from the shoulder 21, is formed with angularly related side indexing surfaces 24 disposed at opposite sides of an intermediate or end indexing surface 25. All three surfaces, in the illustrated embodiment, are equal in area and shape, and it is important to note the angularity and location of the planes of said surfaces in respect to a pivot pin 26 extending through a transverse opening 27 of the extension 22, said opening 27 opening upon the opposite sides of the extension at a location inwardly a short distance from the indexing surfaces 24, 24, 25.

The indexing surfaces are symmetrically disposed in respect to the axis of the pivot pin 26, with each surface lying in a plane perpendicular to a radial line extending from the axis of rotation of pin 26 and intersecting the surface intermediate the opposite ends of said surface.
In this connection, the indexing surface 25 lies in a plane perpendicular to the length of the body portion 10 and extension 22. The surfaces 24 each lie in a plane that is at a 45° angle to the length of the extension and body portion, said surfaces 24 being at angles of 90° to each other and at an angle of 135° to the surface 24. In the preceding relation to the extension 22 are laterally spaced, parallel fork arms 28 formed at the inner end of a wrench head generally designated 20. The pin 26 at its ends engages in openings of the fork arms, and mounts the head on the handle for swinging movement about the axis of the pin 26, that is, about an axis perpendicular to the length of the handle 10, through at least 180°, as shown by the several positions of the head illustrated in Figure 2.

While the head is comparatively thick as shown in Figures 1 and 3, it is nevertheless of flat formation, in the preferred embodiment, and is formed with laterally spaced arms 32 defining between them a work receiving recess 34 that opens upon the outer end of the head, that is, the end of the head diametrically opposite its connection to the handle. Recess 34 is U-shaped, having parallel, flat, opposed side walls 35. Formed in the side walls 35 are confronting, elongated depressions 36 of shallowly V-shaped cross section (Figure 3), said depressions being confined to the midwidth area of the confronting surfaces 35, each depression being equidistant from opposite flat faces 37 of the wrench head.

The angularity of the walls of each depression 36 is such as to permit the same to receive diametrically opposite corner portions of a conventional hex nut or stud 38. At this point, the invention will be hereinafter described with reference to its applicability to a nut 38. However, it will be understood that the device is applicable with equal facility to any other object capable of being rotated by a wrench, and having a suitably formed head, as for example, studs, etc.

The depressions 36 have their lengths extended longitudinally of the head, that is, radially of the axis of rotation of the head about its connecting pin 26, which pin as previously noted extends transversely of the head and also of the handle.

Formed in the inner end surface of the head 30, between the fork arms 28, is a spring-loaded ball detent 39, which serves as an indexing means, and is spring-biased radially inwardly of the axis of the pivotal connection of the head to the handle, so as to bear firmly against a selected indexing surface of the extension 22.

It may be noted that the extension 22 has, in addition to the indexing surfaces 24, 24, 25, a pair of flat indexing surfaces 41, lying in parallel planes that are perpendicular to the indexing surface 25, the planes of the surfaces 41 being parallel to the axis of the pin 26. When the head is in the opposite extreme positions there of designated A, B respectively in Figure 2, the ball detent 39 is in engagement with one or the other of the indexing surfaces 41, 41. When the head is in the position designated C, D in Figure 2, detent 39 is in engagement with one or the other of the surfaces 24, 24. When in the position E, the head has its detent 39 in engagement with surface 25.

In use of the wrench, the head can be moved to any of the five positions shown in Figure 2 and will be releasably retained in said positions by the indexing means comprised of the cooperating indexing surfaces of the extension and the ball detent of the head. Said five positions are uniformly, angularly spaced 45° about the pivot axis of the pin 26. In each position, the head is adapted to engage and turn with a nut 38 or similar workpiece about either a first axis that is radial of the pivot axis of the connecting pin 26 joining the head to the handle, or a second axis that is normal both to the first axis and said axis of the connecting pin.

By reason of this arrangement, the wrench is usable in many situations in which ordinary wrenches, even wrenches that have previously been devised to include pivotally adjustable heads, cannot be employed advantageously. One such situation is shown in Figure 4, merely by way of example. In this situation, the nut 38 is to be threaded onto or off of a stud 40, which is disposed at the inner end of a narrow, elongated passage in a work structure 42. The formation of the structure 42 is such that the handle 10 must necessarily be coaxial with the axis of rotation of the nut or similar workpiece 38, and the handle further must be of substantial length, in view of the elongation of the passage at the bottom of which the nut 38 is to be turned.

There are of course many wrenches that will rotate a nut with the handle of the wrench in coaxial alignment with the axis of rotation of the nut. However, the point to be borne in mind is that applicant's wrench is usable in this situation and also in the various other situations that have been specified in the objects, and that also have been specified with full detail, in the description of positions A through E shown in Figure 2.

In Figure 4, it will be seen that the nut 38 is receivable between the arms 32, with the diametrically opposed corner portions of the nuts engaging in the depressions 36 in the manner shown in Figure 3. The plane of the end 30 is coincident with the longitudinal median of the handle 10, rather than angularly related thereto, that is, the head is at the position E shown in Figure 2. Rotation of the handle about its long axis will now rotate the nut 38.

Considering a different situation, it might be that the nut might be located in back of an abutment, around a corner of the work piece. In this arrangement, head A would be in the position A or B and assuming that the nut rotates on an axis that is parallel to the length of the handle 10, the diametrically opposed facets or flat faces of the nut 38 would be engaged by the opposite side walls 35 of the recess of the head.

In a similar environment, it may be that the nut must be rotated on an axis normal to the length of the handle. In this circumstance, the head is in the position A or B, with the opposed corner portions of the nut engaged in the depression 36. In both this situation and the one described immediately above, the handle would be easily operated, that is, in the situation in which the nut axis is parallel to the length of the handle, the handle can be bodily shifted laterally in an arcuate path about the axis of the nut, to turn the nut. In the situation in which the nut axis is perpendicular to the length of the handle, the handle will extend as a radius of the nut axis, and can be swung laterally.

In another situation, the length of the handle might be at an obtuse angle to the plane of the head 30, that is, the head would be in the position C or D. Again, a nut could be turned about an axis normal to the general plane of the head, the nut in this instance being engaged by the surface 35. Alternatively, the nut could be rotated about an axis that coincides with the general plane of the head, with the nut engaged in the depression 36.

The versatility of the wrench will thus be readily apparent, and it will be seen that the wrench could be used in the manner of an open-end wrench, a socket wrench, a lever-type wrench, etc., to rotate workpieces in almost any situation that is encountered.

It is believed clear that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles of operation and the manner theretofore devised to carry out said principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claim.
What is claimed is:

In a rod joint between a wrench handle and a head connected thereto by the joint for pivotal adjustment to each of a plurality of selected positions, the improvement comprising: a symmetrically shaped longitudinal extension on one end of the handle, having a series of five flat indexing surfaces one of which is in a plane perpendicular to the length of the handle and comprises the outer end surface of the extension, said series including a pair of indexing surfaces in parallel planes disposed perpendicularly to the first plane, the surfaces of said pair being spaced equidistantly from the longitudinal median line of the handle at opposite sides thereof in symmetrical relation to and at opposite sides of said one indexing surface, the remaining two indexing surfaces being disposed at opposite sides of said one surface, in positions extending between said one surface and the surfaces of said pair, each of said remaining surfaces being at an interior angle of 135 degrees to the indexing surfaces between which it extends; and ball detent means adapted to be carried by the head and including a ball element substantially smaller in diameter than the area of each surface, said element being movable into contact with each surface, said ball detent means further including a spring bearing thereagainst and exerting a continuous, yielding pressure effective to bias the ball element toward each surface with which it is in contact, along a line perpendicular to the plane of the contacted surface.

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