

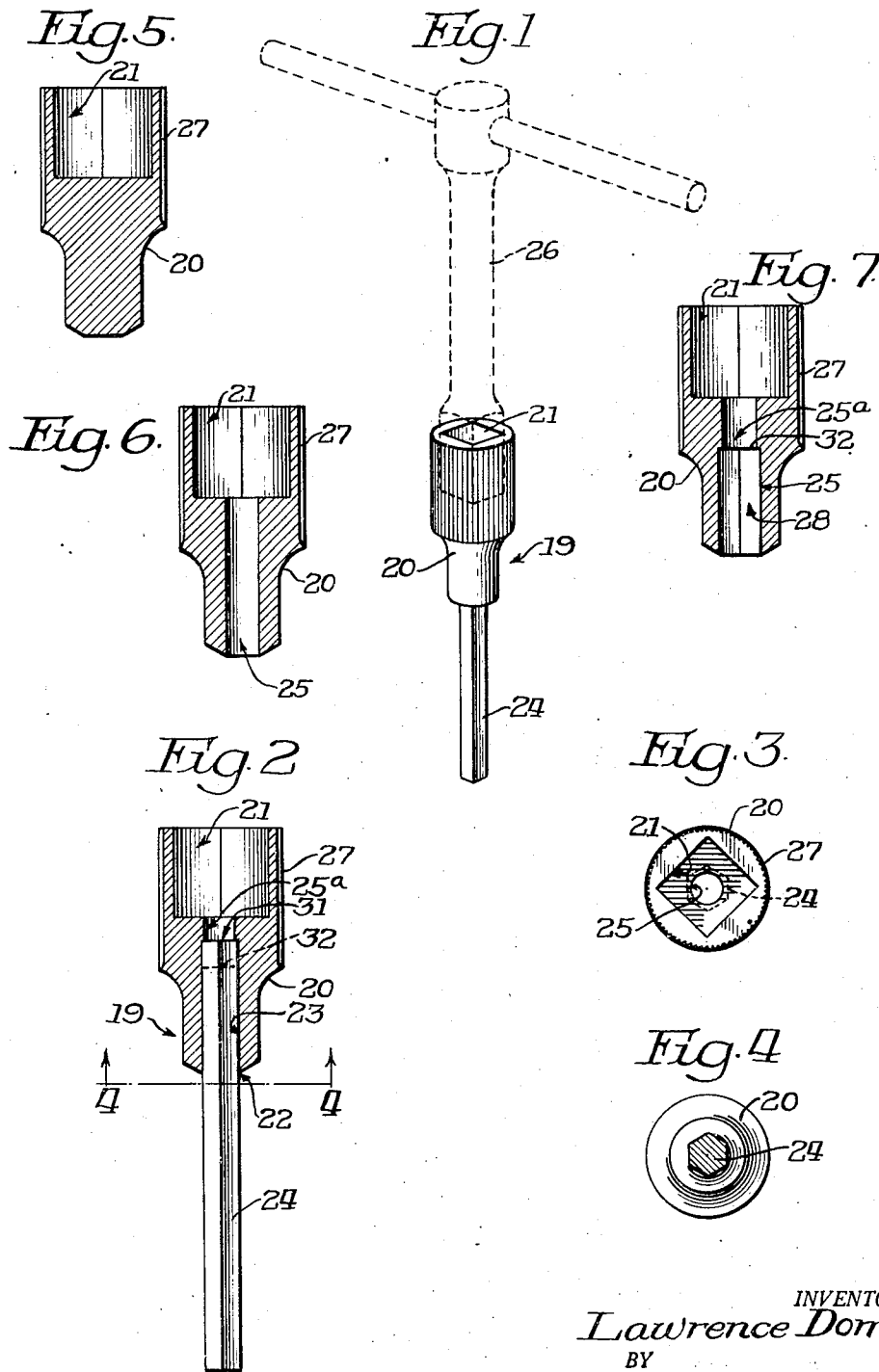
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METHOD OF MAKING INTERNAL WRENCHING TOOLS

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METHOD OF MAKING INTERNAL
WRENCHING TOOLS

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This invention relates to a novel method of making an improved internal wrenching tool.

An important object in connection with the method of making the tool is a step of pressing a hardened bit into an initially-broached bore in a shank in such a manner that the bit actually performs a secondary broaching operation and seats itself positively in a force-fit manner into a reduced cross-section portion of the bore.

An important object in connection with the tool itself is the provision of means for removing and replacing the bit portion thereof in the event of breakage or excessive wear.

Other objects and advantages will be apparent from the following description taken in connection with the drawings in which:

Figure 1 is a perspective view of one embodiment of the present invention illustrating, in broken lines, one form of driving member usable with it;

Fig. 2 is a longitudinal, sectional view of the composite tool shown in Fig. 1;

Fig. 3 is a top or plan view of Fig. 2;

Fig. 4 is a transverse, sectional view of Fig. 2, taken along the line 4-4 of Fig. 2; and

Figs. 5, 6, and 7 are longitudinal, sectional views of the shank portion of the tool, showing a preferred progression of steps in forming and assembling the tool.

Like parts are referred to by like reference characters throughout the figures.

Referring now more particularly to the embodiment shown in the drawings, the improved composite tool, generally designated 19, comprises a shank 20 and a bit 24.

The shank 20 is formed with a polygonal socket 21 (square, in this case), preferably axially aligned with a minor socket or bore, which is generally designated 22 (Fig. 2). The bore 22 has an exterior, non-circular or polygonal portion 23 (hexagonal, in this case) which frictionally grips the similarly non-circular bit 24, as the result of a pressed or driven fit to be described. The bore 22 also has an inner portion 25a of circular cross-section (see Fig. 3) which is preferably in communication with the socket 21, as shown, in order to facilitate removal of the bit by a punch or other driving tool inserted through the open socket 21.

The tool 19 is designed to supplement a line of socket tools or fittings, so as to adapt a standard-sized, male-ended driver (such as the T-handled member designated 26 in Fig. 1) to the driving of a socket- or recessed-head screw (not shown). Formerly, L-shaped, polygonal cross-

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section bars have been employed for this purpose, but they have been inconvenient to use, particularly where it is desired to spin the screw down rapidly prior to wrenching, as well as difficult to use in applying high wrenching torques without using a pipe telescopically fitted over the end of the L member to increase its effective length.

Many of such socket-head screws are provided with entirely smooth outer surfaces on their heads so they are slippery, especially when grasped by a wet or oily hand. Therefore, to further facilitate use of this improved tool, it is preferable that the outer cylindrical surface 27 be knurled, as shown, so it can be firmly grasped, and the screw at the end of the bit thereby quickly spun into place even with very oily, slippery hands. It will be understood that the T-handled driving member 26 is shown only by way of illustration, since the tool 19 can be readily adapted for use with other conventional male-end socket driving tools, such as ratchets, crank-type, high-speed wrenches, and the like.

An important part of the present invention is the method by which the internal wrenching tool 19 is made so as to be economical, to hold the bit 24 firmly in place, and yet to permit the bit to be readily removable for replacement when necessary.

The final steps, with which this invention is concerned, in making the composite tool 19 are illustrated in Figs. 5, 6, 7, and 2. The shank 20 is first formed, as shown in Fig. 5, by appropriate forging, knurling, and machining operations.

Next, as shown in Fig. 6, the circular bore 25 is formed, axially aligned with the socket 21, preferably extending entirely through the shank. Then, by an appropriate initial broaching operation, an outer portion 28 of the bore 25 is enlarged to form a non-circular or polygonal cross-section, as shown in Fig. 7, an inner portion 25a of the bore remaining circular. In this case, the broached portion 28 is approximately the cross-section of the bit 24, but slightly smaller so that pressing the bit into place during the next operation causes a secondary broaching or enlargement of the bore. Preliminary to this next step, the leading end 31 of the bit is first formed so it will effect such broaching action when so pressed through the bore 25. For example, I have found, by simply cutting the leading end 31 off square, that the bit itself, if suitably treated to have a hardness suitably exceeding that of the shank, will function in the manner of a secondary broaching tool. In carrying out this

last step, the bit is pressed upward through the bore 25 past the point 32 (where the initially broached portion 28 ends) and for a substantial distance into the circular cross-section portion 25a as shown in Fig. 2, thereby broaching a close-fitting frictionally-engaging seat for itself where it will be permanently held in place until purposely removed.

In the event that the bit becomes broken or worn, it may be removed merely by driving a punch down through the inner end of the bore 22 and replacing with a new bit in the manner above described, the new bit being seated firmly in the circular cross-section portion of the bore with its end preferably driven past the location of the previous bit.

While, in the embodiment shown, the bit is illustrated as of symmetrically hexagonal cross-section frictionally gripped about its entire periphery by a similarly hexagonal, continuous seat formed in the shank, it will be apparent that other cross-sectional shapes may be satisfactorily employed. For example, the initial broaching operation need only be effective to modify the cross-section of the bore so that a portion of it approximates the shape of only two or more radially extended portions (as, for instance, apices in the case of a polygonal cross-section) of the bit, said bore portions being slightly undersized radially with respect to the bit so the latter will actually cut away or displace a portion thereof when the parts are pressed together so as to form two or more longitudinally extending, circumferentially spaced frictional seats for itself in the shank. These circumferentially spaced seats will preferably be diametrical when only two are provided.

It is believed that in view of the above description, both as to structure and function of the tool, the operation and use of the tool will be obvious.

Although for the purpose of illustration I have shown and described only one form of my improved tool and a preferred method of making it, it will be apparent that many modifications may be employed without departing from the spirit and scope of the invention, as indicated by the appended claims.

I claim:

1. A method of joining a socketed shank to a non-circular cross-section bit, to form an internal wrenching tool, comprising the steps of: (a) forming a bore in said shank; (b) broaching a portion of said bore to a cross-section corresponding in shape but slightly smaller than said bit; and (c) pressing an end portion of said bit entirely through the broached portion of said bore and into the unbroached portion thereof to enlarge said bore sufficiently to hold the bit therein by frictional engagement.

2. A method of joining a socketed shank to a polygonal cross-section bit to form an internal wrenching tool, comprising the steps of: (a) forming a bore in said shank; (b) broaching a portion of said bore to a cross-section corresponding in shape but slightly smaller than said polygonal bit; and (c) forming an end portion of said bit with a broaching edge and pressing said end portion entirely through said broached portion of the shank, and seating it into the un-

broached portion thereof to thereby enlarge the bore by a secondary broaching action of the bit on the bore to hold the bit firmly in place by frictional engagement.

3. A method of joining a socketed shank to a polygonal cross-section bit, to form an internal wrenching tool, comprising the steps of: (a) forming in said shank a bore open at both ends and aligned with said socket to facilitate the insertion of a punch or other driving tool into said bore through said socket; (b) broaching a portion of said bore to a cross-section corresponding in shape but slightly smaller than said polygonal bit; and (c) pressing an end portion of said bit entirely through the broached portion of said bore and into the unbroached portion thereof to cut away the interior of said bore to enlarge the latter sufficiently to permit the bit to enter therein and be gripped by a force fit.

4. A method of joining a socketed shank to a non-circular cross-section bit, to form an internal wrenching tool, comprising the steps of: (a) forming a bore in said shank, having an opening in communication with said socket and another opening adapted to receive said bit; (b) performing an initial broaching operation to enlarge the end portion of said bore adjacent said other opening to a cross-sectional shape, a portion of which approximates that defined by at least two radially extended portions of the cross-section of said bit, but radially undersized with respect thereto; and (c) performing a secondary broaching operation through the operation of the bit itself by forming an end of said bit with a broaching edge and inserting said end in the initially broached end of the bore and pressing it through said initially broached portion and at least part way into the unbroached portion whereby at least two longitudinally extending seats are formed in said shank to retain said bit by frictional engagement.

5. A method of joining a socketed shank to a polygonal cross-section bit, to form an internal wrenching tool, comprising the steps of: (a) forming a bore in said shank; (b) performing an initial broaching operation to enlarge one end portion of said bore to a cross-sectional shape approximating that defined by at least some of the apices of the cross-section of said bit, but undersized with respect thereto; and (c) performing a secondary broaching operation by means of the bit itself by forming an end of said bit with at least one broaching edge and inserting said end in the initially broached end of the bore and pressing it through said initially broached portion and at least part way into the unbroached portion whereby a seat is formed in said shank to retain said bit by a forced fit between the parts.

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