Sept. 25, 1956 C. T. TORRESEN 2,764,197

DRIVER FOR RECESSED HEAD SCREWS

Filed Oct. 7, 1952

2 Sheets-Sheet 1

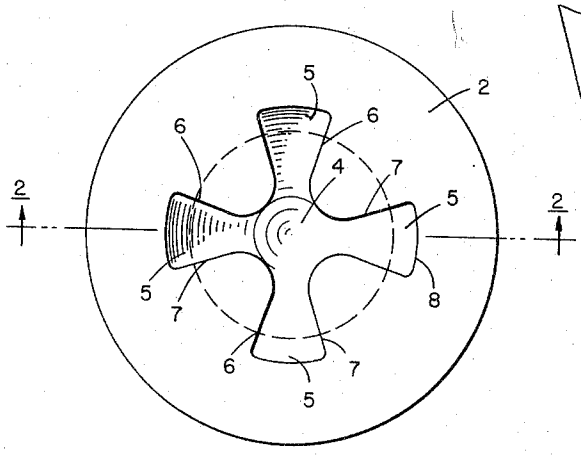


FIG. 1

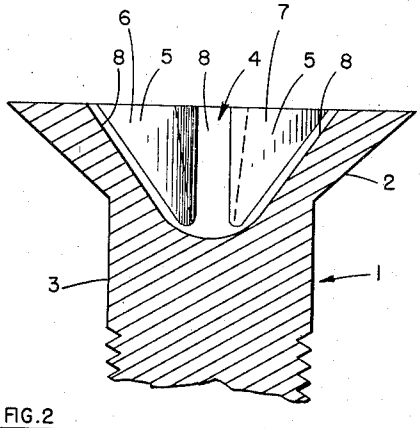


FIG. 2

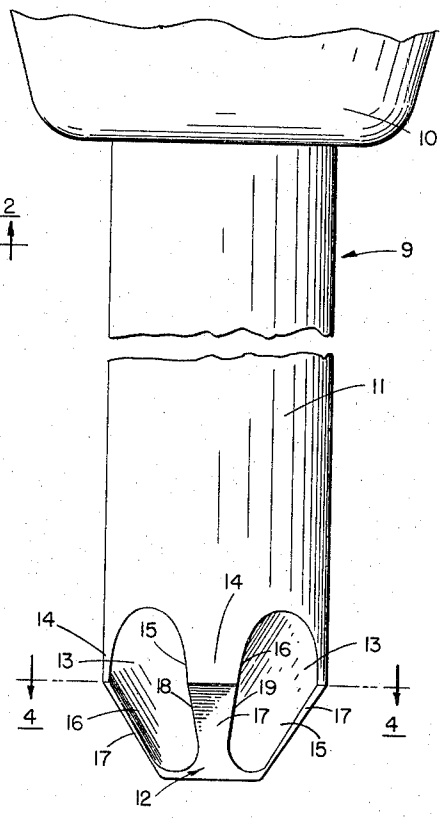


FIG. 3

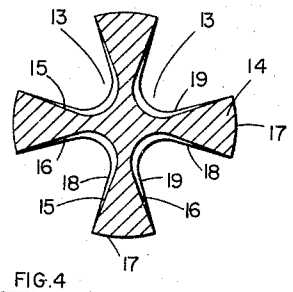


FIG. 4

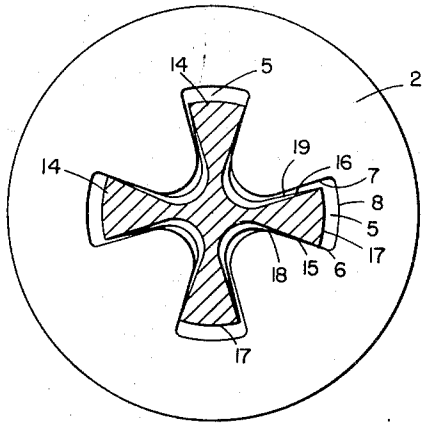


FIG. 6

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2 Sheets-Sheet 2

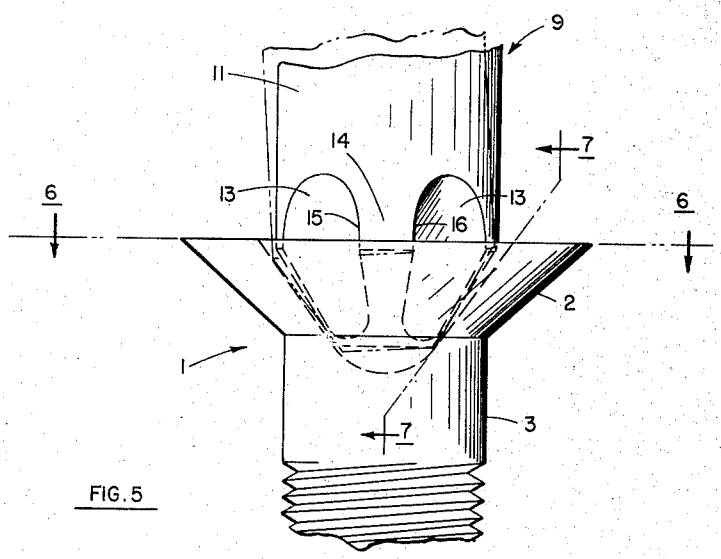


FIG. 5

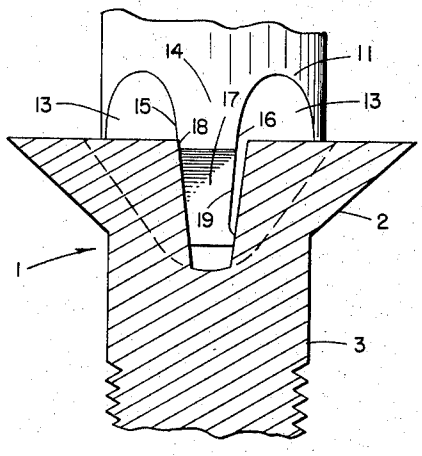


FIG. 7

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DRIVER FOR RECESSED HEAD SCREWS

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3 Claims. (Cl. 145—50)

This invention pertains to a screw and driving tool and more particularly to an improved cross-slot screw and mating driving tool.

A number of socket head screw arrangements have been proposed, many of which have provided improved results, but none of which has completely solved the problems involved. Difficulties are particularly apparent where flathead screws are utilized which necessitate the use of a relatively shallow socket. Hexagonal type sockets are unsatisfactory because their depth is limited by the tapered exterior contour of a flathead screw. The driving tool will tend to round out a socket of this type, destroying the driving faces. The usual cross-slot type of screw recess for driving operation with a complementary driving tool also has certain unfortunate characteristics. The deficiency most often encountered is the requirement of high end pressure for keeping the screw driver in engagement with the slot. If the high pressure is not maintained the end of the driver will disengage the slot before a driving operation is completed and the bit end of the driver may cause damage to the surface of the work. This may even result in a lack of ability to utilize all the fastening force available from larger size screws. For example, in certain precision work screws should be tightened to a predetermined torque range. For screws of 3/8-inch or greater diameter the end pressure required to keep a torque wrench in the driving slot will be more than it is possible for one man to exert in operating the wrench to obtain the required torque. Furthermore, the ordinary cross-slot socket head screw will raise a burr along the surface of the screw during normal driving operation and such a burr is intolerable for many uses of the screws. These screws also have a large fillet at the center of the slot, with the walls of the socket and of the screw driver arranged so that driving often takes place at the fillet rather than along the tines of the screw driver. This results in deformation and breaking-down of the material of the screw around the slot thus ruining the screw.

Therefore, it is an object of this invention to provide a screw and driving tool requiring low end pressure during a driving operation.

Another object of this invention is to provide a screw and driving tool which will balance the strength of the driving tool and of the screw.

An additional object of this invention is to provide a screw and driving tool that will operate equally well for driving the screw in either direction.

Still another object of this invention is to provide a screw and driving tool that will not form burrs in the top surface of the screw.

Yet another object of this invention is to provide a screw and driving tool that will enable torque settings for screws of larger sizes.

A still further object of this invention is to provide a screw and driving tool which will be usable for an indefinite number of operations.

These and other objects of this invention will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a top plan view of the cross-slot screw,

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1,

Fig. 3 is a side elevation of the driving tool,

Fig. 4 is a sectional view along line 4—4 of Fig. 3,

Fig. 5 is a side elevation of the screw and driver during a driving operation,

Fig. 6 is a sectional view taken along line 6—6 of Fig. 5, and

Fig. 7 is a sectional view taken along line 7—7 of Fig. 5.

Referring to the drawings, and particularly to Figs. 1 and 2, screw **1** may be of the flathead type having head portion **2** with a threaded shank **3**. The screw is provided with a driving socket or slot **4** in the central portion of the head. The slot includes four driving recesses **5** which meet at the central part of the screw. The recesses are equally spaced around the top of the screw. Although illustrated in a generally cruciform shape wherein four driving recesses are employed, this screw could be constructed with more or less recesses without departing from the scope of the invention. Each recess **5** has two side walls **6** and **7** which are parallel to the axis of the screw and extend radially outward from the center of the screw. The recesses are further defined by end walls **8** which converge downwardly and constitute the bottom of the slot, as best shown in Fig. 2.

Driving tool **9** is adapted to be received within the slot of the screw for driving the screw in either direction. This tool may be manually rotatable by handle **10**, or adapted for use with conventional power driving equipment. The driver includes a shank or bit portion **11** which is preferably of a hardened steel material. This material should be harder than the material of the screw head for reasons to be made more clear hereinafter. Bit **11** terminates in a substantially conical end or bottom portion **12**. The cone may be cut off at its extremity as illustrated to provide a more or less stubby end, or it may extend downwardly substantially to a point, as desired. The term "conical" as used herein is intended to include a frustum of a cone as well as a perfectly defined cone.

The lower portion of the bit is relieved by substantially axial cutouts **13** so as to form lands or tines **14** corresponding in number and spacing to recesses **5**. These tines are used for driving the screw. Each tine is comprised of two side walls **15** and **16**, and an end wall **17**, the latter being a portion of conical end **12**. Edge **18** is formed where side **15** joins end wall **17**, and edge **19** where side **16** meets the end wall. It is important for this invention that the side walls **15** and **16** are undercut, as best seen in Fig. 3, and in the preferred embodiment they are concave in an axial direction. Nevertheless, these side walls extend radially outward from the central portion of the driver, as shown in Fig. 4.

Figs. 5, 6, and 7 illustrate the driver as received within slot **4** in normal driving position with the axes of the driver and of the screw in substantial alignment. The recesses, although substantially complementary to the tines, are slightly greater in breadth so that when the driver is driving the screw the tines will shift to one side of the slot. This clearance permits easy engagement and disengagement of the screw by the driver as well as allowing angularity. Further provision for angularity between the axes of the driver and the screw may be made by inclining end walls **17** of the tines at a slightly greater angle than that of end walls **8** of the recesses. By these

features the driver may be tilted relative to the screw to the position shown in phantom in Fig. 5 while still properly engaging the slot. As shown in Figs. 5, 6, and 7, the driver is in a position for rotating the screw in a clockwise direction. Edge **18** of each tine engages side wall **6** of its corresponding recess at the extremity thereof. Engagement will obtain along the entire length of tine because of the radial design of the tine and the recess. Because side walls **15** and **16** of the tines are undercut, the greatest breadth of the portion of each tine within slot **4** in every plane parallel to the axis of the bit is along end wall **17** of the tine. When the driver is in normal driving position there will be no contact between the side walls of the tines and the recesses other than along edges **18** or **19**, depending on the direction of rotation, due to the undercut arrangement of the tines.

When the driver is rotated in a driving operation, as illustrated, edges **18** of the hardened bit of the driver will tend to bite into the softer screw material along the bottom of each recess. As a result a minimum of end pressure will be required for holding the driver in driving engagement with the screw. This engagement of the slot by the driver will throw up a burr along the bottom portion of each of the recesses, but this burr is desirable rather than being objectionable. It means that the driver has bitten into the screw material in firm gripping engagement, and it further means that the recess has actually become slightly undercut along its bottom edge, as the screw material was displaced. The overhanging portions of an undercut recess, when used with the undercut driver of this invention, will offer a resistance to the disengagement of the driver from the screw during a driving operation. In fact, if manufacturing techniques permitted their economical fabrication, the screws for use with this invention should perhaps be made with undercut recesses. Recesses with axial side walls, however, are much more easily produced and provide the advantages of undercut recesses without an attendant prohibitive cost of manufacture. The driver and screw arrangement of this invention will satisfactorily perform a driving operation, of course, if the driver is not made of a harder material than that of the screw, but to take full advantage of the unique design of this invention the bit should be harder than the screw, as set forth.

Bit end **11** of the driver may be made of slightly smaller overall diameter than the width of the slot in the screw so that the driving ends of the tines are wholly received within the slot with the top of edges **18** and **19** disposed slightly below the top surface of the screw when in normal driving engagement. By this provision the burr that forms within the driving slot of the screw will not extend beyond the upper surface of the head of the screw.

It is obvious that the same type of driving action will take place for rotation of the screw in either direction. Thus the screw driver and screw arrangement of this invention are equally satisfactory in both removing and driving a screw. In both cases the end pressure required will be low. Rotation of the screw in a counter-clockwise direction will be the same as above except that the driving force will be exerted by edges **19** of the tines.

It should be observed that the screw driver and screw arrangement of this invention provide unique opportunity for balancing the strength of the screw and the screw driver. The screw driver is strong because the outer portions of the tines, where the maximum driving effort is exerted, are also the thickest portions of the tines. Thus maximum strength is at the location where it is needed most. The slot is strong because the recesses are relatively long and the driving force is exerted along the bottom edges of the recesses. The widths of the recesses and of the tines may be balanced for the particular materials used so that neither is appreciably stronger than the other.

It can thus be seen that I have provided an improved socket head screw and driving arrangement requiring low end pressure, and usable over and over again with improved rather than lessened effectiveness. Rotation of the screw in either direction will give the same results. Both the driver and the screw may be designed for maximum strength and failures of either will be minimized.

The foregoing detailed description is given by way of illustration only and not by way of limitation, the spirit and scope of this invention being limited only by the appended claims.

I claim:

1. A driving tool for use with a screw having a driving socket, said socket being defined by radially extending side walls thereby forming a plurality of recesses, said driving tool including a cylindrical bit portion terminating in a substantially conical end, said bit portion being provided with a plurality of substantially axially extending recesses therein thereby to define a plurality of tines, each tine having two side walls and an end wall receivable within a recess, said side walls being concave so that within the radial limits of each of said tines in all planes parallel to the axis of said bit portion the greatest width of each of said tines is at said end wall, the edges of said end wall extending radially with respect to the axis of said bit, whereby each of said tines drivingly engages said screw at the bottom portions of a recess along the edge between a side wall and the end wall of the tine for rotation of said screw in either direction.

2. A screw driving tool comprising a shank provided with a bit of relatively hard material on the end thereof, said bit being provided with symmetrically formed tines projecting from the center thereof in a cruciform pattern, the end surfaces of said tines collectively defining a substantially conical shape for reception into a screw slot, the walls of said tines at said end surfaces extending radially with respect to the axis of said bit, the maximum width of each of said tines at said end portion for any radial position along the tine being at said end surface.

3. A screw driving tool comprising a cylindrical bit member of hardened material having a substantial conical end surface for reception into a screw slot, the exterior surface of said bit being recessed axially from said end surface so as to define four tines, each of said tines having two edges at said end surface extending radially with respect to the axis of said bit; the width of each tine at said end surface being greater than the width of any portion thereof adjacent said surface so that each tine is given an undercut configuration adjacent each of said edges, whereby when said end portion is received within a screw slot having axially extending side walls said edges of said tines are adapted to bite into said walls for rotation of said screw in either direction.

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