Nov. 24, 1942. J. J. FARRELL 2,302,689

SELF-TAPPING SCREW

Original Filed Feb. 25, 1941 2 Sheets-Sheet 1

Fig. 1.

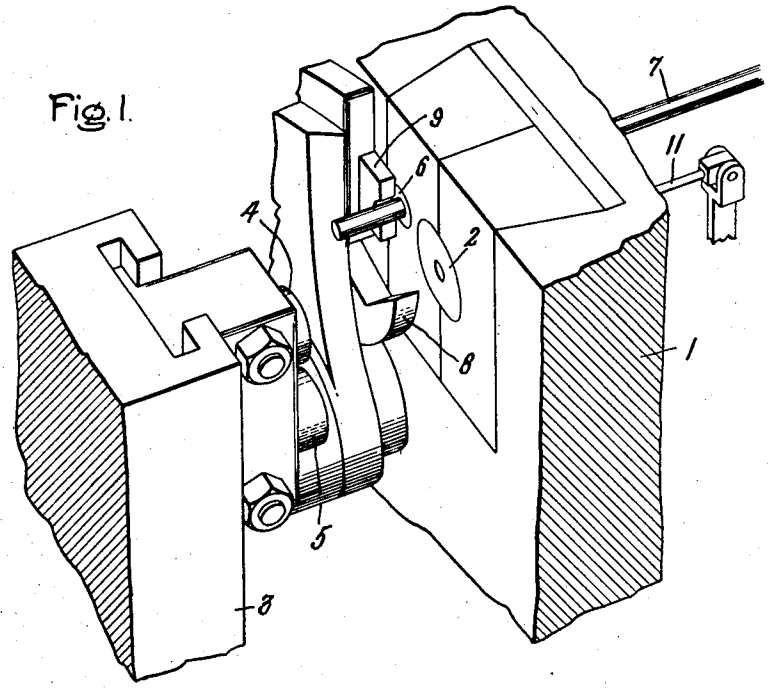

Fig. 2.

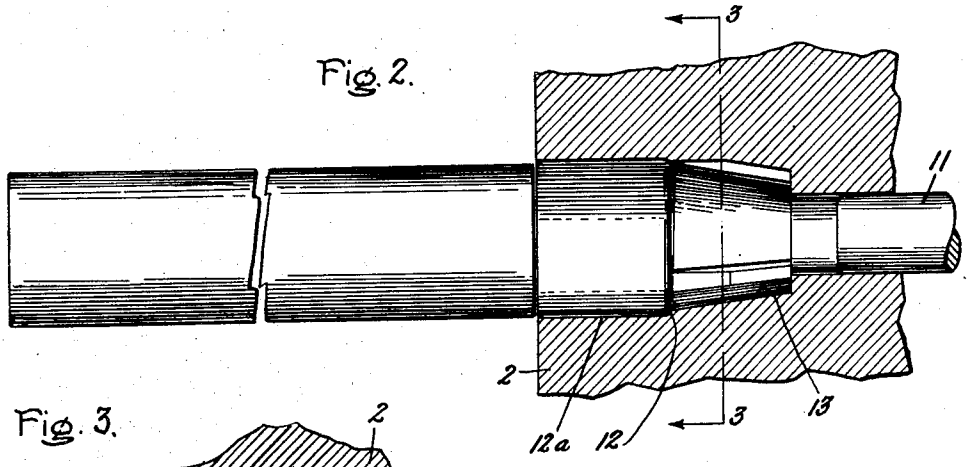

Fig. 3.

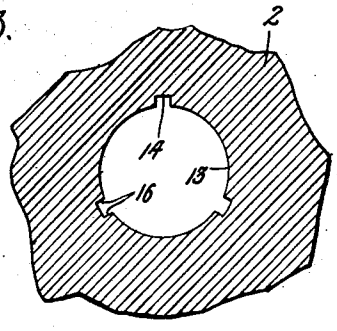

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Fig. 4.

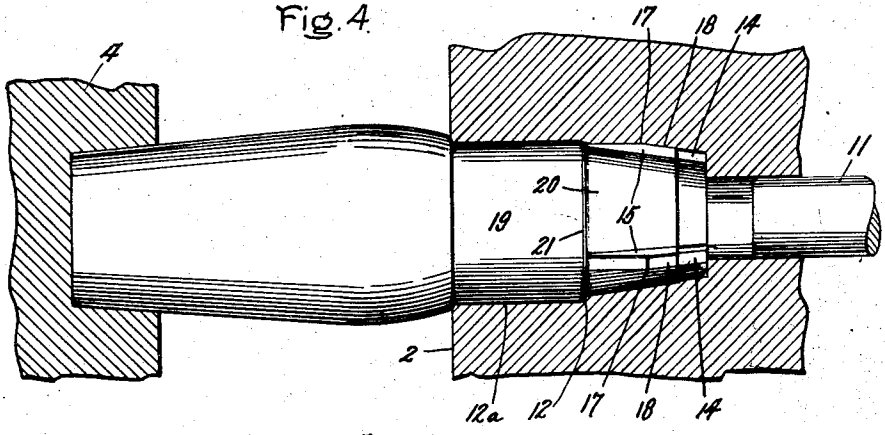


Fig. 5.

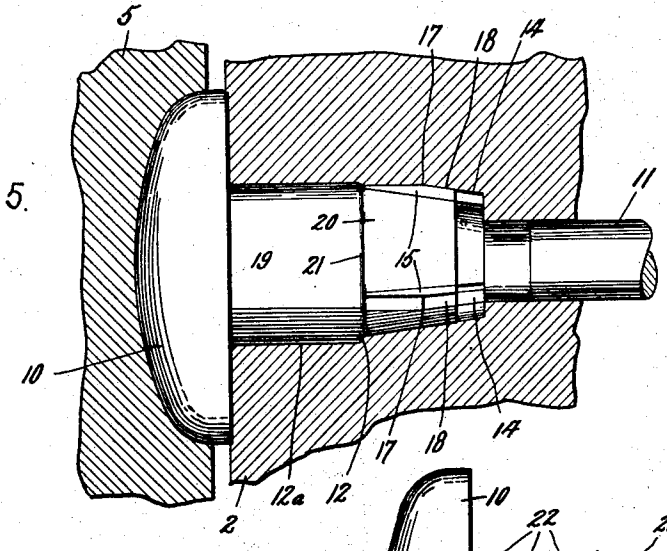


Fig. 6.

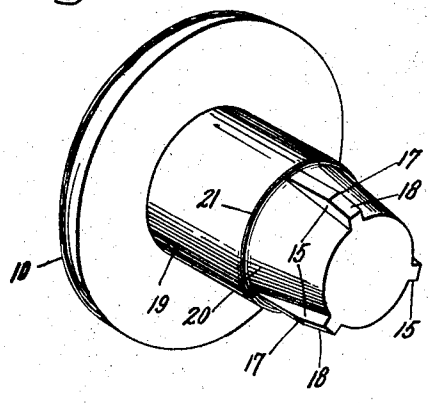
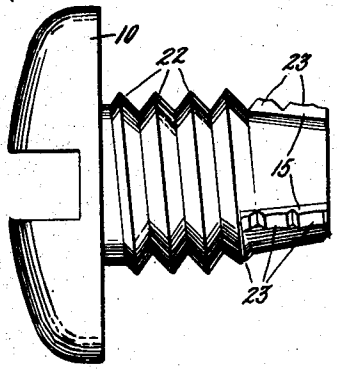


Fig. 7.



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Patented Nov. 24, 1942 2,302,689

UNITED STATES PATENT OFFICE

2,302,689

SELF-TAPPING SCREW

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Original application February 25, 1941, Serial No. 380,478. Divided and this application August 5, 1941, Serial No. 405,557

4 Claims. (Cl. 85—41)

The present application is a division of application Serial No. 380,478, filed February 25, 1941.

The present invention relates to self-tapping screws.

The object of my invention is to provide an improved self-tapping screw and blank from which the self-tapping screw is made. For a consideration of what I believe novel and my invention, attention is directed to the following description and the claims appended thereto.

In the accompanying drawings, Fig. 1 is a fragmentary perspective view of a double blow header for making self-tapping screw blanks; Fig. 2 is a sectional view showing the blank positioned in front of the die; Fig. 3 is a sectional view of the die taken on line 3—3 of Fig. 2; Fig. 4 is a sectional view showing the blank at the end of the operating stroke of the upsetting punch; Fig. 5 is a sectional view showing the blank at the end of the operating stroke of the heading punch; Fig. 6 is a perspective view of the completed blank; and Fig. 7 is a side elevation of a self-tapping screw made from the blank.

Referring to Fig. 1 of the drawings, there is shown a double blow header for making blanks from which the self-tapping screws are made. It is one of a number of well-known types of heading machines which may be used for making the blanks. The details of the operating mechanism of the header are not important for an understanding of the present invention and such mechanism is accordingly not illustrated. The header has a stationary frame 1 carrying a die 2 and a reciprocating carriage 3 carrying upsetting and heading punches 4 and 5. Adjacent the die is a guide 6 through which is automatically fed the wire 7 from which the blanks are formed. When the proper amount of wire has been fed through the guide 6, a transfer finger 8 moves upward into engagement with the projecting end of the wire, and the wire is cut by a shearing member 9. The transfer finger 8 and the shearing member 9 move in unison during the cutting stroke, and the severed portion of the wire is held between these parts and moved to the position shown in Fig. 2 in which it is in line with the die 2 and the upsetting punch 4. At this point the carriage 3 moves forward and the blank is engaged by the upsetting punch 4 and forced into the die. The position of the parts at the end of the forward stroke of the carriage is shown in Fig. 4. The portion of the blank between the die and the upsetting punch has been partially upset to facilitate the forming of a head during the following operation. The body of the blank has been forced into the die and swaged to the shape of the die. The reciprocating carriage 3 now moves away from the blank and is raised to bring the header punch 5 in line with the blank. The carriage now moves forward bringing the header punch 5 against the partially upset end of the blank and forming the same to a head 10. As the carriage 3 moves away from the head the completed blank is knocked out of the die by a plunger 11. The above described operations take place automatically in the described sequence during the operation of the header.

While being forced into the die by the upsetting punch 4, the entering end of the blank first engages an inwardly extending annular shoulder 12 at the inner end of a cylindrical section 12a of the die which reduces the diameter of the entering end. Upon passing the shoulder 12 the entering end of the blank is still further reduced in diameter by engaging with a conical surface 13 on the die which starts at the inner edge of the shoulder 12 and decreases in diameter therefrom. As shown more clearly in Fig. 3, there are a plurality of longitudinal relatively narrow grooves 14 in the conical surface 13 into which metal is squeezed to form ribs 15 on the entering end of the blank. The width of the ribs 15 is kept to a minimum so as to reduce the amount of metal which must be flowed into the grooves 14 during heading and also to provide a wide chip-receiving space between the ribs to keep the chips clear of the threads. Keeping the chips away from the threads reduces the danger of stripping the threads. The width of the ribs is determined by the strength required for tapping when the thread-cutting grooves and projections are formed in the ribs as shown in Fig. 7. The sides 16 of the grooves are perpendicular to the conical surface 13 so that both the leading and trailing edges of the ribs 15 rise abruptly from the conical tapered end of the blank. From adjacent the shoulder 12 the grooves 14 extend parallel to the axis of the blank to the point 17, after which the grooves taper inward toward the axis of the blank. The ribs 15 accordingly have tapered sections 18 at the entering end of the blank. During the above described operations the part of the blank within the die 2 is swaged to the shape of the die. The completed blank accordingly has a cylindrical body 19 corresponding to the section 12a of the die, a reduced or tapered entering end 20 with ribs 15 thereon corresponding to the conical section 13 of the die, and a shoulder 21 at the junction of the body 19 with the entering end of

the blank corresponding to the shoulder 12 of the die.

The blank may be threaded in a thread-rolling machine and the head 10 of the blank slotted in a slotting machine to produce the self-tapping screw illustrated in Fig. 7. During this operation full threads 22 are formed on the body 19 of the screw and partial threads 23 are formed in the ribs 15. Since the major portion of the conical entering end 20 of the blank lies below the root diameter of the thread, no threads are formed in the conical end except adjacent the shoulder 21. The ribs 15 project from the conical end 20 to a height intermediate the root and crest diameters of the thread. The threads 18 formed in the ribs are accordingly incomplete threads, as illustrated. The threads formed in the tapered sections 18 of the ribs are less complete than the threads formed beyond the point 17. There is accordingly a gradual increase in the size of the threads from the entering end of the screw to the full threads on the body 19 of the blank. This makes the screw easier to use since the tapping or thread-cutting action of the screw takes place gradually.

Because the threads 23 in the tapping or thread-cutting section of the screw are of less height than the threads 22 on the main body of the screw, the screw has a tight or snug fit. There is no tendency for the thread-cutting section to cut a thread of larger diameter than the threads 22. This means that the screw can be repeatedly removed and replaced without destroying the snugness of the fit and without stripping the threads previously cut. The edge of the ribs 15 which rise abruptly from the conical end 20 form sharp cutting edges for the teeth 23. Chips cut by the teeth 23 from the material in which the screw is being threaded are received in the spaces between the ribs 15 which from one aspect can be considered as longitudinal chip-receiving grooves or depressions. Because there are three ribs 15, the screw is self-centering. The self-centering feature would be present if a greater number of ribs were used. If this feature were unimportant, fewer ribs could be used.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A self-tapping screw having a body provided with a tapered entering end comprising a conical surface with longitudinal ribs thereon, and a thread formed in said body and said ribs, said conical surface tapering to a diameter less than the root diameter of the thread at the entering end, and said ribs projecting from the conical surface to a height intermediate the root and crest diameters of the thread.

2. A self-tapping screw having a body provided with a tapered entering end comprising a conical surface with longitudinal ribs thereon, and a thread formed in said body and said ribs, said conical surface throughout a substantial part of its length being of less diameter than the root diameter of the thread.

3. A self-tapping screw having a body provided with a tapered entering end comprising a conical surface with longitudinal ribs thereon, the leading edges of said ribs rising abruptly from said conical surface, and a thread formed in said body and said ribs.

4. A self-tapping screw having a body provided with an entering end portion of reduced diameter, longitudinal ribs having the leading edges thereof rising abruptly from said entering end portion, and a thread formed in said body and said ribs, a substantial part of said entering end portion lying below the root diameter of the thread.

JAMES J. FARRELL.