(No Model.)

F. G. ECHOLS.

SCREW CUTTING TOOL.

No. 588,056. Patented Aug. 10, 1897.

Fig. 1.

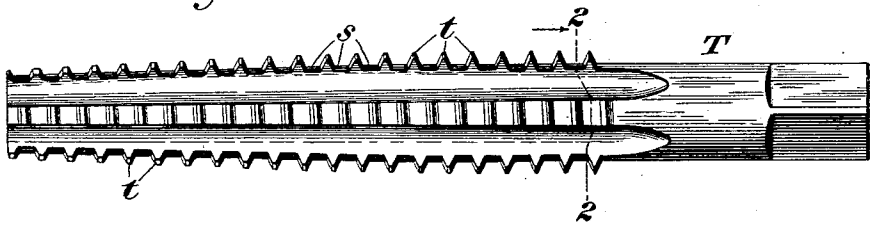


Fig. 2.

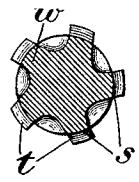


Fig. 3.

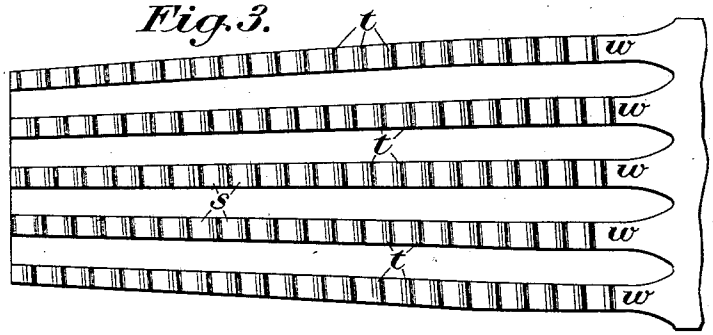


Fig. 4.

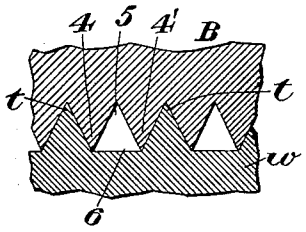


Fig. 5.

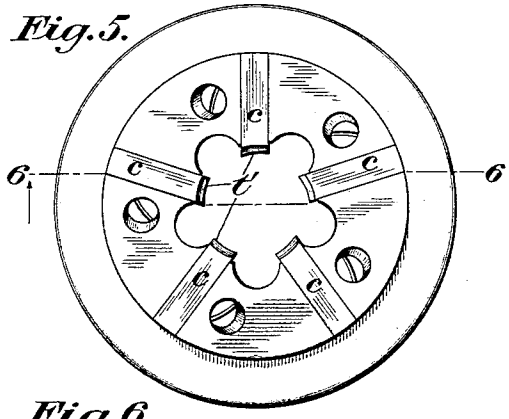


Fig. 7.

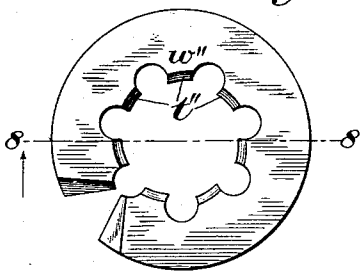


Fig. 6.

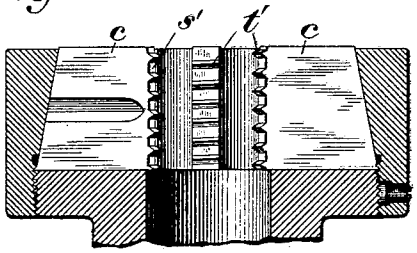
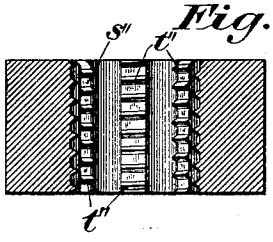


Fig. 8.



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UNITED STATES PATENT OFFICE.

FRANK G. ECHOLS, OF HARTFORD, CONNECTICUT.

SCREW-CUTTING TOOL.

SPECIFICATION forming part of Letters Patent No. 588,056, dated August 10, 1897.

Application filed May 8, 1897. Serial No. 635,656. (No model.)

To all whom it may concern:

Be it known that I, FRANK G. ECHOLS, a citizen of the United States, residing in Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Screw-Cutting Tools, of which the following is a specification.

This invention relates to improvements in screw-cutting tools, such as taps and dies, for forming internal and external screw-threads; and it has for its main object the provision of an improved tool of this type by means of which screw-threads may be cut easily and rapidly without breaking or distorting the same and without injuring the tool used for the purpose.

In screw-cutting tools heretofore employed, in which the teeth in a given row are arranged consecutively, one tooth for each turn of the thread being cut, the row of teeth form together a complete wing extending transversely of the article being threaded, so as to carry forward with the row of cutting faces or teeth not only the chips formed thereby, but also the lubricating material, thereby wiping off substantially all of the lubricating material from the freshly-cut surfaces and leaving only the clean metal in the path of succeeding cutting faces or teeth of the tool. In my improved tool, however, there are formed in each wing thereof numerous blank spaces, through which the chips, and especially the lubricating material, may pass freely around the threading-tool while this is in use, the lubricating material flowing around from one groove to another and thus lubricating the freshly-cut surfaces immediately in advance of the cutting-teeth and with a gradually-increased thoroughness and efficiency. In order to attain this result and form these blank spaces between the teeth of the several wings of the cutting-tool, I so dispose the cutting-faces that the centers of adjacent teeth will be spaced at greater intervals than the pitch of the thread to be cut, the preferred construction being one in which the teeth in each wing are separated by intervals which are multiples of the pitch of said thread. Moreover, these teeth and the spaces therebetween are so located that some of the turns of the thread of the tool will have a less number of teeth than the number of wings from which the teeth rise, the teeth and the blank spaces preferably alternating in each turn.

In the construction illustrated in the drawings, which is the one I prefer to employ, I have shown in each view a screw-cutting tool having an odd number of wings formed with teeth and blank spaces, which are located in a single spiral and alternate from end to end thereof, so that there will be a blank space in each wing between the preceding cutting-tooth in the wing in advance of that containing such blank space and the succeeding tooth in the wing in the rear of such blank space. By means of this organization of the teeth of the threading-tool relatively to the blank spaces thereof I am enabled to obtain the greatest efficiency and the best results, for the reason that after the tool has started there will be a groove in the material operated upon between each pair of teeth of the tool, and through this space the lubricant may flow freely and the chips pass during the whole of the threading operation. Owing to the fact that this intermediate groove between two adjacent teeth of the cutting-tool is always present after the threading operation has begun the threads at opposite sides of the groove are permitted to yield sidewise toward each other, by reason of the mobility of the material being cut, so as to facilitate materially the operation of the tool and prevent binding thereof.

It should be stated here that in my improved screw-cutting tool I am enabled to make use of cutting-teeth having no side relief whatever, as there is always a sufficient space between each pair of adjacent cutting-teeth to permit this sidewise yielding of the screw-threads when the pressure of the sides of the cutting-teeth is applied thereto.

In the drawings accompanying and forming part of this specification, Figure 1 is a side elevation of a tap constructed in accordance with my improvements. Fig. 2 is a transverse section of the same, the section being taken in the line 2 2, Fig. 1. Fig. 3 is a developed view of the periphery of the cutting tool or tap shown in Fig. 1, this view illustrating the manner in which the cutting-teeth and the blank spaces alternate. Fig. 4 is a sectional detail, on an enlarged scale, showing the manner in which adjacent teeth

operate to cut the outer sides of adjacent threads which have a clear space or groove between them and are free to move toward each other. Fig. 5 is a plan of a modification of my invention, showing a separable die and die-stock, in which the former is constructed to operate in the same manner as the tap hereinbefore described. Fig. 6 is a transverse section of the same, the section being taken in line 6 6, Fig. 5. Fig. 7 is a plan of a solid die also embodying my invention; and Fig. 8 is a transverse section of the same, taken in line 8 8, Fig. 7.

Similar characters designate like parts in all the figures of the drawings.

As before stated, one of the main features of my invention consists in spacing adjacent cutting faces or teeth so that there will be a greater interval between the centers of those teeth than the pitch of the thread which is to be cut.

Preferably the cutting-teeth are disposed in successive rows or wings in such a manner that some of the faces of one row are followed by a blank space or spaces in the following row.

Referring first to Figs. 1 to 3, inclusive, T designates in a general way a tap, of taper construction, having five wings, each designated by *w*. The cutting-teeth by means of which the screw-thread is to be formed may be located in any manner within the scope of my invention so long as the distance between the centers of some of the adjacent teeth of the tool is greater than the pitch of the thread to be cut thereby. In this case, however, the teeth, which are indicated by *t*, are formed in rows, one row for each wing *w*, and are separated by blank spaces or interdental spaces *s*, the teeth and the spaces alternating from end to end of each wing. These interdental spaces are at all points of the full depth of the teeth, have substantially flat bottom walls, and are preferably of such size that the teeth in each wing are spaced at intervals which are multiples of the pitch of the thread to be formed by the tool, the teeth in this case being disposed at intervals twice that of such pitch. This will be clear by reference to Figs. 1 and 3, and, moreover, it will be seen by referring to Fig. 3 that the teeth and the interdental spaces alternate also in the direction of the spiral, each turn of the spiral having a series of alternating teeth and spaces in the wings of the tool, and all of these teeth and spaces alternating throughout the whole extent of the spiral from end to end of the tool, so that at every point in the cutting operation a cutting-tooth will be succeeded by an interdental space in the next wing, and said space in turn will be succeeded by a tooth of the next following wing. In the operation of the tap shown in these figures one cutting-tooth comes between two adjacent turns of the thread, so as to cut the outer face or side of each thread. The inner side of each thread faces the groove between these threads, as shown clearly in Fig. 4, and no pressure is brought to bear upon these inner faces at any point in the length thereof while the outer faces thereof are being cut at corresponding points. Hence the metal of the thread being cut is able to support itself at any particular moment at a given point against force applied only at one side of such point. Heretofore this metal has had to support itself against displacement at both sides, owing to the fact that it has been customary to plane opposite sides of the thread at any particular point at the same time, and this action has usually resulted in distorting or breaking off the edge of the thread, especially when the material operated upon has been such as would not oppose much resistance to the pressure exerted against it.

By means of my present invention the thread being formed is relieved of the excessive pressure due to the combined action of tool-cutting teeth operating simultaneously at opposite sides thereof, and is thereby enabled to withstand the action of the tool, so that any number of perfect threads may be formed easily in metals and under circumstances in which threads have been made heretofore only with great difficulty and after the loss of a large percentage of the work and stock.

In Fig. 4 I have illustrated in detail, on an enlarged scale, the action of two separated cutting-teeth upon two adjacent turns of the thread being cut thereby, this view also illustrating the intermediate groove which forms a flowage-space for distributing the lubricant, permitting the escape of the chips and relieving pressure on the threads being cut. The material which is being threaded is represented here by B and may be assumed to be a nut.

4 4′ designate two adjacent threads which have been formed by the action of the cutting-teeth, and 5 represents the groove between those threads.

The blank space between the teeth *t t* is indicated by 6 and is of the same width as the mouth of the groove 5 in the material. One of the teeth *t* bears against the outer face of the thread 4 and the other against the corresponding face of the thread 4′; but as there is no tooth of the tap between these threads at this point there is no pressure upon the inner faces of the latter, and consequently the metal of the threads 4 4′ around the inner sides and at the extreme points of these threads is not grasped between cutting-teeth, as would be the case if the threads were formed by the ordinary tap.

It will be clear that no matter what the material of the stock may be the base of each thread will exert a much greater resistance to displacement by pressure applied only at one side of the thread than when opposite sides of the thread are being cut at the same time and pressure applied thereto, and that the material will be much better able to main-

tain its shape and position when only one side thereof is cut at a time and the opposite side is free to yield during such cutting operation.

Another important advantage which I secure by my invention and one that is due directly to the presence of this groove between adjacent turns of the thread is that very much less relief of the cutting-teeth may be used and that I may entirely dispense with the side relief for the sides of the teeth. The result of this is to give the tool greater stability in action and render it more durable, thereby increasing the amount of work done by a tool of a given size and reducing the cost of such work. By thus overcoming the necessity for relieving the sides of the teeth I am enabled to sharpen the cutting-faces indefinitely by grinding the cutting ends of the same, so as to keep the teeth perfectly sharp without changing the cross-sectional area or form thereof.

It is well known that in ordinary practice the cutting-teeth cannot be ground away on their faces to any considerable distance without affecting materially the size of the threads produced by the cutting-tool.

By making the cutting-teeth of full width from the front to the rear edge thereof the tool can be turned backward freely without drawing chips between the rear ends of the teeth and the work, which would result in binding the tool. Such binding is common in taps and dies, especially in hand-taps, and is the cause of much difficulty in the cutting of threads in many kinds of work, resulting frequently in serious injury to the thread and sometimes in tearing it entirely away.

It is particularly to be noted that the edges of the flat bottom walls of the interdental spaces 6 act as knives and shave off the top of the thread as the tap is driven through the article to be threaded, and thereby remove any metal that may have been distorted or crowded out of place owing to the mobility of the metal in the thread-forming operation.

In Figs. 5 to 8, inclusive, I have illustrated my invention in connection with screw-cutting dies, Figs. 5 and 6 illustrating a separable or expanding die and Figs. 7 and 8 a solid die.

In Figs. 5 and 6 the cutters c correspond to the wings w, (shown in Figs. 1 to 4,) and the cutting-teeth t' alternate with blank spaces s' in each cutter, the teeth and the spaces also alternating in the direction of the thread.

In Figs. 7 and 8 the wings w'' correspond to the wings w, (shown in Figs. 1 to 4,) and the teeth t'' are similar to those shown at t'; but both the teeth t' and the teeth t'' have concave faces instead of convex ones, as is the case with the teeth t'. In this solid die the teeth t'' and spaces s'' alternate with each other in each wing and also in the direction of the spiral or thread in which they are located, the construction in these views and in Figs. 5 and 6 being similar in every respect to that illustrated in Figs. 1 to 4, except that the dies are adapted to cut external threads and the taps internal threads.

Screw-cutting tools, both in the form of dies and in the form of taps, made according to this invention are found to operate with very much less power than is required for screw-cutting tools of the old kinds; and I have also found that screw-cutting taps, especially such as are used for tapping nuts and for similar work, may be made much shorter than they are ordinarily, while securing freer action, requiring less power, and having greater durability, as indicated by a number of tests of the invention with tools of a variety of sizes and kinds.

Having described my invention, I claim—

1. A screw-cutting tool having an odd number of wings each equipped with teeth having no side relief and interdental spaces located in a single spiral and alternating from end to end of the working portion of the tool, said interdental spaces being at all points of the full depth of the teeth and having flat bottom walls in line with the roots of said teeth.

2. A screw-cutting tap having an odd number of wings formed with teeth each of full width from the front to the rear edge thereof, and interdental spaces located in a single spiral and alternating from end to end of the working portion of the tool, said teeth having no side relief, and said interdental spaces being at all points of the full depth of the teeth and having flat bottom walls, substantially as and for the purpose specified.

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Witnesses:
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