No. 639,561.

Patented Dec. 19, 1899.

B. M. W. HANSON.

METAL WORKING TOOL.

(Application filed July 28, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 2.

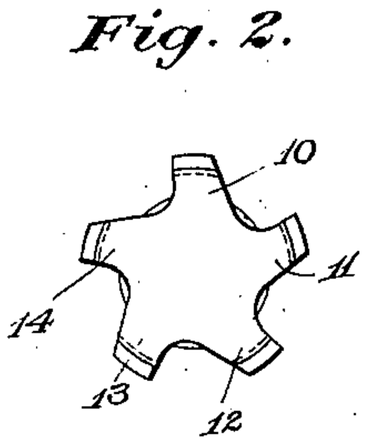


Fig. 1.

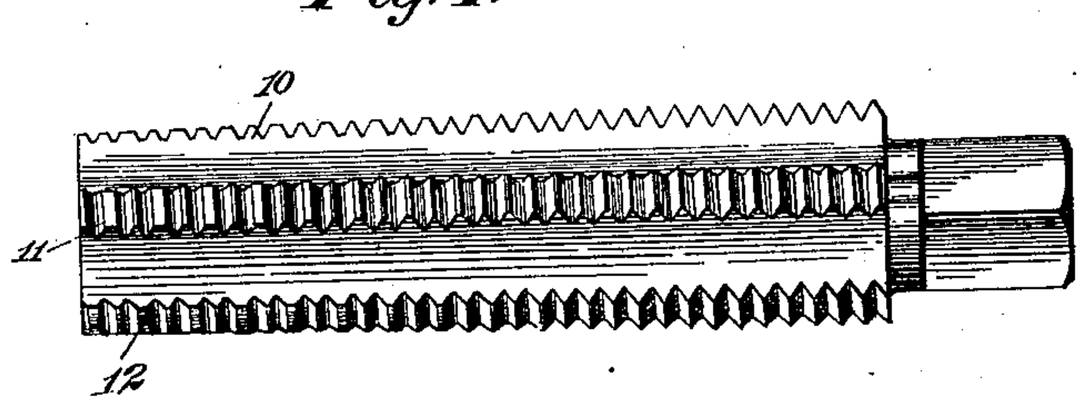


Fig. 3.

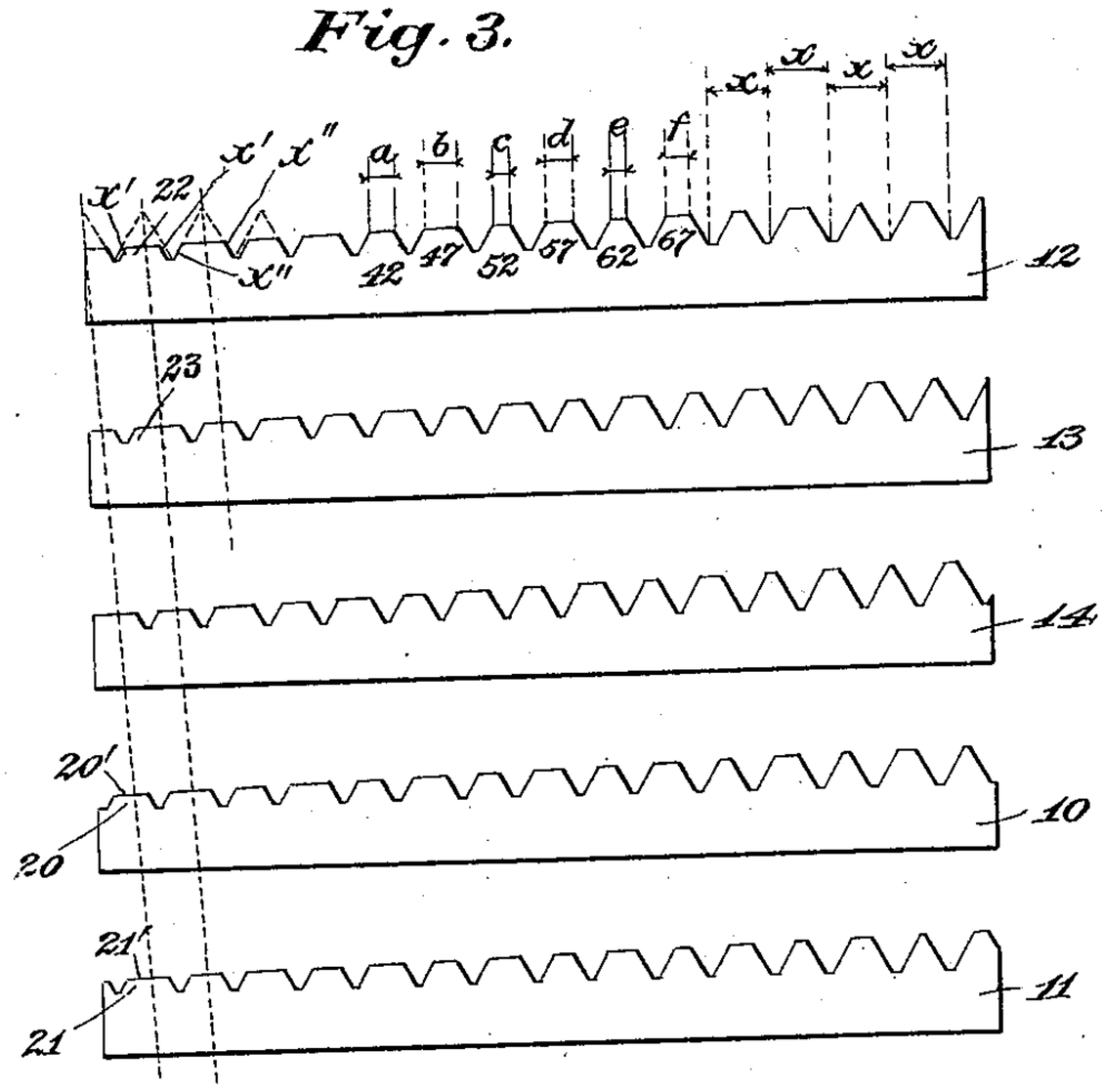


Fig. 4.

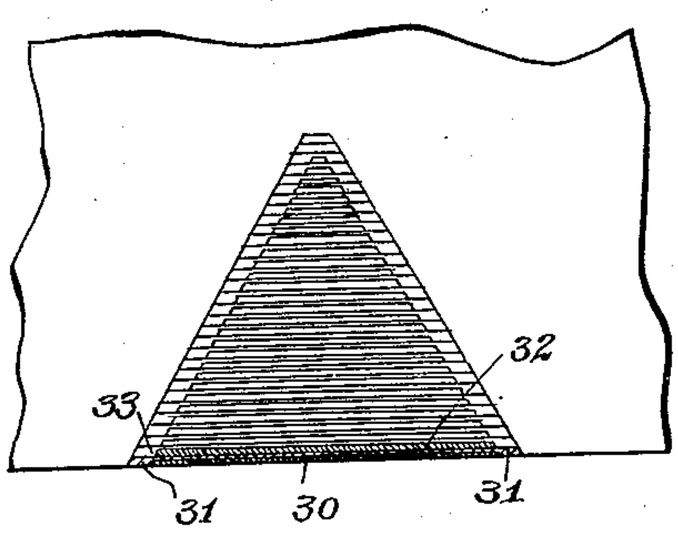
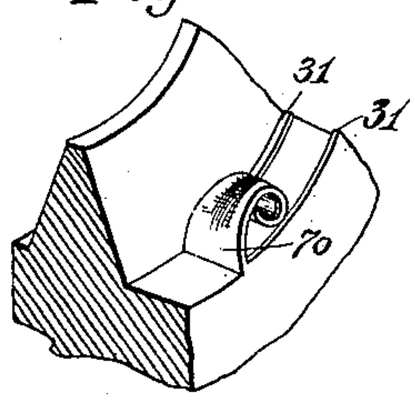


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

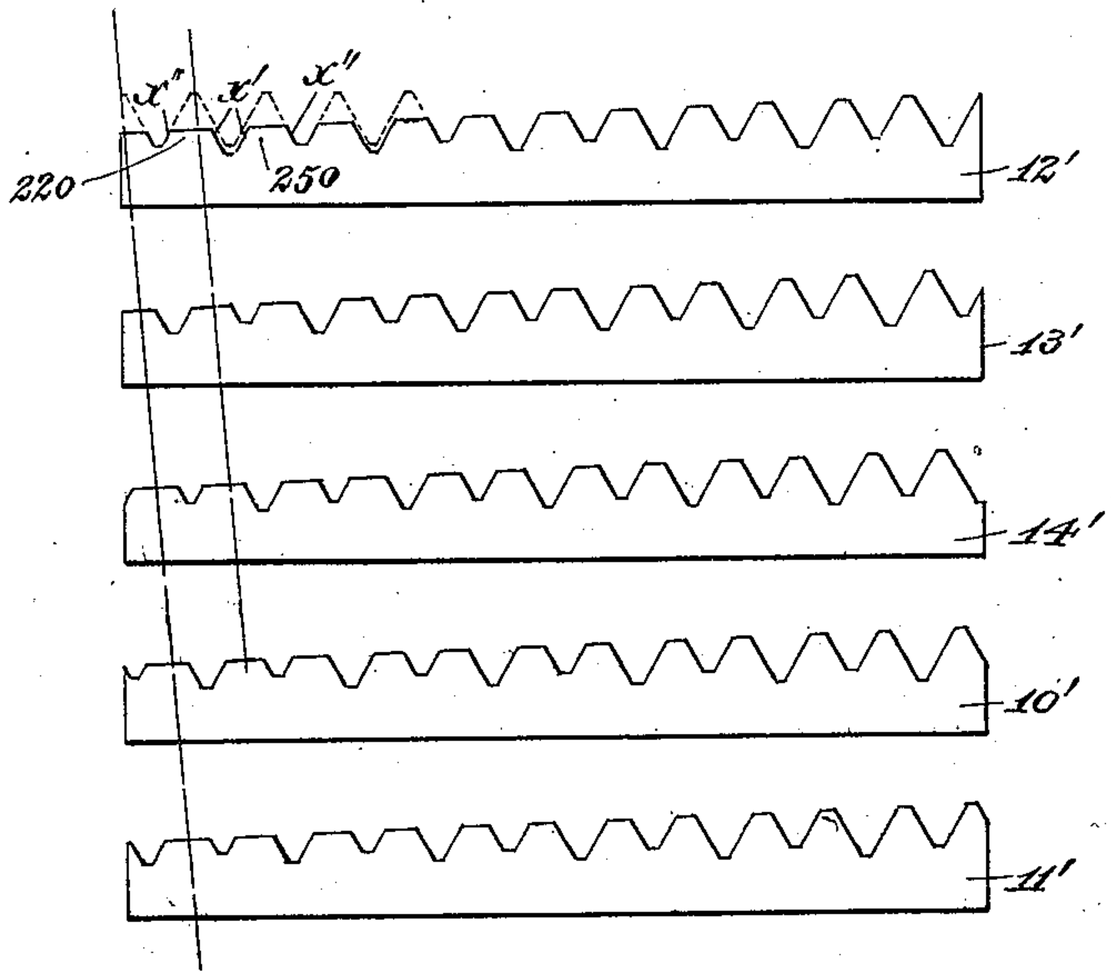


Fig. 7.

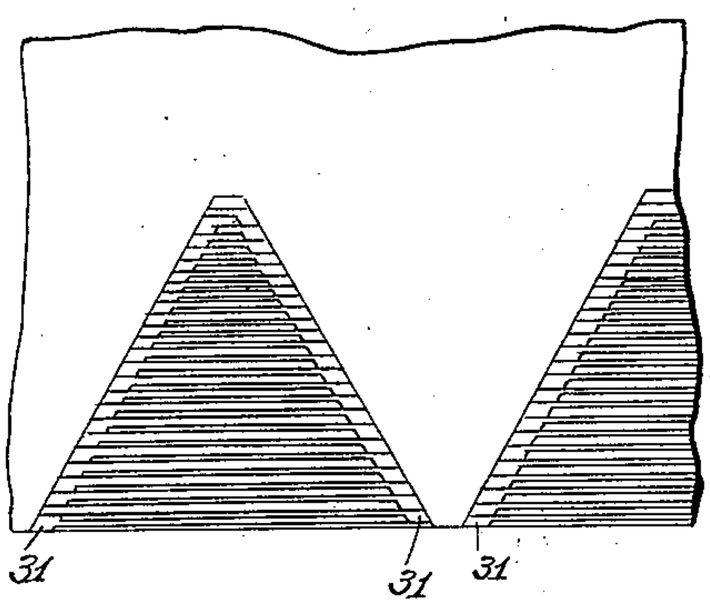
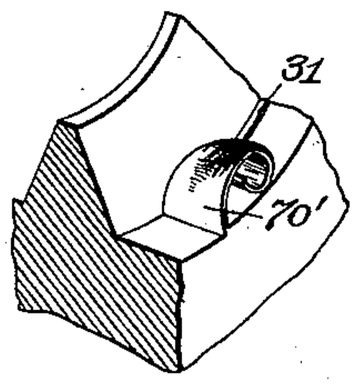


Fig. 8.



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UNITED STATES PATENT OFFICE.

BENGT M. W. HANSON, OF HARTFORD, CONNECTICUT.

METAL-WORKING TOOL.

SPECIFICATION forming part of Letters Patent No. 639,561, dated December 19, 1899.

Application filed July 28, 1899. Serial No. 725,408. (No model.)

To all whom it may concern:

Be it known that I, BENGT M. W. HANSON, a citizen of Sweden, residing in Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Metal-Working Tools, of which the following is a specification.

This invention relates to metal-cutting tools, and more especially to the class thereof employed for forming screw-threads; and it has for its object the provision of a tool of this character whereby either external or internal screw-threads may be cut with rapidity and ease and without liability of distorting or tearing the threads during the cutting operation. To this end the metal-working tool, which in the accompanying drawings is illustrated as a tap, is provided with full and relieved cutting-teeth disposed, preferably, in an odd number of rows in order that the full and relieved teeth may alternate in said rows.

In the drawings accompanying this specification, and in which similar characters represent like parts, Figure 1 is a side view of a tap embodying my invention. Fig. 2 is an end view of the same. Fig. 3 represents, in diagrammatic form, the several rows of cutting-teeth as they follow each other in either a tap, a die, or an analogous article. Fig. 4 shows, on an enlarged scale and in an exaggerated manner, the action of a number of consecutive teeth of a screw-cutting tool upon the metal to be cut. Fig. 5 is a detail in perspective, showing a section of thread in the work and the form the chip assumes while being cut. Fig. 6 represents, in diagrammatic form, the several rows of cutting-teeth of a modification of my invention. Fig. 7 illustrates, on an enlarged scale, the action of a number of teeth of said modification; and Fig. 8 is a detail in perspective of a section of thread, showing the character of chip produced by said modification.

The tool illustrated contains five rows of cutting-teeth, (numbered 10, 11, 12, 13, and 14,) in which a few teeth at the end of each row are left of standard size and form for finishing and precisionizing the thread. Toward the other end thereof the tool is preferably tapered to permit the thread to be cut in a gradual and easy manner. The cutting-teeth of the tool are alternately relieved in consecutive order in each convolution, and by virtue of the uneven number of rows of teeth the same alternation of full and relieved teeth will be found in each of the several rows longitudinally of the axis of the tool. While the distance from center to center of the teeth in each row is the same throughout the length of the tool, yet the sides of every alternate tooth in said row are relieved or cut away, so that the cutting edges at the tops of said teeth will proportionally vary from one end of the tap to the point where the cutting-teeth are left full and of standard form. By comparison of the rows 10, 11, and 12 (illustrated in Fig. 3) it will be seen that the tooth 20 is narrower at the top than the tooth 21 of row 11, and inasmuch as the row 11 follows the row 10 when the tool is in operation the radial distance of the cutting edge 21′ of tooth 21 is somewhat greater than the radial distance of the cutting edge 20′ of tooth 20 from the center or axis of the tool. In view of this construction it is evident that while the tooth 20 cuts a groove the width of which is less than the full width of the thread to be cut, the tooth 21, being left full width and at the same time cutting a trifle deeper than the tooth 20, will in this manner form the thread to the full width required. Referring to Fig. 4, in which the amounts of the consecutive cuts taken by the succeeding cutting-teeth to form a thread are greatly exaggerated in order to better illustrate the several operations, it will be seen that the portion of stock to be removed by the tooth 20, and indicated in Fig. 4 by the numeral 30, is centrally located in the groove of the thread to be formed, so that when the tooth 21, which, as above mentioned, is left full width, comes into action it will remove an amount of stock indicated at 31 in Fig. 4. The succeeding tooth 22 of row 12, following the tooth 21, will cut another groove by removing stock, as indicated by 32, and the tooth 23 of row 13 will take a chip, as indicated by 33 in Fig. 4. The side edges of the several cutting-teeth being of true form every other tooth—as, for instance, 21 23, &c.—being of full width at its base, will therefore cut a thread of true shape and without requiring a special cut for finishing after the cutting-teeth in the taper portion of the tool have consecutively done

their work. The fact that the teeth 21 23, &c., are left of full width at their bases is a very important feature in the proper working of the tool, inasmuch as the first groove—as, for instance, 31—is sufficient to guide all the succeeding full-width cutting-teeth, and thus properly feed the tool to the work. It has been found in practice that when a groove of less width than a succeeding tooth will produce is first cut into the metal a second and full-width tooth will take a chip much more easily and with less friction than has heretofore been the case, for the reason that when the chip of the full width is cut the side portions of said chip will curl toward each other, thereby obviating all tendency of their being crowded or wedged in place, by which action the proper operation of the tool would, of course, be greatly interfered with.

It will be understood that toward the small end of the tool the teeth will naturally be wider at their cutting tops than at the larger end, and in Fig. 3, in the row designated by the numeral 12, a series of teeth 42, 47, 52, 57, 62, and 67 is shown, the tops of said teeth gradually decreasing in width as their distance from the small end of the tool increases, as will readily be seen by a comparison of the distances indicated by the dotted lines *a*, *b*, *c*, *d*, *e*, and *f*. As shown by said figure, the tooth 42 will cut a narrow groove of a width equal to the length of the line *a*, and in the succeeding convolution the tooth 47 will cut a wide groove of a width equal to that of the line *b*, the tooth 52 will cut a narrow groove equal to that of line *c*, to be followed in the succeeding convolution by the wide groove *d*, and so on, the top cutting edges growing less in width as they approach the finishing end of the tool. As above mentioned, the distances from center to center of the cutting-teeth in one row are the same throughout the length of the tool, and hence the width of the said cutting-teeth at their bases, as indicated by dotted lines *x x* on the row 12 (shown in Fig. 3) will be the same. Every other tooth being relieved and therefore being smaller at its base than the adjacent tooth, by having the cutting edges of the several teeth in each row tapered on a straight line, the amount of work to be done by each tooth individually will be nicely proportioned and gradually increased toward the full-size end of the tool. The relief imparted to the alternate cutting-teeth in conformity with my invention extends to the bases of said cutting-teeth, which at that point are left full-faced, and therefore have another cutting edge for trimming off any bur which may be produced by the action of the side cutting edges of the teeth.

In Fig. 6 is shown a series of rows 10′, 11′, 12′, 13′, and 14′ of cutting-teeth of a screw-cutting tool embodying a modification of my invention, in which each tooth of a pair of adjacent cutting-teeth is relieved at the side adjacent to the other tooth, while the other side of each tooth constitutes the cutting edge. Each tooth of the next pair of cutting-teeth in the same row is also relieved in the same manner, and so on throughout the row. Referring to Fig. 6, the teeth 220 and 250, which in their correct and full form would have the outlines indicated by the dotted lines in said figure, have their sides designated by *x′* relieved, so that they will have no cutting functions, while the sides *x″* are left of full and correct form to serve as the cutting edges for producing the thread.

It will be observed that in both forms of tools shown in Figs. 3 and 6, respectively, the thread is formed by removing a shaving having at its edge a thickened portion or shoulder 31, which leaves in the stock another shoulder, which is cut away by the following or succeeding tooth to an extent corresponding with the full width of the thread to be cut at that particular point. In other words, the first tooth will remove a shaving of a width less than would be required to form the thread, and the succeeding tooth will remove the excess of stock at the side left by the preceding tooth. The next cutting-tooth will remove an amount of stock which is less than the groove in the thread to be formed would require, while the succeeding tooth will remove the excess of stock left by the preceding tooth, and so on, until the thread is formed. In one form of tool (that shown in Figs. 1 to 3) what may be termed a "double-L-shaped" chip 70 is removed, as shown in Fig. 4, while in the form illustrated by Fig. 7 a "single-L-shaped" chip 70′ will be taken from the stock, as represented by Fig. 8. In both forms of tap, however, the teeth are so constructed that the chip removed will have a long thin body portion and a thicker edge portion, the result being that the chip will curl into an involute form, and will, therefore, be much more readily received in the clearance space or groove of the tap. The tap being tapered in the usual form the widths of the cutting-teeth at the top will of course be formed progressively narrower toward the full-size end of the tap, and said teeth will likewise cut proportionately deeper into the metal.

With a tool of my invention friction of the cutting-teeth is reduced to a minimum and none of the teeth slide over and burnish the metal, and therefore cause it to offer greater resistance to the succeeding teeth.

In a former screw-cutting tool of which I am aware the teeth were arranged to remove the metal by a series of cuts forming steps in the walls of the groove, and these walls were subsequently trimmed by other cutters to make them smooth and finish the threads.

While the invention is shown applied to a tool having an uneven number of rows of teeth, yet it is not limited thereto, as it can be employed with tools having even numbers of rows. Furthermore, the invention is not limited to a tool having a tapering form, as it could readily be applied to tools of even diameters

throughout their working-surfaces or to other forms of tools.

Having thus described my invention, I claim—

1. A screw-cutting tool the teeth of which are formed and located as set forth, whereby they remove from the stock a chip having a thin body portion and an edge portion thicker than said body portion.

2. A screw-cutting tool having teeth of progressively-increasing heights, said teeth being constructed and located as set forth, whereby chips L-shaped in cross-section may be removed from the stock.

3. A screw-cutting tool having alternately-disposed teeth, certain teeth being of less width than the groove to be progressively formed, and the others of the full width of said groove, each tooth of less width cutting a narrow groove in the stock, and each tooth of full width overlapping said narrow groove, and removing from the stock a chip having a thin body portion and an edge portion thicker than said body portion.

4. A screw-cutting tap having a series of rows of teeth, each of said rows having narrow teeth and full-width teeth alternately disposed, whereby when the tap is in operation the narrow teeth will form grooves in the stock, and the full-width teeth will overlap said grooves and remove chips having thin body portions and edge portions thicker than said body portions.

5. A tool having a series of rows of teeth every alternate tooth of each row being of greater width than the preceding tooth in the row, said teeth being so located and proportioned that chips of progressively-decreasing size having thin body portions and edge portions thicker than said body portions are removed from the stock.

6. A screw-cutting tool having alternate narrow and wide teeth of gradually-increasing heights, said teeth being located and proportioned to operate progressively, and the wide teeth removing chips of L-shaped cross-section from the stock.

7. A screw-cutting tool having a series of rows of cutting-teeth of like pitch, the teeth of each row being alternately of less width and of full width with relation to the groove to be progressively formed, and the teeth of less width being relieved at the sides, each tooth of less width forming a groove in the stock, and each tooth of full width overlapping said groove and removing from said stock a chip having a thin body portion and edge portions thicker than said body portion.

8. A screw-cutting tool having an odd number of rows of teeth, certain teeth being of less width and others of full width with relation to the groove to be progressively formed, and the teeth of one set alternating with those of the other set, both longitudinally and circumferentially of the tool and each tooth cutting deeper than the preceding tooth.

9. A screw-cutting tap having a series of rows of teeth, some of said teeth being of less width and others of full width with relation to the groove to be progressively formed, and the teeth of one width alternating with those of the other width in each row and also circumferentially of the tap and each tooth cutting deeper than the preceding tooth.

10. A screw-cutting tap having a series of rows of teeth, each row having alternating teeth of different widths, and each tooth cutting deeper than the preceding tooth, and also having a set of standard finishing-teeth.

11. A taper tap having an odd number of rows of cutting-teeth, each row having teeth of different widths, the teeth of one width alternating with those of the other width, and each tooth cutting deeper than the preceding tooth, and also having a set of finishing-teeth of the desired standard size.

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