March 7, 1939. K. W. REED ET AL 2,150,037

CHASER

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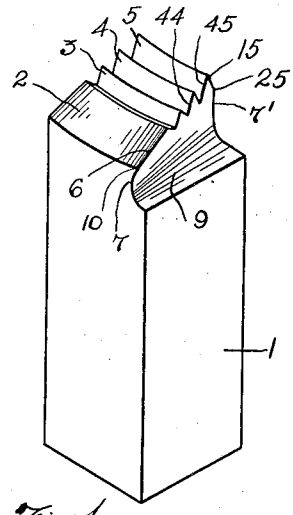


Fig. 1

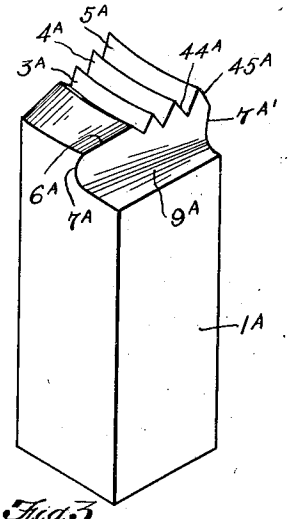


Fig. 3

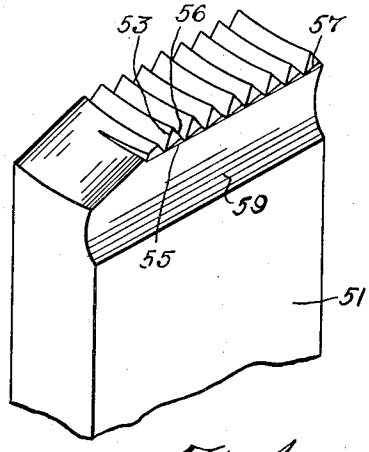


Fig. 4

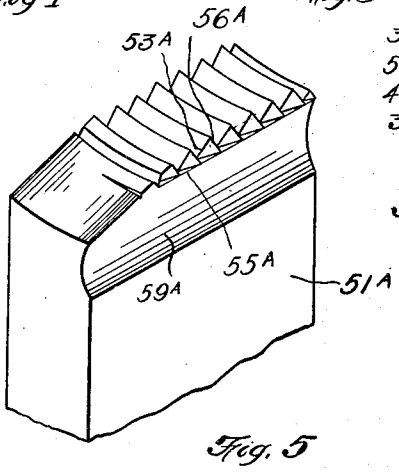


Fig. 5

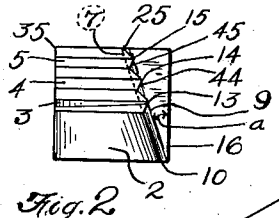


Fig. 2

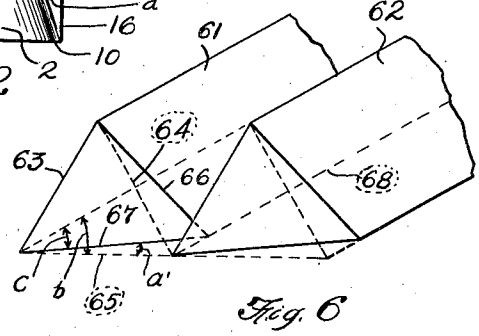


Fig. 6

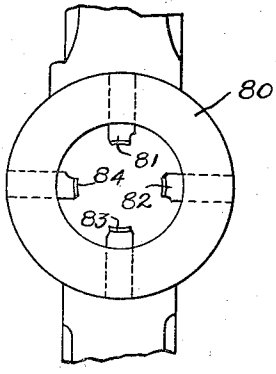


Fig. 8

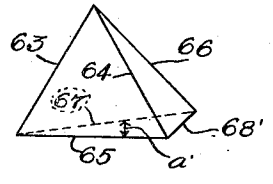


Fig. 7

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CHASER

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3 Claims. (Cl. 10—111)

This invention relates to chasers or cutting dies for thread cutting machinery and has for its purpose the application to such dies a principle of tooth formation whereby appreciable saving in power may be accomplished without sacrifice of accuracy or of cutting efficiency. The chasers shown in Figs. 1, 2 and 4 represent embodiments of our invention in its general application, whereas the chasers of Figs. 3 and 5 represent exceptional embodiments which may under certain circumstances be used, optionally, in connection with the general formation.

This invention is susceptible of application in a variety of forms. Such variations of form are determined either by the character of the thread to be cut, such as tapered or straight, the cross-sectional shape of the thread, the nature of the material, such as steel, iron, brass, and so on, or by the size of the work, which is important as determining the shape and dimensions of parts of the chasers to be used. Our invention, therefore, can be applied to more than one style of chaser or chaser tooth with variations dependent upon the shape of the entire chaser or by the purposes to which it is to be applied.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain structure embodying the invention, such disclosed means constituting, however, but one of various structural forms in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a perspective view of a chaser to which our invention is applied having only a few teeth;

Fig. 2 is an end view of the chaser shown in Fig. 1;

Fig. 3 is a corresponding view of a chaser of the same type, but with a reversed tooth formation as will be explained in the specification;

Fig. 4 is a perspective of the toothed end of a chaser with a larger number of teeth and in which the principle is applied in another manner;

Fig. 5 is a perspective corresponding to Fig. 4 but in reverse, as explained hereafter;

Fig. 6 is an enlarged diagrammatic showing of two tooth ends for explaining the principle of the invention;

Fig. 7 is a diagrammatic perspective for use in the explanation of Fig. 6; and

Fig. 8 is a front elevation of a die stock equipped with chasers according to the present invention.

The chasers of Figs. 1, 2 and 3 show the application of our invention to short chasers having only a few teeth, and thus having a shank 1 or 1A of approximately square cross section. The working end of the chaser is based upon standard construction in that the throat 2 and teeth 3, 4 and 5 are disposed in the usual relationship, the embodiment shown being for a taper thread, and the entering edge 6 is undercut as at 7—7′ to give the usual top rake. However, the undercut portion or chip groove 9 is also inclined from front to rear along the entering edge 6 and its intersection with the teeth 3, 4 and 5 so as to make an angle with the tooth body at the entering end of each tooth. In the embodiment shown for illustrative purposes herein, this angle a in Fig. 2 is approximately 25°. That is, taking the entering edge as a line from the point 10 to the point 15, this line 10—15 as best seen in Fig. 2, makes an angle of about 25° with the side of the body 1. This angle is shown as side rake and so referred to in this specification and claims.

Although our invention is not limited to any specific angle of side rake, angles on the order of from 15° to 45° have been satisfactory. One factor in determining the side rake angle to be employed is the consideration that the rear teeth 5 must not be too short. For example, the land distance 25—35 must be sufficient to maintain necessary strength of the tooth, having regard for the material to be cut, and other pertinent factors.

It will be observed that the leading end of the tooth structure in Figs. 1 and 2 is of a somewhat complex shape due to the curvature of the undercut portion, wherein top rake is superimposed upon side rake. The entering points 13, 14 and 15 of the teeth 3, 4 and 5 respectively thus overhang to some extent, having the usual top rake which is thus best illustrated by the dotted line 7, Fig. 2, and is also visible in Fig. 1. In our improved form the cutting is done principally by the leading edges such as 44 of the tooth 4 and 45 of the tooth 5.

Before describing the chaser shown in Fig. 3, we will explain the modified application of the principle of our invention which is illustrated in Fig. 4. Here the chaser is one having many teeth and consequently greater depth in the axial direction of the work than in the chaser of Fig. 1. Obviously to put side rake on this

chaser simply by inclination of the top rake cut **59** would be impracticable as making the land distance of the rear teeth too short.

Consequently the top rake cut **59** is conventional, that is, parallel to the side **51** of the chaser, and our inventive principle is applied by making an individual side rake cut on each tooth thus sharpening each of the leading edges **53** and so on throughout the chaser. The principle employed will be best understood by reference to the diagram of Figs. 6 and 7. Here two teeth are shown, **61** and **62**. For simplicity these are illustrated as though formed entirely of plane surfaces and straight lines, all the curvature of lines and planes which characterizes the construction in an actual chaser being omitted. On this basis, the front or entering face of the tooth **61**, in the prior art form, is considered as a triangular plane bounded by the actual lines **63** and **64** and the imaginary line **65**. The line **65** is drawn simply from the root of one tooth to the root of the next, delimiting the tooth end surface from the shank, or more strictly, from the face of the chip groove. In order to apply the principle of the invention it is necessary to have the cutting edge **63** sharpened to acuteness, and this is done by removing the portion of metal shown in Fig. 7, which for theoretical purposes may be considered as a pyramid having the slant edges **63**, **64** and **66** and base **67**, **68'**. In Fig. 6 and Fig. 7 the lines **63** and **66** are shown solid because both represent edges common to the finished tooth and to the removed pyramid. In Fig. 6 lines **64** and **65** are shown dotted because they are not present in the finished tooth, but they are shown solid in Fig. 7 because if the end shape was made by removing a single piece they would be solid.

Our invention may be applied as shown in Fig. 4 where the lines **53**, **55**, **56** and **57** correspond respectively to the lines **63**, **65**, **66** and **67** of Fig. 6.

Referring to Fig. 6 for a comparison between Figs. 2 and 4, it will be observed that the angle *a* of Fig. 2, which we term the side rake angle, is defined in Fig. 4 for each tooth, and is the functional equivalent of the angle *a'* of Fig. 6. (The angles *a* and *a'* are not actually equal in the drawing because Fig. 6 is adapted from a specimen other than Fig. 1.) If the same angle of side rake is applied to Fig. 4 as to Fig. 2 it will be applied by so shaping the tooth ends of Fig. 4 as to leave the angle *c* of Fig. 6, which is the complement of *a'*. If Fig. 4 and Fig. 1 are to have equally acute teeth *a'* must equal *a*, but our invention is capable of being embodied within a wide angular range. What has happened in Fig. 6, therefore, is that the face **63**, **64**, **65** has been cut back by removing the pyramid of Fig. 7 so that the right angle *b* ordinarily used in chaser teeth has been reduced by the amount of the angle *a'* leaving the acute angle *c*. In Figs. 6 and 7 the tooth root is indicated by the line **68**, a portion of which forms one of the base lines **68'** of the removed pyramid. Of course in Fig. 7 the line **67** is shown dotted simply because it is concealed behind the front and side faces.

The effect is to sharpen the leading slant edge of the entering end of each tooth, whether the form used is that of Fig. 2 or that of Fig. 4.

For cleaning threads it is sometimes desirable to have one chaser in the set with its sharpened tooth edges placed on the trailing edge (in the direction of axial movement along the work) instead of on the leading edge; that is, having the acute edge at **66** instead of **63**, and thus having all the relationships of Fig. 6 reversed. Such a modification of the chaser of Fig. 1 is shown in Fig. 3 and such a modification of the chaser of Fig. 4 is shown in Fig. 5. In Fig. 3 the reference characters of Fig. 1 are used with the exponent A and in Fig. 5 the reference characters of Fig. 4 are used, likewise with the exponent A, all to designate analogous parts.

Thus in Fig. 3 the top rake and side rake are combined in a single cut, but the cut is deeper at the rear than at the front, bringing the point **7A'** nearer than the point **7A** to the side **1A**. That is, the side rake slopes outward from front to rear. As a consequence, the sharpened slant edges of the various teeth will be at the rear as **45A**, **44A** and so on, being the trailing edges in the direction of work feed. Applying this reverse arrangement to Fig. 5, there is no side component to the top rake cut **59A**, but each tooth is inclined at its end in the same manner as at **53**, **56** of Fig. 4, but in opposite sense. Thus the acute edges such as **56A** are the trailing edges, formed by the intersection of the tooth end surfaces with the rear faces of the respective teeth.

It will be observed from the detailed figures that each tooth is given its side rake by what may be considered an inclination of its frontal plane (that is, the plane of the entering face) about one of its side slant edges, or in another way of putting it, the entering face is relieved. Thus, in the forms of Figs. 1 and 4 the forward slant edge forms the edge of an acute dihedral angle, whereas the rear edge similarly forms the edge of an obtuse dihedral angle. In practice the entering face may be a portion of a cylindrical or approximately cylindrical surface because the top rake is usually formed by a curved, not a plane, surface. Thus the edges which are shown as straight lines **63** and **66**, Fig. 6, may actually be curved lines and it has been attempted to so indicate in Figs. 1 and 3, but the curvature is very slight and the showing is not noticeable in a perspective. It is not essential to go into the details of possible intricacies of shape for the purposes of this disclosure, since these may be varied without departure from the principles of the invention.

The application of our principle to actual work has shown a saving of about 30% in power required to rotate the die stock with teeth so sharpened as to give a value of 15° to the angle *a*, Fig. 2, and with diminishing power requirements as the sharpness of the leading edge increases.

This saving in power is believed to be due to the more effective shearing action upon the stock, accomplished by using an acute leading edge of the tooth (see angle *c* Fig. 6) as compared with the former square edge (angle *b* Fig. 6). Tests have not shown that the circumferential length of the teeth (distance **25—35**, Fig. 2) is an important factor. Therefore, as great or substantially as great a saving is accomplished by the form of Fig. 4 as by the form of Fig. 1.

The chasers are for use in any conventional die stock such as **80** Fig. 8, wherein four such chasers **81**, **82**, **83** and **84** are illustrated. These may be any chasers embodying the principles of our invention, either the chasers of Fig. 1 or of Fig. 4. As explained hereafter, it may be desirable to have certain of the chasers in the set formed with reverse side rake teeth. For example, if **81**, **82** and **83** of Fig. 8 each represents a chaser of Fig. 1, **84** of Fig. 8 might either represent a chaser of Fig. 1 or a chaser of Fig. 3.

Similarly, if **81**, **82** and **83** of Fig. 8 each represents a chaser of Fig. 4, **84** of Fig. 8 might either represent a chaser of Fig. 4 or a chaser of Fig. 5.

From the foregoing it will be seen that we have discovered a principle and invented thread-cutting means and implements embodying that principle whereby the cutting efficiency is increased. The invention may be applied to existing threading equipment by reason of the fact that no change in the general style and proportions of such equipment is required. On the other hand our invention is not limited to the embodiments shown.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. A threading chaser comprising in combination a body, teeth on the end thereof all having the same top rake and a sharper angle at the entering edge of each tooth than at the trailing edge, a chip groove adjacent said teeth with the side of the chip groove forming the entering ends of the teeth, said chip groove being shallow in front and deepening to the rear.

2. A taper threading chaser having a plurality of teeth all of equal top rake and all of equal side rake, both rakes being formed by the chip groove surface, said teeth being sharper along the front edges of their entering ends than along the rear edges of the entering ends, and said chip groove so inclining from front to rear as to make the rear teeth shorter than the front teeth.

3. A threading chaser comprising in combination a body, teeth on the end thereof all having top rake in the same positive direction and a sharper angle at the entering edge of each tooth than at the trailing edge, a chip groove adjacent said teeth with the side of the chip groove forming the entering ends of the teeth, said chip groove being shallow in front and deepening to the rear.

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