Jan. 5, 1943. G. HOHWART 2,307,680

TAP STRUCTURE

Filed June 10, 1942

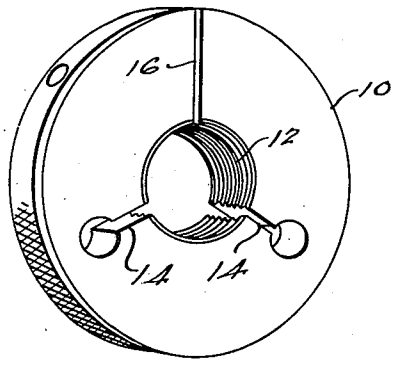


Fig. 1.

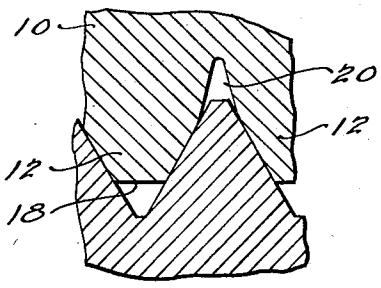


Fig. 2.

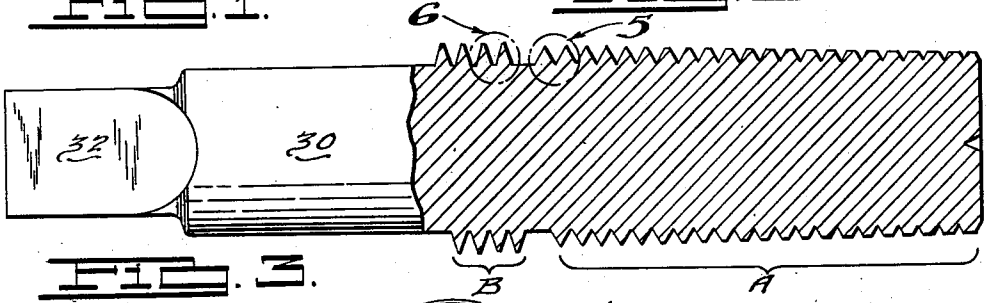


Fig. 3.

Fig. 4.

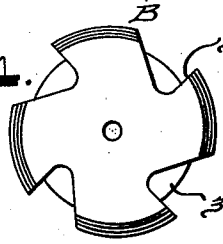


Fig. 5.

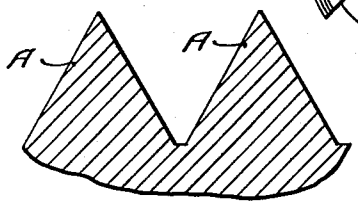


Fig. 6.

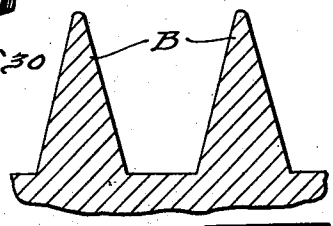


Fig. 8.

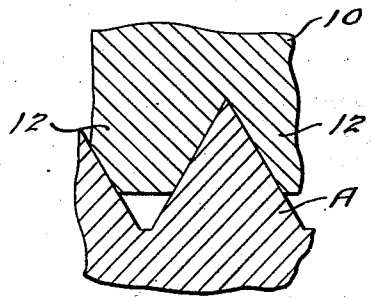
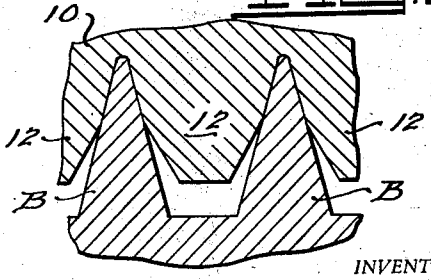


Fig. 7.



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TAP STRUCTURE

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6 Claims. (Cl. 10—141)

This invention relates to taps of the type employed for forming threads in cylindrical bores and the principal object is the provision of a new and improved tap, by the use of which certain advantages are capable of being realized.

Objects of the invention include the provision of a tap capable of being employed for threading the bore in a piece of work and to provide a relief at the root of the threads formed thereby; the provision of a tap which is capable of forming a thread in the bore of a piece of work to conform to the cross-sectional configuration of the threads of a threaded piece to be threaded thereinto and at the same time to provide a relief for the crests of the threads of such threaded piece; the provision of a tap having formed thereon two axially distinct groups of cutting teeth and one group of which is formed to cut a thread in the bore of a piece of work in substantially exact accordance with the cross-sectional configuration of at least a portion of the depth of the threads of a threaded part which is intended to be screwed thereinto, and the other group of which comprises cutting teeth which do not conform to the cross-sectional configuration of the threads of a threaded piece intended to be screwed into the work but instead are arranged to cut a relief at the root of the threads in the work for the crests of the threads of the threaded part to be received thereby; the provision of a construction as above described in which at least a portion of the cutting faces of one of the groups of cutting teeth on the tap are so constructed and arranged as to cut a thread in a piece of work of approximately the full cross-sectional configuration of that portion of the teeth of a threaded part adapted to be received thereby, and the remaining group of teeth are so constructed and arranged as to remove metal from the piece of work over a lesser width than the teeth of the first group but to a greater depth; and the provision of a tap of the type described in which the teeth of both groups are of generally triangular cross-sectional conformation but the angle between the sides of the cutting edges of one group is greater than the angle between the sides of the cutting edges of the other group and the depth of the teeth of the first group is less than the depth of the teeth of the second group.

The above being among the objects of the present invention, the same consists in certain novel details of construction and combinations of the parts to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which illustrates the suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views.

Fig. 1 is a perspective view of a conventional type of adjustable thread ring gage, in the production of which the present invention is particularly adaptable;

Fig. 2 is an enlarged, fragmentary, sectional view taken diametrically through a thread ring gage and illustrating the preferred form of threads and relief at the roots of the threads provided therein and the manner in which a threaded part to be gaged thereby is intended to fit the same;

Fig. 3 is a partially broken, partially sectioned side elevational view of my improved tap;

Fig. 4 is an end view of the top shown in Fig. 3, looking from the right as viewed in Fig. 3;

Fig. 5 is an enlarged, fragmentary, sectional view, taken diametrically through the tap shown in Fig. 3 and included within the circle 5 illustrated in Fig. 3;

Fig. 6 is a view similar to Fig. 5 but of that portion included within the circle 6 of Fig. 3;

Fig. 7 is a view similar to Fig. 5 but illustrating a piece of work associated therewith and the threads formed in the work thereby; and,

Fig. 8 is a view similar to Fig. 6 but illustrating in section a fragment of a piece of work associated therewith in the manner which occurs by the employment of the tap shown in Fig. 3.

The present invention has been provided primarily for the purpose of forming the threads in thread ring gages and for that reason the following description and explanation will be limited to its application to such thread ring gages, but those skilled in the art will recognize its adaptability to any use where it is desired to provide a relief at the roots of the threads in any threaded bore and its application is, therefore, not limited to the manufacture of thread ring gages only.

In accordance with conventional practices and in accordance with "Screw Thread Standards for Federal Services, 1942" as outlined in "National Bureau of Standards Handbook H-28," the roots of the threads in thread ring gages are formed with a relief for the crests of the teeth of the threaded part which is to be received and gaged or tested thereby. This applies, of course, to threads in which the opposite sides thereof are disposed at an angle to each other and particu-

larly to the so-called 60° V-threads. The relief which is required at the roots of the teeth of a "Go" thread ring gage is of only half the width of that desired at the root of the teeth for the "Not go" thread ring gage, but nevertheless such relief is desired, and is required in the larger sizes of thread ring gages for well understood reasons.

In accordance with conventional methods such relief is produced by a tool in a lathe after the threads have been cut in the gage blank, and while this method is satisfactory in the larger sizes of thread ring gages, the difficulty in applying such methods to small thread ring gages and particularly to those adapted to gage parts of less than one inch in diameter has been so great that the requirements of such relief in such smaller sizes has been waived and threads of full V-character at the roots have been accepted. Even in the larger size of gages it is difficult to centralize the relief with respect to the roots of the threads as will be appreciated by those skilled in the art. Nevertheless, the desirability of such relief at the roots of the teeth of all thread ring gages is still desirable and would still be required in the smaller sizes if capable of being provided without involving too great an expense. The present invention provides a means by which such relief may be provided at the root of the threads in a thread ring gage in an accurately centralized and economical manner regardless of the diameter of the work which is to be gaged thereby and is equally applicable to gages adapted to gage parts less than an inch in diameter as it is to larger gages.

It has heretofore been proposed to provide such relief by forming a tap, the cutting teeth of which, and particularly the finishing teeth of which, are complementary in cross-sectional configuration with the desired cross-sectional configuration of the threads, including relief at the roots thereof, desired in the final gage, but those skilled in the art will appreciate the difficulty of accurately forming such cutting teeth with each side of a tooth including cutting edge portions disposed at an angle with respect to each other, and because of this difficulty such taps have had a very limited use.

The present invention provides a tap by means of which both the threads and the relief between them may be formed in the bore of a gage, but in which the sides of the cutting teeth are in all cases perfectly straight in cross-sectional configuration, thus enabling them to be formed in an accurate, simple and economical manner. This is accomplished by providing a tap with two axially distinct groups of cutting teeth. The cutting teeth of one of these groups may be and preferably are identical to the teeth of a conventional tap except that the finishing teeth thereof could be of full triangular form, that is, without any crest, although this latter feature is not essential in all cases.

The second group of teeth is also straight sided in cross-sectional configuration and are disposed at the same helix cycle and in continuation of the helix of the teeth of the first group of threads so as to insure the relief cut thereby being centralized with the roots of the threads cut by the first group, but the sides thereof in cross-sectional configuration are disposed at a lesser angle with respect to each other than the sides of the teeth of the first group, and the teeth of the second group are longer and project radially to a greater distance than the teeth of the first group. Consequently, these teeth of the second group, when following the teeth of the first group through a bore, remove metal from the bore at the root of the threads formed by the teeth of the first-mentioned group, thereby to provide the desired relief. The relative width and depth of such relief may, of course, be controlled by the width and the length of the teeth of this second group of teeth on the tap.

In constructing a tap in accordance with the present invention the teeth of the first group above described are preferably arranged toward the operative end of the teeth from the teeth of the second group, although it will be recognized that this order may be reversed without affecting the principles of the present invention. Where arranged as preferred, as above described, when a tap is employed upon a piece of work, the first group of teeth in operating upon the work will form threads in the bore thereof substantially complementary in cross-sectional configuration to the cross-sectional configuration of the threads of the part to be gaged thereby, and after such threads have been formed in the work, the second group of teeth will then engage the work and remove material at the root of the threads thereof to form the desired relief.

Referring now to the accompanying drawing, in Fig. 1 is illustrated a conventional form of American Standard adjustable thread ring gage. This comprises a body portion **10** of disc-like conformation having a central bore provided with threads **12** therein, providing surfaces for gaging the threads in a piece of work in a conventional manner. The body **10** is provided with a pair of radial slots **14** extending outwardly from its bore to render the body flexible for adjusting purposes, and a locking slot **16** which extends from the bore through the periphery and between opposite sides of which a suitable adjustable and locking mechanism (not shown) is employed for adjusting the gage to and locking it at the desired diameter.

It is assumed for the purposes of illustration only that the thread gage illustrated in Fig. 1 is a so-called "Not go" thread ring gage and the tap shown in Fig. 3 is constructed for the purpose of forming the threads therein, but it will be understood in this connection, and as will be readily recognized by those skilled in the art, that the same principles of construction are equally applicable to a tap which is adapted to form a "Go" thread ring gage.

Referring to Fig. 2 which illustrates the desired type of engagement between the threads of the thread ring gage shown in Fig. 1 and the piece of work to be gaged thereby, the gage being a "Not go" thread ring gage, the crests of the threads **12** are truncated as at **18** for an amount equal to ⅜ of the pitch of the thread to ensure that the gage will check the pitch diameter only of the part being gaged thereby. For the same reasons, a relief **20** is formed at the root of the threads **12**, and it being considered that this is a "Not go" thread gage, the width of this relief at the point where it intersects the sides of the threads **12** is equal to one-fourth of the pitch of the threads.

As a matter of explanation, it might be explained that where the gage is a "Go" thread ring gage the crests **18** of the threads **12** would be of a width equal to one-fourth of the pitch of the threads and the maximum width of the relief **20** in such case would be one-eighth the

pitch of the threads instead of the figures given and shown for a "Not go" gage.

In accordance with the present invention, the threads 12 with the relief 20 between them are formed by means of a tap, a preferred construction for which is illustrated in Figs. 3 and 4. This tap comprises a main body portion 30, having a squared driving end portion 32 in the particular form shown, and having two groups "A" and "B" of cutting teeth formed externally thereof at the opposite end. The teeth of groups "A" and "B" are, of course, formed in accordance with conventional practice, that is, they are arranged helically around the axis of the body portion 30 and, as illustrated in Fig. 4, are interrupted at intervals around the periphery by longitudinally extending grooves 34 to present circumferentially directed cutting faces providing cutting edges. The pitch of the teeth of both groups "A" and "B" is, of course, the same and the teeth of group "B" are arranged as a continuation of the same helix that the teeth of the group "A" are arranged in.

In Fig. 3, the groups "A" and "B" are shown as axially spaced from one another and while this is preferable from a manufacturing standpoint, it will be recognized that it is not essential to the successful carrying out of the present invention.

The teeth of group "A" may be and are preferably identical to the teeth of a conventional tap of the same diameter and pitch, and in accordance with conventional practice those teeth at the entrance end of the tap are truncated for substantially their full depth and the amount of truncation decreases towards the opposite end of the teeth until the last few rows of teeth present cutting faces fully complementary to the threads of the parts to be gaged thereby, with the possible exception that these teeth are preferably brought to a sharp point, and, accordingly, constitute finishing teeth. In other words, where the tap, as shown, is constructed to form 60° V-threads in a piece of work, then the cross-sectional configuration of the finishing teeth is of full V-like form and with opposite sides disposed at an angle of 60° with respect to each other.

The teeth of group "B" are of greater length, that is, they project radially outwardly from the axis of the main body portion to a greater extent than the teeth of group "A." Their opposite sides are disposed at an angle with respect to each other less than the corresponding angle of the sides of the teeth of group "A." The reduction in angularity between the sides of the teeth of group "B" as compared to those of the teeth of group "A" is more or less unimportant as long as it is material, but where the teeth of group "A" are 60° teeth, the teeth of group "A" are preferably formed with their opposite sides at an angle of approximately 30° with respect to each other.

Thus, in employing the tap illustrated in Figs. 3 and 4 to form the threads 12 in a gage such as shown in Fig. 1, the tap is threaded into the central bore of the main body 10 of the gage and when the finishing teeth of group "A" have engaged such bore, then the threads therein will have assumed the cross-sectional configuration illustrated in Fig. 7, which is that configuration which has heretofore been acceptable for ring thread gages for gaging parts under one inch in diameter. However, in accordance with the present invention, the tap illustrated in Figs. 3 and 4 is continued to be threaded through the work 10 upon which the threads of group "B" thereof will engage the work. These teeth of group "B" being arranged in the same helix as the teeth of group "A" will, therefore, follow in aligned relation to the teeth of group "A" through the work 10 but, being narrower than the teeth A and having their opposite sides disposed at a lesser angle than the teeth of group "A," they will only remove metal from the work 10 radially outwardly beyond the points of intersection of their opposite sides with the opposite sides of the threads 12 formed by the preceding teeth of group "A," in the manner illustrated in Fig. 8. In other words, the teeth of group "B" will have clearance between the sides of the threads 12 of the work formed by the teeth of group "A" except over that width at the root of the threads 12 where the relief 20 is desired, and being longer than the teeth of group "A" will remove metal from the work to form such clearance 20 centrally of the roots of the threads in all cases.

In view of the fact that the teeth of both groups "A" and "B" of the tap illustrated in Fig. 3 are formed with straight sides, each group may be formed in accordance with the conventional practices followed in forming conventional taps, and in forming the tap of the present invention the identical procedure followed in conventional practice in grinding taps is followed in the present case in the grinding of the cutting teeth of each group "A" and "B." Thus, the tap of the present invention may be constructed in an extremely accurate manner and at not a materially greater cost than in constructing a conventional tap of equivalent size and of equivalent construction. However, by its use the relief which is required in ring thread gages may be accurately and economically obtained, regardless of the size of the gage. Therefore, it provides a means which not only permits the desired relief to be obtained in ring thread gages in sizes heretofore substantially impossible from a commercial standpoint, but permits the required relief to be obtained in larger sizes in a more economical and efficient manner.

Having thus described my invention, what I claim by Letters Patent is:

1. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon, the teeth of both groups being arranged in the same helix about the axis of said main body portion, the cutting teeth of both of said groups having straight sides and the angle between the sides of the cutting teeth of one of said groups being materially less than the angle between the sides of the cutting teeth of the other of said groups, and said teeth of said one of said groups being longer than the teeth of the other of said groups and narrower at their bases than the teeth of said other group.

2. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon, the cutting teeth of one of said groups being arranged in a helix about the axis of said main body portion and the cutting teeth of the other of said groups being arranged in a continuation of said helix, the teeth of one of said groups being narrower and longer than the teeth of the other of said groups.

3. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon, the cutting teeth of both of said groups having straight sides arranged in converging relation with respect to each other and the teeth of one of said groups being narrower and projecting radi-

ally to a greater extent from the axis of said main body portion than the teeth of the other of said groups, the teeth of one of said groups being arranged in continuance of the helix of the other of said groups.

4. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon, the teeth of both of said groups being arranged in a common helix about the axis of said main body portion, that group of said teeth nearest the entering end of said tap having a uniform base width and a portion of them being truncated, the teeth of the second group having a base width less than the base width of the teeth of the first-mentioned group, and the height of said teeth of said second group being greater than the height of said teeth of the first group.

5. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon, the cutting teeth of both of said groups being arranged in a common helix about the axis of said main body portion, the teeth of one of said groups all having the same base width and having the opposite sides thereof arranged at an angle of 60 degrees with respect to each other, the teeth of the second of said groups all having the same base width which is less than the base width of the first-mentioned group and the teeth of said second group projecting radially from the axis of said main body portion to a greater distance than the teeth of the first mentioned group.

6. A tap comprising a main body portion and two axially distinct groups of cutting teeth thereon arranged in a common helix about the axis of said main body portion, the teeth of one of said groups having sides arranged at an angle of 60 degrees with respect to each other and presenting cutting edges of a uniform base width, the cutting teeth of the second of said groups having the sides arranged at an angle of approximately 30 degrees with respect to each other presenting cutting edges having a base width less than the base width of the teeth of the first-mentioned group and the teeth of said second group projecting radially of said main body to a greater extent than the teeth of the first-mentioned group.

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