

March 18, 1969

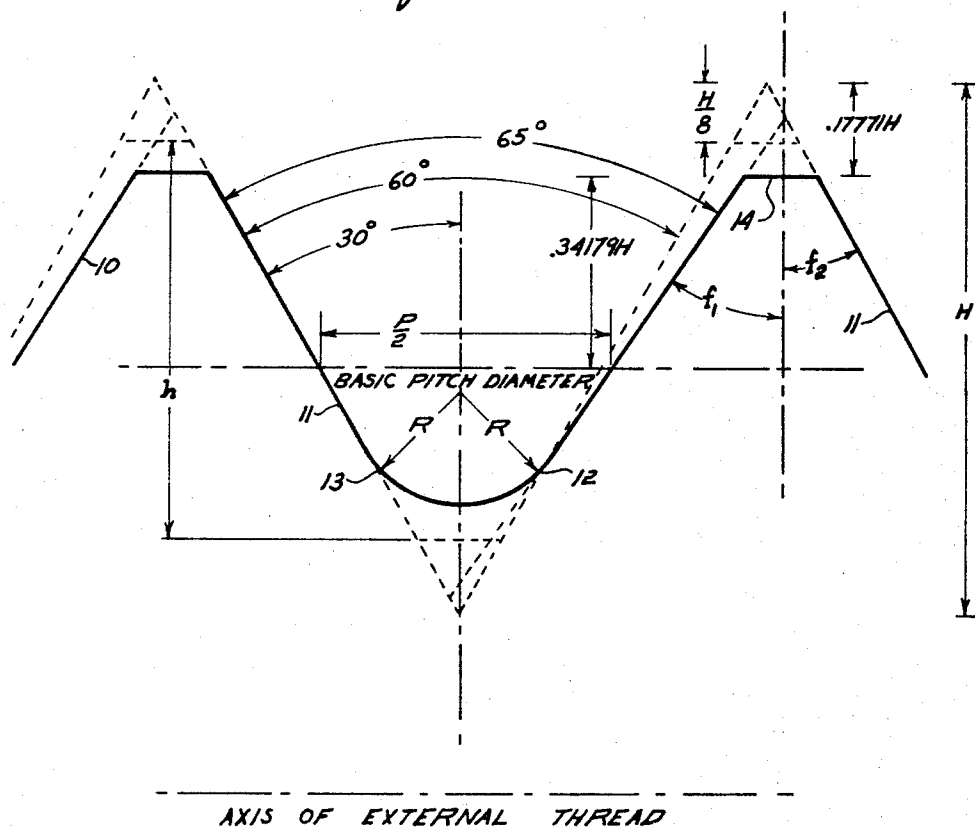
E. F. GOWEN, JR., ETAL

3,433,117

HIGH FATIGUE BOLT THREAD

Filed June 5, 1967

Fig. 1



INVENTOR.
Edmund F. Gowen, Jr.
BY *Raymond Ollie, Jr.*
Richard A. Walton
Symmes, Trevelick & Lechner
ATTORNEYS

1

3,433,117

HIGH FATIGUE BOLT THREAD

Edward F. Gowen, Jr., Churchville, Raymond Ollis, Jr., Oreland, and Richard A. Walker, Warrington, Pa., assignors to Standard Pressed Steel Co., Jenkintown, Pa., a corporation of Pennsylvania

Continuation-in-part of applications Ser. No. 285,980, June 6, 1963, and Ser. No. 494,150, Oct. 8, 1965.

This application June 5, 1967, Ser. No. 643,617

The portion of the term of the patent subsequent to June 6, 1984, has been disclaimed

U.S. Cl. 85—1

4 Claims

Int. Cl. F16b 35/00, 27/00, 29/00

ABSTRACT OF THE DISCLOSURE

A screw thread member wherein the threads are formed by rolling in such a manner that the resulting thread form has an asymmetric thread profile with the pressure flank angle being 32–37° and the non-pressure flank angle being 30°. In addition, the threads have a uniform negative lead correction of 0.001 to 0.007 in./in. of thread.

This invention relates to an externally threaded member that is especially useful in the thread system described in our co-pending application Ser. No. 494,150 filed Oct. 8, 1965, now Patent No. 3,323,402, as a continuation of our then co-pending application Ser. No. 285,980 filed June 6, 1963, now abandoned; and this application is a continuation-in-part of the aforesaid applications.

The thread system specified in the aforesaid applications is one that increases the fatigue life of threaded elements by effecting certain modification as to the form and relative arrangement of the threads of the internal and externally threaded members or elements; viz., the applications are concerned with a screw thread system including an internally threaded member and an externally threaded member whose flanks, crests, and roots are formed by rolling, said system is characterized in that—

(a) The pressure flank of the internal thread from its root and at least to about the vicinity of its pitch line is disengaged from the pressure flank of the external thread and the pressure flank of the internal thread is in contact with the pressure flank of the external thread in the vicinity of the pitch line when the system is loaded.

(b) The internal threads have, when in an unloaded condition, a progressively longer lead than the lead of the unloaded external threads, the lead differential being sufficient to compensate for the shortening of the lead of the internal threads and the elongation of the external threads which occurs on loading of the thread system and thereby provide for a more uniform distribution of stress concentration at the roots of the engaged external threads, and,

(c) Said thread system being further characterized in that the true pitch diameters of the internal and external threads are corrected to cause the virtual pitch diameters to approach the basic pitch diameter and thereby prevent an interference fit when in an unloaded condition.

The present aspect of the invention is concerned with providing externally threaded screw thread members which when used with a conventional internally threaded member, will provide a thread system of the general type contemplated in the aforesaid applications and also provide the benefits achieved thereby.

The externally threaded screw thread elements contemplated by this aspect of the invention are characterized in that the thread has an asymmetric thread profile, the flank angle of the pressure flank being about 32° to 37° (preferably 35°) and the flank angle of the non-pressure flank is

2

about 30°; the threads have a uniform negative lead correction of 0.001 to 0.007 inch per inch of thread; and in that the threads (i.e., the roots, crests and flanks) are formed by rolling but preferably without packing the crests in the rolling operation.

The external thread form and formulae (maximum material condition) of threads of the preferred asymmetric 65° included angle embodiment of this invention is illustrated in FIGURE 1. This embodiment is intended to be used with conventional symmetrical 60° included angle mating internal threads (preferably internal threads meeting military specification MIL-S-8879).

As can be seen in FIGURE 1, the profile of the thread is asymmetric in form, the flank angle f_1 of the pressure flank 10 is 35° and the flank angle f_2 of the non-pressure flank 11 is 30°, thus giving an included angle of 65°. It will be understood however, that the benefits of this invention can be obtained with asymmetric included angle configurations of about 65° ± about 2°; in such arrangements the non-pressure flank should have a more or less conventional flank angle of 30° and the pressure flank shall carry the principal flank angle modification.

The external threads have a uniform negative lead correction of 0.001 to 0.007 inch per inch of thread and in the preferred asymmetric 65° included angle embodiment, the lead correction shall be uniformly minus 0.0025 in./in. ± 0.0010.

In the preferred asymmetric 65° included angle embodiment of the invention, the root of the asymmetric thread is modified from that of a symmetrical 60° included angle thread in that the root is formed by a radius R that blends with the non-pressure flank 11 at a gage interference point 13 of 68% to 75% of the unified basic thread depth h , and the same radius blending with the pressure flank 10 at a gage interference point 12 of 70% to 77% of the unified basic thread depth h . In both cases, the measurements are from the truncated crest 14 of the asymmetric thread; the crest shall be truncated from the sharp crest of the fundamental (60°) triangle an amount equal to $0.1771H$ where H is the depth of the fundamental (60°) triangle. [H and h are dimensions defined in Handbook H-28 (1957), Screw Thread Standard for Federal Services, National Bureau of Standards.]

When the 65° included angle asymmetric, lead corrected external thread is used in combination with a conventional symmetrical 60° mating internal thread, the virtual pitch diameter of the external threads must be corrected so that the virtual pitch diameters of the internal and external threads approach the basic pitch diameter which is located at $0.34179H$ from the truncated crest and therefore the unloaded system will be free of interference fit.

As was pointed out in the parent applications, in the preferred embodiment, the flanks, roots and crests of the external thread are formed by a one step rolling operation. In this connection, machining the correction onto a conventional thread form will induce surface stresses and necessitate a retempering operation to remove the stresses. Further, rolling permits a greater freedom of formation and enables higher strength materials (e.g., up to 260,000 p.s.i.) to be threaded. In rolling the thread, if the rolling conditions are such that the rolling operation fully forms the thread but does not compact or pack the material in the vicinity of the crest still greater enhancement of fatigue life is obtained. If the crest is compacted or coined, the fatigue life of the member will be adversely affected to a very significant degree.

When an externally threaded member as described above (a rolled thread whose form is modified so as to provide the asymmetric 65° ± about 2° included angle and the prescribed negative lead correction) is used in combination with a conventional symmetrical 60° included

3

angle internally threaded member, the fatigue life enhancement of the system will be greater than the fatigue life changes obtained by the combined additive effects of each of the individual thread form modifications and thread rolling applied alone to the externally threaded member.

We claim:

1. A screw thread member having external threads characterized in that—

- (a) the flank angle of the pressure flank is 32–37°;
- (b) the flank angle of the non-pressure flank is 30°;
- (c) the threads have a uniform negative lead correction of 0.001 to 0.007 in./in. of thread and in that
- (d) the threads are formed by rolling.

2. A screw thread member according to claim 1 wherein the threads are formed by rolling but without packing the crests.

3. A screw thread member according to claim 1 characterized in that—

- (1) the flank angle of the pressure flank is 35°;
- (2) the flank angle of the non-pressure flank is 30°, and
- (3) the threads have a uniform negative lead correction of 0.0025 ± 0.001 in./in. of thread.

4

4. An externally threaded member according to claim 3 and further characterized in that the root of the thread is a radius blending with the non-pressure flank at a gage interference point of 68% to 75% of the unified basic thread depth and with the pressure flank at a gage interference point of 70% to 77% the unified basic thread depth.

References Cited

UNITED STATES PATENTS

2,842,180	7/1958	Brown et al.	151—22
3,050,318	8/1962	Van Der Wissel	151—22
3,069,961	12/1962	Baubles	85—1
3,129,963	4/1964	Robbins	85—46
3,323,402	6/1967	Gowen et al.	85—46

FOREIGN PATENTS

194,042	1/1965	Sweden.
---------	--------	---------

20 MARION PARSONS, JR., *Primary Examiner.*

U.S. Cl. X.R.

85—46