NASA CASE NO. MSC-18,742-1

PRINT FIG. 2

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JSC

(NASA-Case-MSC-18742-1) REUSABLE CAPTIVE BLIND FASTENER Patent Application (NASA) 14 p HC A02/MF A01

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Unclas

G3/37 11561

AWARDS ABSTRACT NASA Case No. MSC-18742-1

REUSABLE CAPTIVE BLIND FASTENER

The instant invention is directed to a one-piece reusable fastener capable of joining materials together from one side (blind backside).

The fastener comprises a screw driven pin E ending in a wedge-shaped expander cone 31. Cone 31 cooperates within a slotted collar end 21 comprising a plurality of tangs 22 on cylindrical fastener body D. The fastener is set by inserting it through aligned holes in workpieces B and C to be joined. Turning pin E in one direction draws cone 31 into collar 21 deforming tangs 22 radially outward to mate with back-tapered hold 12 in workpiece C, thus fastening workpieces B and C together. Reversing the direction of pin E withdraws cone 31 from collar 21, allowing tangs 22 to resume their contracted configuration upon withdrawing the fastener from the insertion hole.

The novelty of the invention appears to lie in its particular two element captive configuration and its ability to join materials together from only one side with substantial strength in tension and shear over many reuse attachment cycles, and with no special operations on the main assembly parts other than the tapering of the back end of the insertion hole.

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Employer: Rockwell International

Initial Evaluator: David S. Grissom

Serial No: 293,417

Filing Date: 8-14-81

REUSABLE CAPTIVE BLIND FASTENER

msc-18,742-1

Description

Origin of the Invention

The invention described herein was made in performance of work under a NASA contract and is subject to the provisions of the National Aeronautics and Space Act of 1958, Public Law 568 (72 Stat. 435, U.S.C. 2457).

Technical Field

This invention relates to blind fasteners and consists particularly of a reusable, one-piece fastener which remains united with a removable work piece and which requires no special operations on the main assembly parts other than beveling of the back or remote ends of the insertion holes.

Background of the Invention

There are many examples in the prior art of devices utilizing bolts or rivets with retracting wedges combined with expanding sheaths or the like to provide blind fastenings. However, the prior art does not disclose a unitary or one-piece fastener which is self-retained in a detachable work piece and which can be repeatedly removed with the latter work piece and reinstalled without damaging any of the parts.

Examples of typical, somewhat similar, prior art, blind fasteners are disclosed in the following United States patents:

Jeal et al, No. 3,878,760, discloses a bolt threaded into a headed body and set by utilizing a remote head on the bolt to permanently swage a separate sleeve upwardly about an expansion cone on the body shank and portions of the bolt 18 deformed into slots in the body head.

Leonardo et al, No. 3,922,947, has a separate, segmented collar 18 which is permanently expanded by

upward screwing of bolt 10.

Fischer, No. 3,958,488 discloses gripping sleeve elements 2, 12, and 12a, non-releasably expanded within the work piece.

Wenger, No. 3,812,756, uses a cone on the remote end of a bolt to non-releasably expand an O-ring within the work piece.

Summary of the Invention

An object of the present invention is to provide a reusable blind fastener which may remain captive on the removable work piece only.

Another object is to provide a unitary or one-piece blind fastener which may be secured in operating assembly with minimal modification of the work pieces.

Still another object is to provide a novel blind fastener with improved load carrying capabilities in both shear and tension.

In accordance with the invention, the novel, one-piece, reusable, captive fastener consists of a body with an outer end head and a hollow, internally-threaded, tubular shank. At its remote or distal end, an unthreaded portion of the shank is provided with axially projecting tabs, preferably integral with the main portion of the shank and resiliently carried thereby. The outer surface of the body, intermediately, is provided with an annular lip which is flaired to securely underly a chamfer or recess in the removable work piece so that the fastener remains captive in the latter even when freed from the fixed work piece. An expander pin is internally threaded in and through the body and has a wrenching socket in its outer end and an expander cone at its remote end which may be actuated, upon rotation of the pin, to expand the body tangs against the beveled, remote corner of the wall of the accommodating bore in the fixed work piece to effect secure fastening together of the work pieces. The outer work piece with the fastener unit captive therewith

may be removed by reverse rotation of the pin to cause the expansion cone to withdraw from the body tangs which then relax to permit withdrawal of the fastener unit.

Brief Description of the Drawings

In the accompanying drawings,

Fig. 1 is a longitudinal center section through the novel fastener operatively assembled with work pieces.

Fig. 2 is a similar section showing the body tangs relaxed for insertion and withdrawal of the fastener.

Fig. 3 is a partial longitudinal center section through the inner or remote portion of the body with the expansion tabs relaxed, and

Fig. 4 is an enlarged, partial, cross section taken on the corresponding section line of Fig. 3.

Detail Description of the Drawings

Fig. 1 shows the novel fastener unit, generally designated A, operatively assembled with outer removable and inner fixed work pieces B and C. Work piece B has a bore 10 with a remote corner chamfer 11 and fixed work piece C has a somewhat smaller bore 10a and a larger remote corner chamfer or diverging countersink 12. Both chamfers can be formed by suitable tools inserted through bores 10 and 10a, if necessary.

The fastener unit A comprises a body D with an outer head 13 overlying removable work piece B, and a hollow shank including an outer portion 14 with an internal thread 15, and a reduced skirt portion 16. The shank portion 14 exteriorly terminates in a shoulder 17 between shank portions 14 and 16. The shoulder is partly severed axially, as at 19 (Fig.3), for flairing, as at 17a in Figs. 1 and 2, as will be explained. Portions 16 of the body shank beyond threading 15, is reduced both internally and externally.

The collar-like inner extremity 21 of the body shank is slightly thicker than adjacent part 16 and consists of

a plurality of individual tangs 22 formed from the body material by axial cuts 23 and small radial holes 24 at the ends of the slots. The body, preferably, is formed of metal which is tempered at its lower extremity to provide spring metal quality in the small sections connecting tangs 22 and the adjacent shank part 16 whereby the tangs will be normally resiliently biased to their relaxed positions, as in Figs. 2 and 3. At the upper ends, of tangs 22, portion 21 is provided with internal annular recessing 25 which cooperates with the spring resilience of the tangs in relaxing of the latter when the fastner is to be released. Radial bores 24 provide stress relief in the hinging portion of the tangs.

Broadly, the hinging of tangs 22 is not, necessarily, resilient, but may be merely flexible, and body A may be made of other materials, as plastics. It is contemplated however, that the tangs may be expanded and contracted many times.

Received in body A is the expansion pin E with its outer threaded portion 27 meshing with body threads 15. A wrench socket 28 provides for rotating the pin to propel the same longitudinally within body A.

A reduced portion 29 of the pin is adjacent threaded portion 27 thereof and forms the shoulder 30 therewith. At the extreme inner end of the pin is the expander cone 31.

Operation

In order to install the fastener, work pieces B and C are first bored and bevelled, as at 10, 10a, 11, and 12. Fastener unit A with body D and expander pin E assembled is then installed in outer work piece bore 10 and lip 17a flaired with a suitable tool to snugly grip edge bevel 11 to hold the fastener unit captive. Other means, such as embedding the flair 17a in a differently located recess in bore 10, may be used to secure the fastener in

removable work piece B.

The joined fastener A and movable work piece B are then assembled with fixed work piece C with the work pieces abutting and fastener body D snugly fitting bores 10 and 10a. Pin E will be screwed into body D of the fastener merely far enough to cause the inner extremity of the cone 31 to approach or contact the free extremities of tangs 22 (Fig. 2).

With the tangs resiliently biased, they will converge slightly in the relaxed position, being limited by engagement with reduced pin portion 29 just above cone 31.

In order to secure the assembly, pin E is rotated to cause the cone to enter the tanged collar 21 and expand tangs into firm engagement into undercut 12. To remove outer work piece B and captive fastener A, pin E is rotated in the opposite direction, propelling cone 31 out of collar 21, relaxing the tangs to permit withdrawal of the fastener unit from bore 10a without damaging or otherwise affecting any of the parts, either of the work pieces or the fastener.

The fastener parts will remain threadedly assembled in a one-piece assembly and this assembly will remain captive in removable work piece B until disassembled, as by straightening of flaired lip 17a.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

ABSTRACT OF THE DISCLOSURE

A one-piece blind fastener self-retained in a detachable work piece B and capable of repeated removals from and reinstallations in the fixed work piece C.

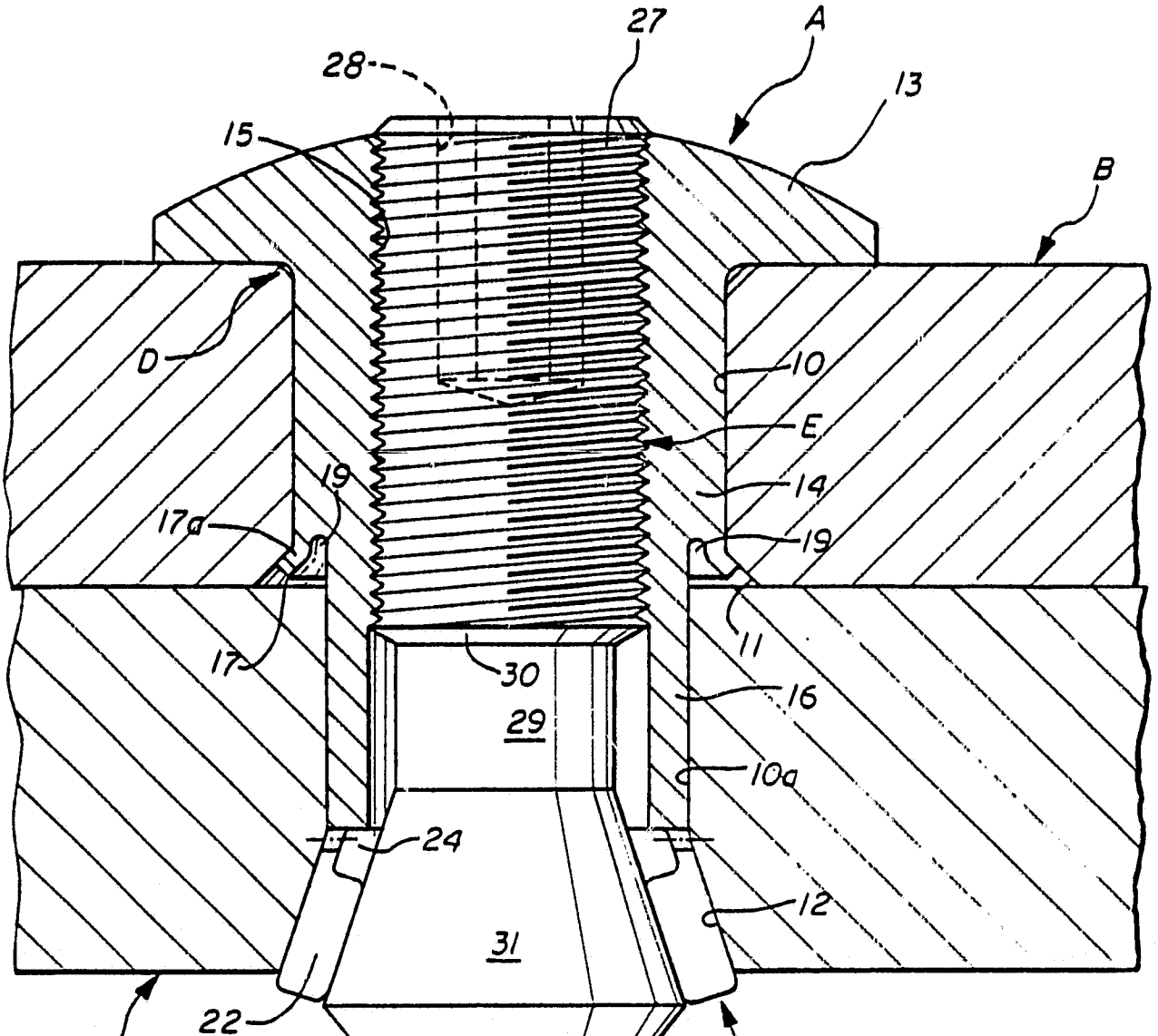
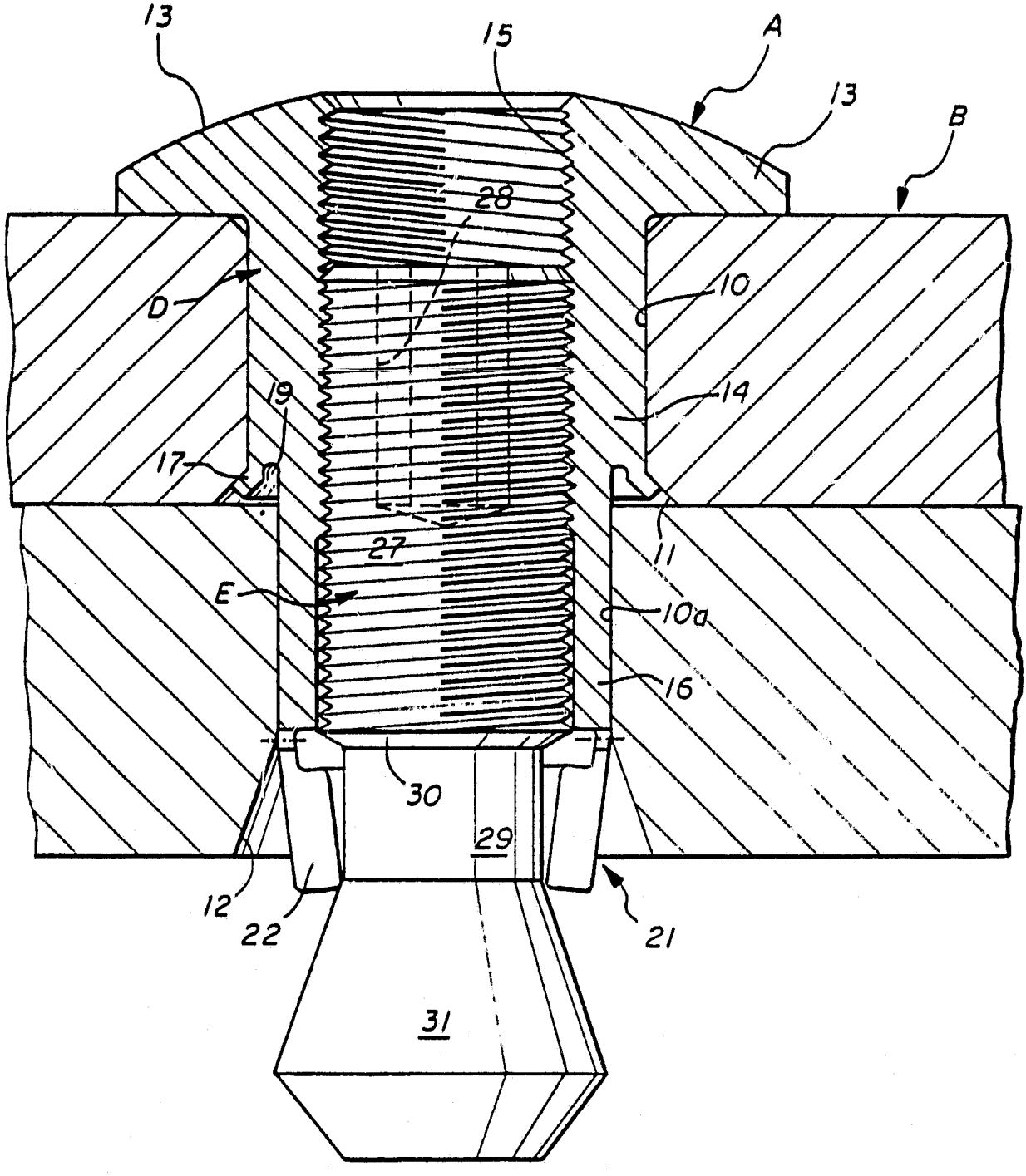


FIG. 1

FIG. 2



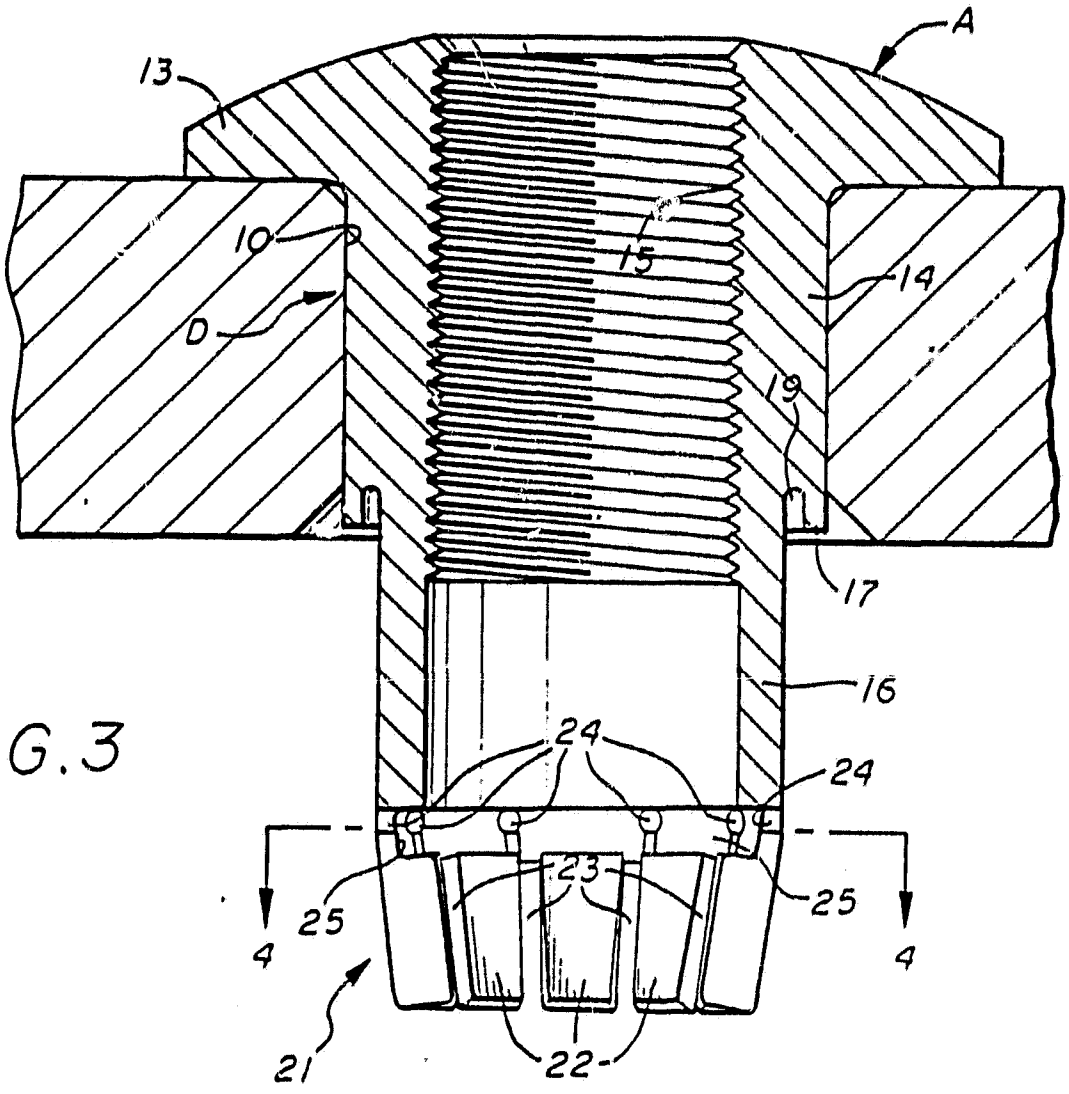


FIG. 3

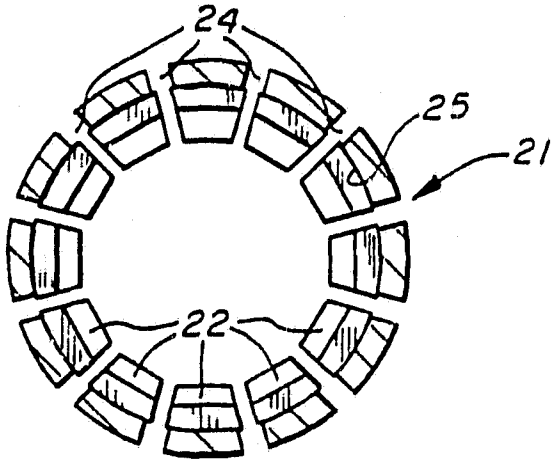


FIG. 4