

Jan. 4, 1966

J. H. DEVINE ETAL
SELF-CONTAINED RATCHET-LIKE FASTENER WITH
CENTERING SLEEVE AND CENTER COMPONENT

3,227,029

Filed Aug. 4, 1961

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Fig. 1

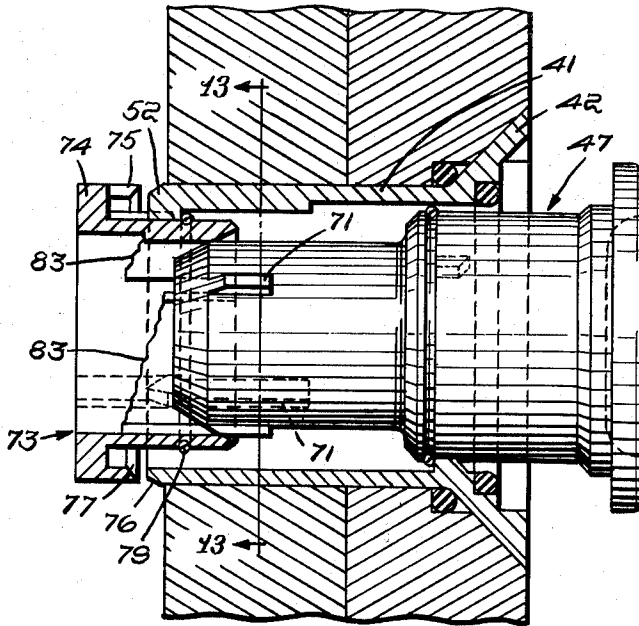
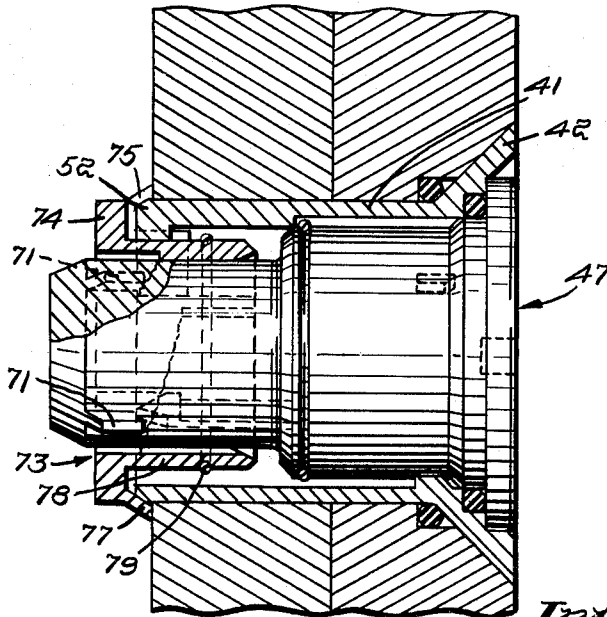


Fig. 2



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Fig. 3

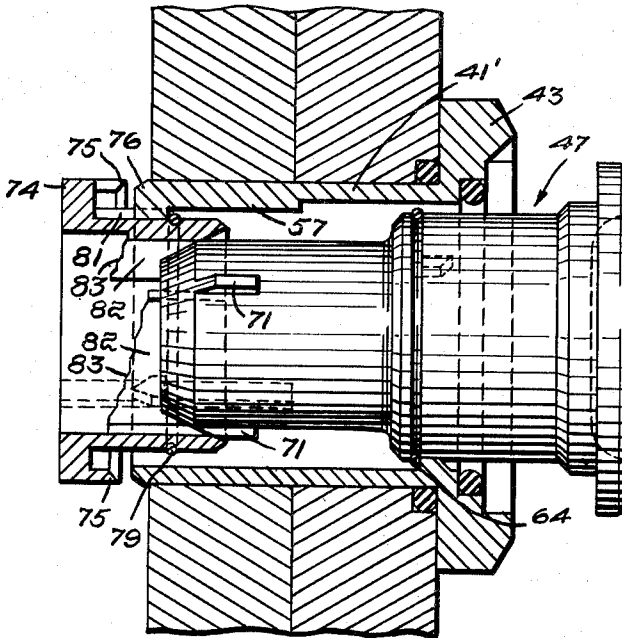
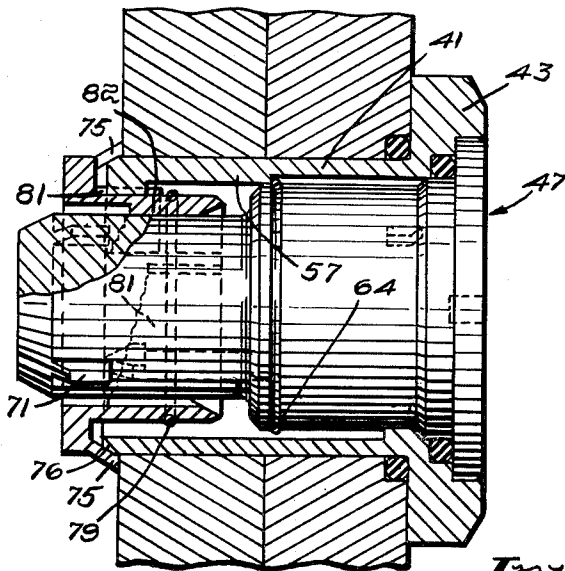


Fig. 4



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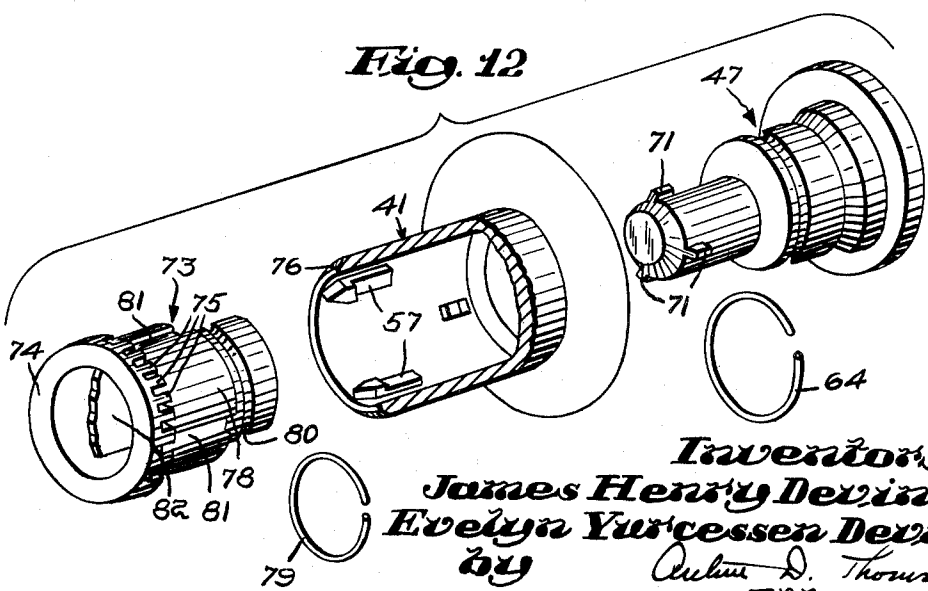
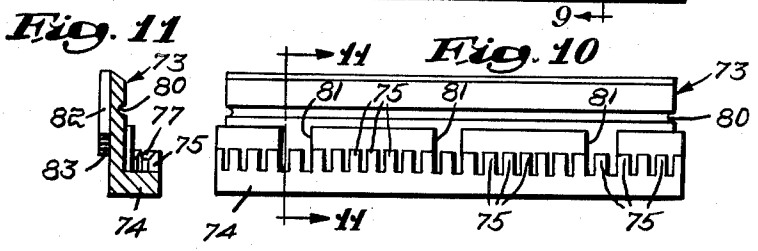
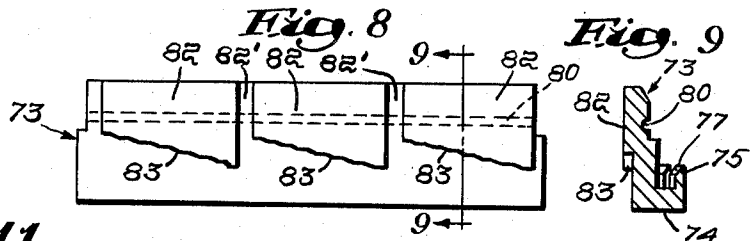
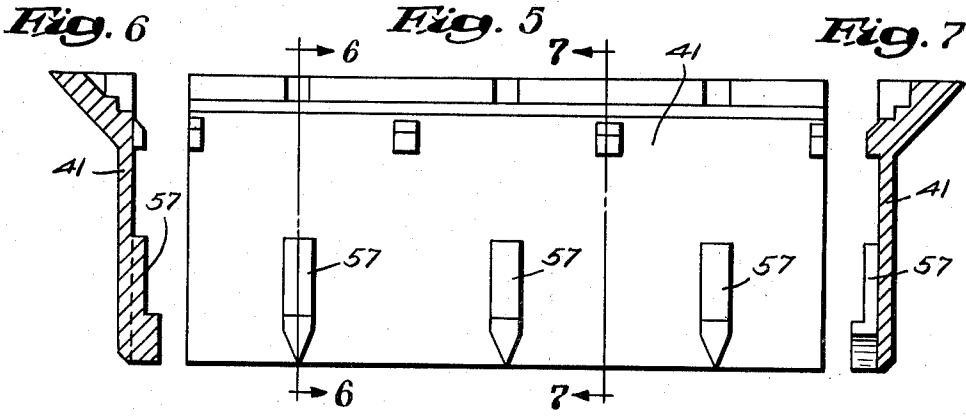
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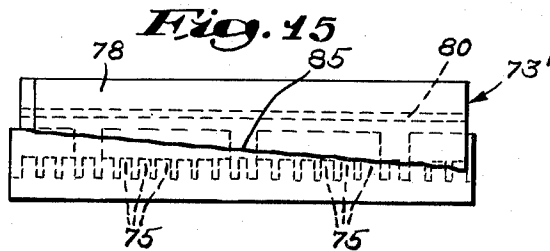
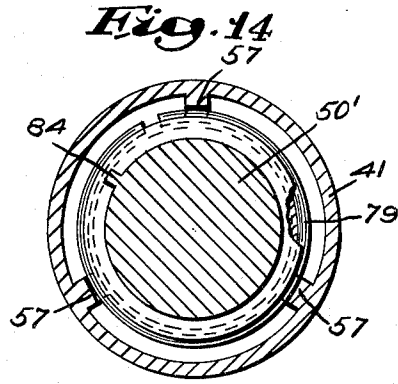
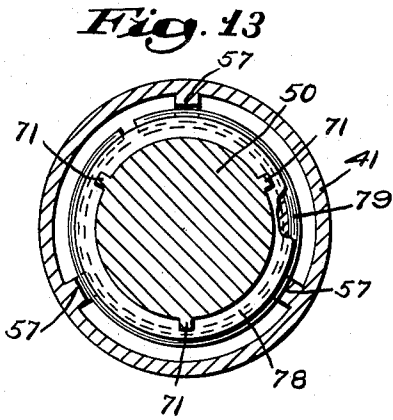
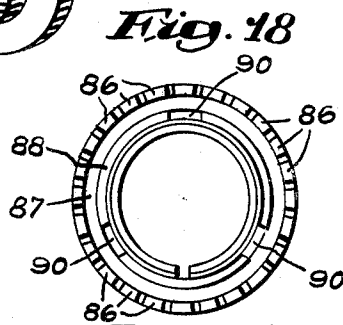
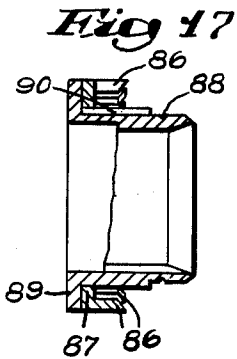
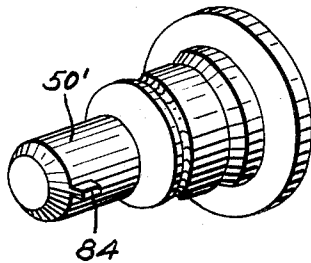


Fig. 16



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Fig. 19

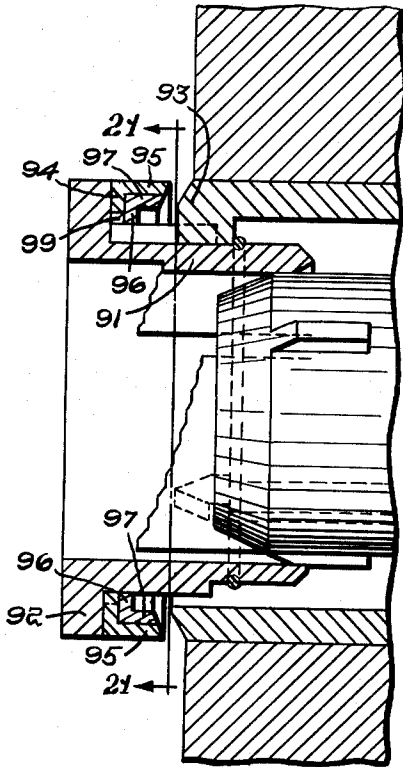


Fig. 20

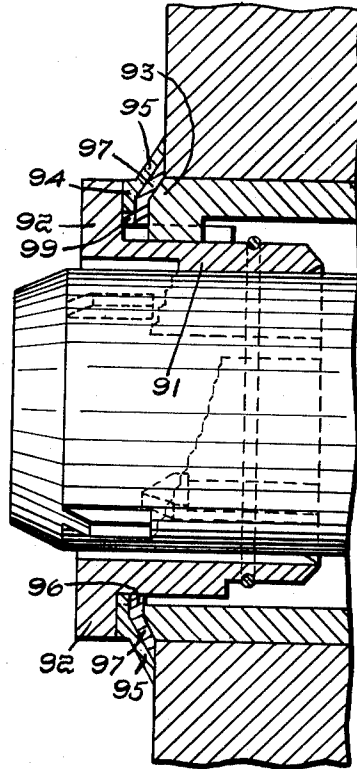


Fig. 21

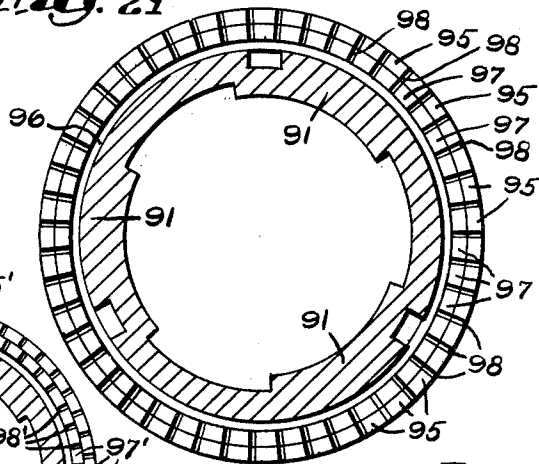
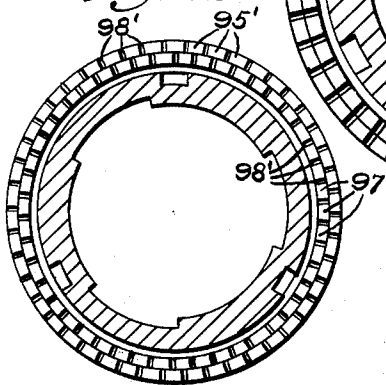


Fig. 22



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SELF-CONTAINED RATCHET-LIKE FASTENER WITH CENTERING SLEEVE AND CENTER COMPONENT

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6 Claims. (Cl. 85-5)

This invention relates to improvements in fasteners for clamping together two or more structural plates or panels, irrespective of the accessibility of the innermost plate or panel, and pertains more particularly to a multi-component fastener in which a nut component has expandable head portions adapted to be secured in expanded, clamping position by a bolt-like center component having tensioning engagement with the nut component for locking the fastener in such clamping position.

The principal purpose of the invention is to provide a fastener of the type described in which both the center component and the nut component are permanently retained within a sleeve component, so that the fastener is an inseparable, self-contained unit.

In our copending application Serial No. 835,580, filed August 24, 1959, now Patent No. 3,096,678, we have disclosed a novel blind bolt designed for the same general purpose and comprising a multi-segment, expandable nut assembly retained within a centering sleeve, and a separate, removable center component adapted to be threaded into interiorly threaded segments of the nut assembly, to tighten and secure the bolt.

In our copending application Ser. No. 129,403 filed concurrently herewith, now Patent No. 3,160,053, we have disclosed in one embodiment, a ratchet-like fastener with a multi-part nut component and centering sleeve, assembled as a unit, and a separate, removable center component; the nut segments having interior, step-ratchet ledges respectively engaged by exterior lugs on the rotatable center component, so that the fastener may be quickly tightened or secured by torquing the center component through an arc of less than 120°.

In accordance with the present invention, the improved fastener preferably has a similar rapid, step-ratchet action for locking and unlocking the clamping elements, but the centering sleeve is provided with interior stop members which cooperate with exterior shoulder elements carried by the nut component and the center component, respectively, to limit the extent of longitudinal movement of said components relative to the sleeve, and thus permanently hold the three components in assembled relation as a self-contained unit. It is contemplated, however, that the center component of the improved unitary fastener may be machine threaded to screw into the nut component, as in said application Serial No. 835,580, now Patent No. 3,096,678, if desired. The unitary fastener may be inserted through concentric openings of the panels to be clamped, and may be removed therefrom and reused, at will, without separation or misplacement of any of its component elements, and without spending the time and effort required in fitting a separate center component into operative relation with the nut component in the centering sleeve.

Hence, when such a unitary fastener operates with a short turn ratchet-like action, as preferred, the time and effort expended in applying and securing prior types of fasteners or blind bolts having one or more removable elements, is materially reduced; the possibility that the removable center component may not easily engage with its complementary nut component is eliminated; and there is no risk that one of the components will become mislaid or lost.

Another objective of this invention is to provide a

fastener of the type described in which the nut component has a one-piece body and a clamping head portion provided with resilient fingers adapted to be expanded to clamping position by engagement with the inner end of the sleeve component, when the nut component is torqued to locking position by rotation of the center component.

A further object is to provide novel means for preventing relative rotation between the sleeve component and the nut component, while permitting limited longitudinal movement therebetween.

Additional features and advantages of this invention will become apparent from the following description of the several embodiments thereof illustrated in the accompanying drawings. It will be understood, however, that the structural details of the fastener components herein shown and described may be varied to suit particular conditions or purposes without departing from the essence of the invention as set forth in the appended claims.

In the drawings:

FIG. 1 is a diametrical section with the center component in elevation, showing an embodiment of the improved unitary fastener inserted in the concentric openings of a pair of plates or channels, in unlocked position; the sleeve component having a flush type head portion;

FIG. 2 is a view similar to FIG. 1, showing the fastener in locked or clamping position;

FIGS. 3 and 4 are views similar to FIGS. 1 and 2, respectively, showing a sleeve component having an optional protruding type head portion;

FIG. 5 is a developed planar view of the interior surface of the sleeve component;

FIGS. 6 and 7 are sections in lines 6-6 and 7-7 of FIG. 5;

FIG. 8 is a developed, planar view of the interior surface of the unitary nut component of FIGS. 1 to 4;

FIG. 9 is a section on line 24-24 of FIG. 8;

FIG. 10 is a developed, planar view of the exterior surface of the nut component of FIG. 8;

FIG. 11 is a section on line 11-11 of FIG. 10;

FIG. 12 is an exploded perspective of the components of the fastener of FIGS. 1 to 11;

FIG. 13 is a section on line 13-13 of FIG. 1, showing a center component having a single locking lug;

FIG. 14 is a view similar to FIG. 13, showing an optional form of center component;

FIG. 15 is a developed, planar view similar to FIG. 8, but showing the interior surface of the modified nut component of FIG. 14;

FIG. 16 is a perspective view of the modified center component of FIG. 14;

FIG. 17 is a sectional view of the modified nut component of FIG. 14;

FIG. 18 is a plan view of the modified nut component shown in FIG. 17, looking to the left thereof.

FIGS. 19 and 20 are fragmentary sections, similar to FIGS. 1 and 2, showing a further modification of the one-piece nut component in which two concentric rings of expanding fingers are provided;

FIG. 21 is a section on line 36-36 of FIG. 19; and

FIG. 11 is a view similar to FIG. 21, showing, to a smaller scale, an optional arrangement of the spring fingers of the two concentric rings or washers.

In the unitary fastener shown in FIGS. 1 to 13, the sleeve component and the center component are the same in structure and function as the corresponding components just described, and the nut component is retained in the sleeve and is torqued to clamping position in a similar fashion. The nut component 73 comprises a one-piece, tubular body portion, and an annular projecting head portion 74 (FIG. 10) provided with a plurality of integral, upstanding resilient fingers 75 which are nor-

mally concentric with the tubular body of the nut component and with the projecting sleeve end 52 (FIG. 1). Thus the spring fingers 75 are expanded on engaging the inner end of sleeve 41 during torquing of the fastener to clamping position (FIG. 2). Said inner sleeve end 52 is preferably beveled at 76 (FIG. 12) so that the spring fingers 75 are flared outwardly during that operation (FIGS. 2 and 4); and the tips of the fingers are also preferably beveled at 77 (FIG. 11), so that they engage flatwise against the surface of the innermost plate or panel 53 in flared clamping position. The beveled surfaces 77 are preferably knurled or serrated to restrain slipping due to vibration or otherwise.

The tubular body 78 of the modified nut component is equipped with a C-ring 79 fitting in a groove 80 (FIG. 12), said ring functioning only as a stop member for the purpose previously explained. The body portion 78 also has longitudinal grooves or channels 81 which provide keyways slidably receiving the keys 57 of the sleeve component, to prevent relative rotation between the sleeve and nut components, as previously explained.

The interior surface of the nut component is provided with circumferentially spaced bosses 82 providing the step-ratchet ledges 83, corresponding in function to the bosses 69 and ratchet ledges 70 of the previous embodiment. The center component 47 is, as aforesaid, the same as before, having the locking lugs 71 which are inserted through the grooves 82' between bosses 82 and which ride on said ratchet ledges 83, when the center component is rotated to tension the fastener in clamping position.

In the optional form shown in FIGS. 14 to 16, the stem portion 50' of the center component has a single locking lug 84, to tension the fastener. It is thus apparent that the one-piece nut component may have one or more ratchet ledges, and that the center component may have a corresponding number of locking lugs. It will be understood that the surface of ratchet ledge 85 (and also the surfaces of the ledges 83) may be knurled or serrated, and that the complementary surface of the locking lugs 84 or 71 may be similarly roughened to increase frictional resistance to loosening of the tensioned components. It will also be understood, as previously mentioned, that said components may have complementary screw-threaded surfaces, rather than the aforesaid ratchet ledges and locking lugs shown on the drawings, if the time and effort required to secure or release the fastener is not an important factor.

In the further modification of FIGS. 17 and 18, the resilient, expandable clamping fingers 86 of the nut component are formed on a separate washer or ring member 87 which fits around the tubular body portion 88 and seats on an annular projecting flange 89 constituting the head portion of the one-piece component. The circumferentially spaced upstanding fingers 86 function in the same manner as the expandable spring fingers 75 of the previous embodiment, and the nut component body 88 has grooves 90 which slidably receive the key members 57 of the sleeve component, as aforesaid.

In the still further modification of the head portion of the nut component, illustrated in FIGS. 19 to 21, two complementary washers or rings are provided and the spring fingers thereon are so arranged that, in clamping position (FIG. 20), they provide a substantially continuous bearing on the surface of the innermost plate or panel.

As in the form of FIG. 17, the one-piece nut component of FIGS. 19 to 21 has a tubular body portion 91 formed with an annular, radially projecting flange 93 constituting the head portion thereof. The tubular body fits within the protruding, beveled end 93 of the sleeve component of the previous embodiments, and is grooved to accommodate the key members of the sleeve as aforesaid.

An outer ring member 94 having closely spaced, up-

standing spring fingers 95 seats on flange 92, with the ring of fingers spaced a substantial distance radially from the concentric body portion 91. A second concentric ring member 96 seats on ring 94 between body 91 and fingers 95, and ring 96 has complementary upstanding spring fingers 97, similarly spaced circumferentially; the fingers of the respective ring or washer members being radially aligned relative to each other and of substantially uniform width, so that the fingers 97 of the inner ring are opposed to the fingers 95 of the outer ring. The spaces between the expandable fingers of each washer or ring are preferably narrow, as indicated by the slits 98 (FIG. 21).

The ring members and upstanding fingers thereon are maintained in that relationship by suitable interlocking means, such as the engagement of one or more detents 99 of the inner ring member 96 within one or more complementary holes or recesses in the outer ring member 94, so that the respective washer members are restrained from relative rotation, although both rings may rotate together with respect to the head flange 92 of the nut component.

In the unstressed condition of the clamping fingers (FIGS. 19 and 21), the complementary rings of spring fingers are in close concentric, opposed relation. When tensioned to clamping position (FIG. 20), both sets of fingers are expanded or flared outwardly by engagement with the beveled sleeve end 93. The ends of all the spring fingers (which may be beveled and knurled as previously explained) thus engage flatwise against the surface of the innermost of the plates or panels which are thus clamped together by the fastener, in a substantially continuous bearing of 360°.

The optional and preferred embodiment illustrated in FIG. 22 provides a double ring of expandable spring fingers, the fingers of the respective rings or washers being offset in staggered relation so that the flared or expanded fingers will provide a complete, uninterrupted bearing against the panel surface, when tensioned to clamping position. Except for the staggered relation of the fingers of the respective rings, the two rings or washers are assembled on the head flange of the nut component and interlocked as in FIGS. 19 to 21.

In FIG. 22, the fingers 95' of the outer ring are uniformly staggered circumferentially with respect to the fingers 97' of the inner ring, so that the fingers of one ring overlap the slits 98' between the fingers of the other ring. Thus, when both sets of spring fingers are expanded, as aforesaid, no gaps will exist in the continuous circular bearing afforded by the tips of the composite rings of clamping fingers.

It will be appreciated that the slits 98 and 98' of the double ring embodiments just described, may taper inwardly to points adjacent the body of each of the washers or rings 94 and 96, which should be made of highly tempered steel. It will also be understood that, when tension on the clamping fingers is released by rotation of the center component, the fingers will spring back to normal position (FIGS. 21 or 22) so that the fastener may be removed as a unit, and reused repeatedly, if desired.

After the center component has been loosened and removed from the nut component, the unstressed expandable head portions of the latter will be contracted (by the spring action of the resilient fingers of FIGS. 1 to 22), so that the fastener can be withdrawn from the openings in the plates or panels which have been clamped together. If necessary a pointed tool may be inserted in one of the sockets 42' of the sleeve head, to pry loose the head of the center component so that it may readily be grasped for removal of the fastener unit.

The optional forms of the one-piece nut component of FIGS. 1 to 22 are especially practicable in fasteners of relatively small sizes, whereas a multi-segment nut component as shown in our Patent No. 3,096,678 is

usually more suitable in larger fasteners subjected to greater stresses and strains.

In each of the several embodiments above described, the nut component and center component are permanently retained in the sleeve component by mutually engageable stop elements forming permanent parts of the bore of the sleeve component and the exterior surface of the nut and center components, respectively, after the three components have been assembled to provide a unitary, self-contained fastener. The stop elements permit limited longitudinal movement of the nut and center components relative to each other and to the sleeve, but, in association with the protruding head portion or flange of the nut component effectively prevent removal of the nut component or the center component from the sleeve component, once they have been assembled as herein described.

The key members of the sleeve component and the keyways of the nut component prevent relative rotation between said components, while permitting relative longitudinal movement therebetween, so that the nut component may be drawn outwardly of the fastener into the sleeve and torqued to clamping position by rotation of the center component within the nut component; said components having cooperative mutually engageable means for screwing and unscrewing said components relative to each other. Said means may be the step ratchet elements herein described, the screw-threaded connection disclosed in our copending application Ser. No. 835,580, now Patent No. 3,096,678, or other suitable and functionally equivalent means.

This arrangement permits the nut component to be of relatively short length; and it will be evident that the nut segment may be of constant length, for any given diametrical size, regardless of the overall length of the fastener. Only the sleeve and center components (which are relatively inexpensive to manufacture) need be varied in length to provide longer or shorter fasteners.

We claim:

1. A self-contained fastener for clamping together structural panels having concentric openings therethrough, irrespective of the accessibility of the opening in the innermost panel, the fastener being insertable as a unit into said openings and comprising a sleeve component adapted to extend into said openings and to seat on the outermost panel; a nut component having a body portion disposed within the inner end portion of the sleeve component, and having a clamping head adapted to engage the innermost panel when the fastener is in clamping position; a center component adapted to engage and seat upon the sleeve component, and having a stem portion rotatably disposed within the nut component; cooperative screw-acting means on said stem portion and said nut component for torquing the nut component to clamping position as a consequence of the rotation of the center component; and cooperative stop means on the sleeve component and on the nut and center components, respectively, for limiting longitudinal movement of the nut and center components in both directions relative to the sleeve component, whereby the three assembled components are held in assembled relation as a self-contained

unit; said nut component comprising a one-piece tubular body portion and an annular flange constituting part of the clamping head of said component, a plurality of resilient clamping fingers carried by said flange and projecting outwardly of the fastener in concentric relation to said tubular body, the sleeve component having an inner end portion engageable by said fingers while the nut component is being torqued to clamping position, whereby the resilient fingers are flared outwardly to engage the innermost of said panels and clamp the panels together.

2. A fastener as described in claim 1, said clamping fingers being integral upstanding elements of said flange, and being closely spaced around the periphery thereof.

3. A fastener as described in claim 1, comprising a ring member seating on said flange, said fingers being integral with said ring member and upstanding therefrom in spaced peripheral relation.

4. A fastener as described in claim 1, comprising a pair of concentric ring members, each having a circular row of closely spaced spring fingers upstanding therefrom, one of said ring members seating on said flange and the other ring member seating on the first named ring member, and means restraining relative rotation between said ring members.

5. A fastener as described in claim 4, the spring fingers of one ring member being opposed to and radially in line with corresponding fingers of the other ring member.

6. A fastener as described in claim 4, the spring fingers of one ring member being circumferentially offset from corresponding spring fingers of the other ring member, so that the fingers of the respective members are disposed in staggered, mutually overlapping relation, to provide a circumferentially continuous bearing on said innermost panel when the clamping fingers of the nut component are torqued and flared to clamping position.

References Cited by the Examiner

UNITED STATES PATENTS

567,115	9/1896	Atkinson et al.	85—3
856,868	6/1907	Heffner	85—5
1,085,571	1/1914	Terney	85—5
1,755,590	4/1930	Carr	151—41.71
2,099,678	11/1937	Curtis	85—40
2,181,657	11/1939	Herst	85—35
2,259,137	10/1941	Iftiger	285—35
2,403,330	7/1946	Benton	85—40
2,404,169	7/1946	Gidden.	
2,516,554	7/1950	Coyne	85—40
2,517,364	8/1950	Torresen	85—5
2,670,513	3/1954	Schlueter	85—5
2,737,222	3/1956	Becker	151—69
2,787,185	4/1957	Rea	85—40
2,919,736	1/1960	Kann	151—69
3,062,253	11/1962	Millheiser	151—69
3,096,678	7/1963	Devine et al.	85—5

FOREIGN PATENTS

13,936 12/1908 Great Britain.

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