Jan. 10, 1961 W. O. TAIT ET AL 2,967,557

CAPTIVE SCREW WITH SLEEVE TO PREVENT ENGAGEMENT OF THE SCREW HEAD WITH THE WORK

Filed Nov. 23, 1956

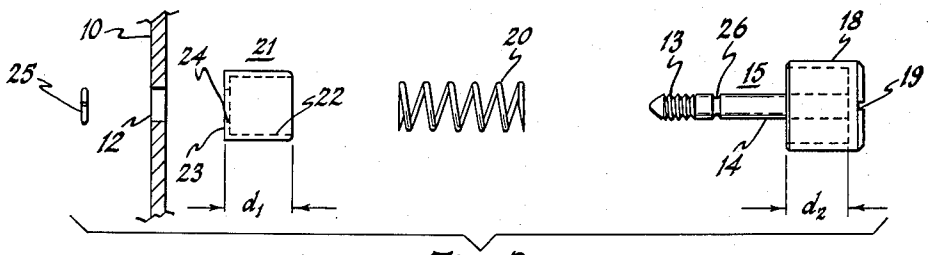


Fig. 2

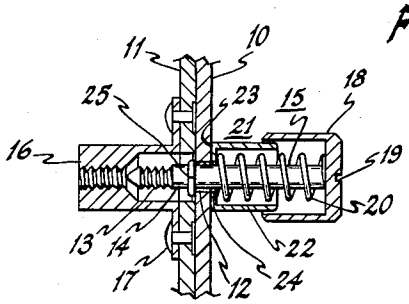


Fig. 1

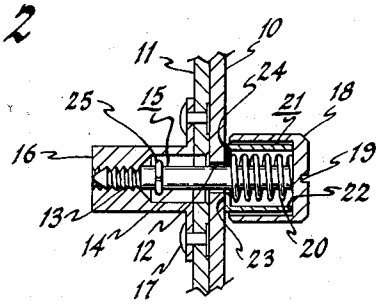


Fig. 3

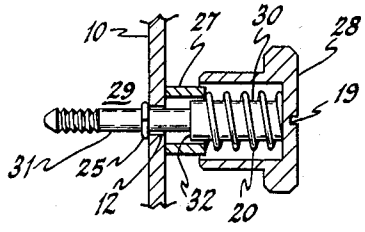


Fig. 4

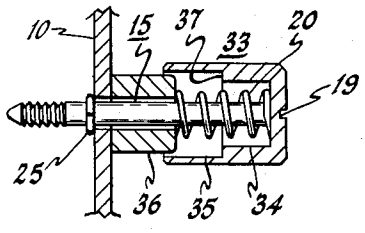


Fig. 5

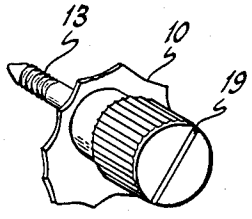


Fig. 6

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United States Patent Office 2,967,557 Patented Jan. 10, 1961

2,967,557

CAPTIVE SCREW WITH SLEEVE TO PREVENT ENGAGEMENT OF THE SCREW HEAD WITH THE WORK

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Filed Nov. 23, 1956, Ser. No. 624,071

4 Claims. (Cl. 151—69)

This invention relates to fastening devices, and more particularly to fasteners of the capitivated type.

Captive fasteners are often used to secure electrical assemblies or units within a housing or supporting frame. These units generally consist of a metal chassis on which electrical and mechanical components are mounted and a front panel attached to one side of the chassis. These assemblies may be installed within the housing or supporting frame by providing guides attached to each side of the chassis which cooperate with guides located within the supporting frame. The assemblies are slid into the supporting frame upon these guides. The fasteners are usually attached to the front panel near each side for engaging with suitable receptacles affixed to the supporting frame. When the front panel is moved into position against the supporting frame, it is important that the fasteners be properly aligned so they will not be damaged by striking the frame or mating receptacles. Fasteners for this application should be easily operated by hand, should not mar the exposed surface of the front panel, and should be readily removable from the panel without damaging either the fastener or the panel.

In one type of prior art fastener the engaging element or stud is maintained perpendicular to the panel by a retaining cup which completely surrounds the stud. This cup, while keeping the stud in the desired position for engagement with the receptacle, prevents operation of the fastener without a screw driver or other tool. The fastener is usuallly secured to the panel by inserting it in an opening in the panel and then flaring over the lower part of the cup. Removal of the stud is prevented by flaring the top of the cup over the head of the stud. Such fasteners cannot be readily removed from the panel and require the use of special tools in their assembly.

Other known captivated fasteners provide an accessible knurled knob to permit rotation by hand. Such fasteners, however, generally permit the rotated element to bear against the panel or other stationary surface when the fastener is engaged, thereby scratching or otherwise marring the exposed panel surface after prolonged use. Furthermore, fasteners of this type are not provided with means for maintaining their alignment normal to the panel surface when they are disengaged from their receptacle. A panel member having a plurality of such fasteners is not readily attached to a cabinet, and considerable difficulty is often encountered in the alignment of all of the fasteners with their receptacles.

In accordance with our invention, a fastener is provided which has its longitudinal axis maintained normal to the panel member by a spring surrounding the stud. The spring is held in compression between a cap attached to the shank of the stud and an annular member, the annular member telescoping inside the cap. The annular member prevents marring of the surface of the panel member by the cap as the fastener is rotated and also helps to maintain alignment of the stud. The fastener is assembled and secured to the panel member by means of a simple retaining ring which may be readily removed

and does not require the use of special tools for installation.

It is a principal object of this invention to provide an improved fastening device which, when disengaged, is positioned with its axis substantially normal to the panel member to which it is secured.

Another object is to provide a fastener that is relatively simple, attractive in appearance, and whose operation does not mar the exposed portion of the panel to which it is attached.

A further object is to provide a fastener which may be moved into exact alignment with its receptacle without damaging either the fastener or receptacle.

Other objects and advantages of the invention will be apparent from the following description, the appended claims, and the drawing of which:

Fig. 1 is a side view partially in section of the fastener assembly disengaged from its receptacle.

Fig. 2 is an exploded side view partially in section of the fastener assembly.

Fig. 3 is a side view partially in section of the fastener assembly engaged with its receptacle.

Fig. 4 is a side view partially in section of a modified form of our fastener.

Fig. 5 is a side view partially in section of another form of the fastener.

Fig. 6 is a perspective view of the fastener attached to a panel member.

Referring to Fig. 1, a panel member **10** is shown ready for securing to the side wall **11** of a box, supporting frame, or other structure. Panel **10** is provided with an aperture **12** through which the threaded portion **13** and shank **14** of stud **15** has been inserted.

A receptacle **16** is fixedly attached to side wall **11** by suitable means such as rivets **17** and is adapted to be releasably engaged with stud **15**. Stud **15** may be threaded, as shown, or may use any other suitable engaging means. A portion of receptacle **16**, having a diameter slightly larger than retaining ring **25**, is left unthreaded so that if the panel **10** and side wall **11** are brought together forceably, the threaded portions of stud **15** and receptacle **16** will not be damaged.

Referring now to the exploded view of Fig. 2, the shank end **14** of stud **15** is secured to the inside center of the closed end of hollow cylindrical cap **18**. The outside surface of cap **18** is preferably knurled to permit easy turning and may be provided with a screw driver slot **19** or other operating means.

A helical spring **20**, having an inner diameter slightly larger than the diameter of stud **15**, is placed over the stud so as to surround shank portion **14**. An annular cup **21** is then placed over and surrounds helical spring **20** with its open end toward cap **18**.

Annular cup **21** comprises a sleeve portion **22** and a disc portion **23** which partially encloses one end of the sleeve. The inner diameter of the sleeve is greater than the outer diameter of helical spring **20** while the outer diameter of the sleeve is slightly less than the inner diameter of cap **18**. The length "d_1" of sleeve **22** is preferably slightly greater than the inside depth "d_2" of cap **18**. The disc **23** of cup **21** has an aperture **24** through which stud **15** may be inserted but which is smaller in diameter than the inner diameter of helical spring **20**.

To assemble the fastener to panel member **10** the threaded portion **13** of stud **15** is projected through aperture **12** of panel **10**, and retaining ring **25** is placed in groove **26** cut in shank **14** of the stud thereby securing the fastener to the panel member.

Spring **20** should be of sufficient length to assure that, when the fastener is in the disengaged position shown in Fig. 1, it will bear against cap **18** so that the cap and attached stud **15** are forced to a position in which the re-

taining ring 25 presses against the surface of panel member 10. Cap 18 and annular cup 21 are so proportioned that when the fastener is in the disengaged position the edge of cap 18 will overlap the open end of the cup, thereby concealing helical spring 20.

In order to join panel 10 to side wall 11 of the supporting frame the panel is brought into alignment with and touching the supporting frame, and the threaded portion of stud 15 is inserted in the unthreaded portion of receptacle 16. Any small mis-alignment that may exist between the fastener and the receptacle may be compensated for by moving the fastener laterally in aperture 12 of panel 10, the aperture being made large enough to permit some lateral displacement of stud 15. Since the fastener is held in substantially the correct position by helical spring 20, it cannot be jammed between the panel and side wall. Moreover, spring 20 permits some angular movement of stud 15 and the stud can be moved into alignment with receptacle 16 without damaging the threads of either the stud or the receptacle. The threaded portion 13 of stud 15 is engaged with the threaded portion of receptacle 16 by pressing cap 18 toward the panel and rotating the cap. When the stud has been fully engaged compressing spring 20, the open end of annular cup 21 bears against the inside surface of cap 18 and the closed end is in contact with the outside surface of panel member 10, as shown in Fig. 3. The edge of cap 18 does not touch the panel and, therefore, the panel is not damaged by rotation of the cap 18 and stud 15.

Fig. 4 shows another embodiment of this invention. In this form the annular cup is replaced by an annular member 27 which surrounds the stud and is positioned between panel member 10 and helical spring 20. The annular member 27 is of sufficient length to assure that the open end of cylindrical cap 28 will overlap it when the stud is fully disengaged from its receptacle. Stud 29 comprises two sections of different diameters. Stud section 30, having the greater diameter, is surrounded by spring 20 and the upper part of annular member 27. The other section 31 of stud 29 passes through aperture 12 in panel 10. Step 32 resulting from the change in diameter of stud 29 is located outside of hollow cap 28 so that when the fastener is fully engaged with its receptacle, step 32 will bear against the surface of panel member 10, thereby preventing contact of the edge of cap 28 with the panel.

Still another embodiment is shown in Fig. 5. In this form the hollow cylindrical cap 33 comprises two portions, the portion 34 adjacent to the closed end having a smaller inner diameter than the other portion 35. When the fastener is engaged, the annular member 36 telescopes within the portion of the hollow cap having the larger inner diameter and rests against step 37 which results from the change in inner diameter of the cap. The length of annular member 36 is made greater than the distance between the open end of portion 35 of cap 33 and step 37 to prevent contact of the edge of the cap with the panel when the fastener is fully engaged.

Fig. 6 is a perspective view of the fastener which is typical of all of the forms presented since the outward appearance of each embodiment is almost identical. The knurled cap is easily rotated by hand and when pressed in toward the panel is prevented from marring the panel surface by one of the means previously described. The annular member or sleeve conceals the spring and stud, thus contributing to the attractive appearance of the fastener while providing a bearing surface against the panel.

The fastener components may be held together before installation in the panel member by the same retaining ring that is used to secure the fastener to the panel after installation. The retaining ring would, of course, be removed prior to insertion of the stud in the panel aperture and then replaced after insertion of the stud. The fastener can also be slightly modified to provide a unit which will remain assembled when the retaining ring is removed. This may be accomplished in the embodiment of Fig. 1 by reducing the entire outer diameter of the sleeve with the exception of a small portion near its open end. After assembly of the helical spring and cup on the stud, the portion of the sleeve having the larger outer diameter is inserted inside the cap and the open end of the cap is peened over toward the stud. Since the inner diameter of the open end of the cap will now be less than the outer diameter of the open end of the sleeve, the cup cannot be removed from the assembly although it may telescoped within the cap.

The fastener is easily manufactured, assembled, and attached to the panel member. Since simple retaining means may be used, flaring or similar operations which would make it difficult if not impossible to remove the fastener from the panel without damage are eliminated. When a number of fasteners are used to attach a panel to a supporting frame no difficulty is encountered in engaging them simultaneously since each of the fasteners is prealigned and may be moved smoothly into its receptacle.

As many changes could be made in the above construction and many different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A fastening device adapted for attaching a panel member to a supporting frame, said supporting frame including receptacle means, comprising in combination, a hollow cap having an open end and a closed end, a stud having one end rigidly attached directly to the inner surface of said hollow cap, the other end of said stud extending outside said hollow cap, said other end having a threaded region for positive engagement with said receptacle means, a cylindrical member surrounding said stud, said cylindrical member having an outer diameter less than the inner diameter of the open end of said hollow cap, said cylindrical member telescoping within said hollow cap and having an end surface situated outside of said hollow cap for abutting against one side of said panel member, helical spring means surrounding said stud, said spring means being partially compressed between the inside of said hollow cap and said cylindrical member by insertion of the other end of said stud through an aperture in said panel member, and retaining means attached to and carried by said stud at a fixed position thereon between said cylindrical member and the threaded region of said stud, said fixed position being spaced from said threaded region and said hollow cap, said retaining means having a portion protruding from said stud for abutting against the other side of said panel member for holding the fastening device to said panel member, said hollow cap having an internal abutment surface for abutting the other end surface of said cylindrical member, the distance from said internal abutment surface to the open end of said cap being less than the axial length of said cylindrical member.

2. The fastening device as defined by claim 1, wherein the inner surface of said hollow cap is cylindrical, said stud being coaxially aligned with said cap, said cylindrical member including a sleeve portion and an inwardly extending annular disc portion at one end of said sleeve portion, said annular disc portion comprising the end surface of said cylindrical member for abutting against one side of said panel member, said helical spring means being situated within said sleeve portion in compression between the inner surface of the closed end of said hollow cap and the inner surface of said annular disc portion, the length of said cylindrical member being longer than the depth of said cylindrical cap for preventing the open end of said hollow cap from engaging the outside surface

of said panel member when said fastening device is engaged.

3. The fastening device as defined by claim 1, wherein the inner surface of said hollow cap is cylindrical and includes first and second portions of different diameters, said first portion being adjacent to the closed end of said cap and having a diameter smaller than the diameter of said second portion, said stud being coaxially aligned with said hollow cap and having one end rigidly attached directly to the inner surface of the closed end of said cap, said cylindrical member telescoping within said second portion of said hollow cylindrical cap and having an outer diameter greater than the inner diameter of said first cylindrical portion of said cap, said helical spring means surrounding said stud and compressed between the inner surface of the closed end of said hollow cap and one end of said cylindrical member, the length of said cylindrical member being longer than the length of said second cylindrical portion of said hollow cap for preventing the open end of said hollow cap from engaging the outside surface of said panel member when said fastening device is engaged.

4. A fastening device comprising a hollow cap having a closed end and an open end, said cap having an inner cylindrical surface of uniform diameter, a stud coaxially disposed relative to said cap, said stud having one end rigidly attached to the closed end of said cap and its other end extending outside of said cap, said other end being threaded, said stud having a circular groove located outside said hollow cap in spaced relationship with the threaded end of said stud, a cylindrical member having a sleeve portion and an inwardly extending annular disc portion, said cylindrical member being coaxially disposed upon said stud between said circular groove and the closed end of said hollow cap, the length of said cylindrical member being slightly longer than the depth of said hollow cap and approximately equal to the spacing between said circular groove and the open end of said hollow cap, said sleeve portion telescoping within said hollow cap in sliding contact with said inner cylindrical surface of said cap, the inner surface of said annular disc portion being in sliding contact with the outer surface of said stud, a helical spring surrounding said stud and situated within said cylindrical member and said hollow cap, said spring being in compression between said annular disc portion and the closed end of said cap, and retaining means attached to and carried by said circular groove in said stud, said retaining means having a portion protruding beyond the outer surface of said stud.

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