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(54) IMPROVEMENTS RELATING TO SECURING METHODS

(71) We, CRABTREE ELECTRICAL INDUSTRIES LIMITED, formerly J.A. Crabtree & Co. Limited, a British Company of Lincoln Works, Walsall WS1 2DN, West Midlands do hereby declare this invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:-

This invention is concerned with improvements relating to securing methods, such as riveting.

In the securing together of two generally planar members (which includes the securing together of two generally planar parts of two members) it is known practice to provide in each of the two members a circular aperture, so arranged that when the two members are brought together in a desired, face-to-face relationship, the apertures are aligned. A securing device such as a rivet may then be inserted through the two apertures, and "set" to secure the two members in said desired relationship.

Alternatively, the two members may be so secured together by the insertion through the apertures of a screw threaded device, such as a nut and bolt combination.

Additionally, it is known to provide one of the members with a projection bounding the aperture thereof, such projection when the two parts are in a desired, face-to-face relationship, extending through and beyond the aperture of the other member, and the two members are secured together by upsetting a terminal portion of the projection, involving outward deformation thereof, against the outer face of the said other member.

Heretofore in the method set out in the last preceding paragraph the aperture and projection bounding said aperture are circular and cylindrical respectively, being provided by a stamping and/or pressing operation. Thus, both in the method set out in the

last preceding paragraph and in the method set out in the last preceding paragraph but one, difficulty is encountered when the two members are in face-to-face relationship in retaining them in the desired relationship whilst the members are actually being secured together: although the retention of the members in a position in which the apertures are in alignment is relatively easy, difficulty is particularly encountered in retaining the two members in for example a specific angular orientation.

According to this invention there is provided a method of securing together two generally planar members, in which each member is provided with an aperture and at least one projection disposed adjacent to a first part only of the periphery of the aperture and standing proud of one side face of the said member, the projection of each member being so arranged that when the two members are placed in a predetermined relationship with their said side faces abutting, the projection of one member extends into the aperture of the other member adjacent to a second part only of the periphery of said aperture, and the projection of said other member extends into the aperture of said one member adjacent to a second part only of the periphery of the aperture of said one member, preventing relative face-to-face movement of said two members from said predetermined relationship, subsequent to which the two members are secured together. Thus, the projections may co-operate with sides of the apertures to prevent relative face-to-face movement between said two members.

If desired, each member may be provided with a second projection disposed adjacent to a third part only of the periphery of the said aperture and standing proud of said one side face of the said member, said further projections being arranged such that when the two members are placed in said prede-

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terminated relationship, the further projections of said one member extends into the aperture of the other member adjacent to a fourth part only of the periphery of said aperture, and the further projection of said other member extends into the aperture of said one member adjacent to a fourth part only of the periphery of the aperture of said one member.

If desired, the apertures may be generally rectangular, the projections being in the form of walls extending at least part way along some of the sides of the rectangles.

Each wall may stand proud of the surface to an extent sufficient such that the two members when in predetermined relationship may be secured together by "upsetting" internal portions of the walls by effecting an outward deformation thereof, to restrain orthogonal separative movement between the two members. However, if desired the walls may each extend into but not beyond the aperture, a fastening device extending through the two apertures to restrain the two members against relative orthogonal movement.

This invention also provides an assembly comprising two planar members secured together in face-to-face relationship, each member being provided with a through-extending aperture and a projection disposed adjacent to a part only of the periphery of the aperture, each projection extending through part of the aperture of the other member, and the two projections being effective to restrain relative face-to-face movement of the two members.

There will now be given detailed descriptions, to be read with reference to the accompanying drawings of three methods of securing together two generally planar members which are preferred embodiments of this invention, the assemblies of members then so secured together also being illustrative of certain aspects of this invention.

In the accompanying drawings:-

Figures 1 to 6 show stages in the method of securing together two generally planar members which is the first embodiment of this invention:

Figures 7 to 12 shows stages in the method of securing together two generally planar members which is the second embodiment of this invention:

Figure 13 is a view, corresponding to Figures 6 and 12 of an assembly comprising two planar members secured together by the method which is the third embodiment of this invention; and

Figure 14 is a plan view showing a modification of the methods shown in Figures 1 to 13.

In the mutually perpendicular co-ordinate system shown in respect of Figures 3 and 4, the X and Z co-ordinates are parallel to the

plane of the members, and the Y co-ordinate is at right angles to said plane.

In the method which is the first embodiment of this invention, the two generally planar members 6,8 which are to be secured together in a desired face-to-face relationship are each provided, by stamping and pressing operation, with generally circular apertures 10,12 respectively, together with a projection 14,16 respectively of semi-annular form disposed adjacent to a first part (i.e. half) the periphery and of the aperture. It will of course be appreciated that the apertures 10 and 12 are not strictly circular, being formed by semi-circles having radii which differ by the thickness of the projections, radial abutment surfaces thereby being provided at the dividing line.

The two projections 14,16 are so arranged on the members 6,8 that when the two members are brought together in face-to-face relationship in a desired orientation, the projection 14 enters the peripheral part of the aperture 12 not bounded by the projection 16, and the projection 16 enters the peripheral part of the aperture 10 not bounded by the projection 14.

Thus, the projection 14 co-operates with part of a side face of the apertures 12 of the member 8, and the projection 16 of the member 8 co-operates with part of a side face of the aperture 10 of the member 6, to prevent relative face-to-face movement between the two members, in particular in directions along the Z-Z axis, and in one direction along the X-X axis, relative face-to-face movement in the other direction extending along the X-X axis being prevented by co-operative engagement between the end faces of the two projections, with the radial abutment surfaces of the apertures. Such co-operative engagement also prevents face-to-face movement between the two members in the form of relative rotational movement about the Y-Y axis (see Figures 3).

The two projections 14,16 each stands proud of the inner faces 7,9 of the two members an extent such that when the two members are in said desired face-to-face relationship, a terminal part 14' of the projection 14 projects beyond the outer face of the member 8, and a terminal part 16' of the projection 16 projects beyond the outer face of the member 6 (see Figure 3). Relative linear separative movement of the two members in the direction Y-Y is prevented by upsetting the terminal parts 14', 16' of the two projections in a generally outward direction against the outer faces of the two members 6,8 (see Figures 5 and 6).

In the first embodiment, each of the planar members 6,8 is provided with one projection only, each projection being semi-annular. However, in the method which is

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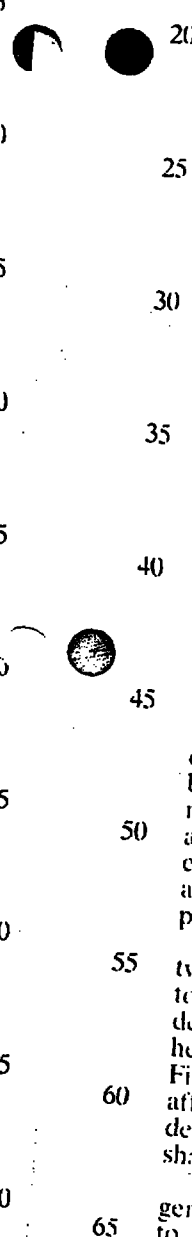
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the second embodiment of this invention (in which like numerals, but with the suffix *a* have been used to identify like parts) the member 6 is provided with two projections 14a, 14a, each of which being in the form of a part of an annular switch subtends an angle of 90°, as is the member 8a. The two projections on each member bound diametrically opposite parts of their associated aperture, and when the two members are brought together in the desired face-to-face relationship, the four projections interlap with one another.

The advantage of the second embodiment is that, when terminal parts of the four projections are deformed outwardly to secure the two parts in the desired face-to-face relationship against relative orthogonal movement in the direction Y-Y, a more uniform distribution of securing forces around the two co-axial apertures 10a, 12a, is provided.

In the third embodiment, in which like numerals with the suffix *b* have been used to identify like parts, the two projections 14b, 16b do not stand proud of the surface 7a, 9a of their associated member to an extent sufficient such that the two members when in said desired relationship, terminal parts of said projections extend beyond the outer face of the two members. Thus, a terminal part 14b, of the projection 14b, extend generally flush with the outer face of the member 8b, and a terminal part 16b, of the projection 16b, extends generally flush with the outer face of the member 6b.

In the third embodiment, a securing device in the form of a rivet 20 is inserted through the aligned parts of the apertures 10b, 12b, which are not occupied respectfully by the projections 16b, 14b, a head 22 of the rivet seating against the outer face of the member 6b, and a shank 24 of the rivet being set against the outer face of the member 8b. In this manner the two members are secured together against relative orthogonal movement in the direction Y-Y by the rivet 20, and against relative movement in other directions both by the frictional engagement caused by the clamping force exerted on the two members by the rivet, and by abutment of the end faces of the two projections.

It will however be appreciated that the two members may similarly be clamped together by the use of a screw threaded device, such as a nut and bolt. Although as hereinbefore described and illustrated in Figures 1 to 13, the planar members are afforded with generally circular apertures, if desired the apertures may be of other shapes.

Thus, as illustrated in Figure 14, two generally planar members 6c, 8c which are to be secured together in a desired face to

face relationship with each other are provided, by stamping and pressing operations, with generally rectangular apertures 10c, 12c respectively, together with projections 14c, 16c respectively disposed adjacent to two sides of the rectangular apertures 10c, 12c.

WHAT WE CLAIM IS:-

1. A method of securing together two generally planar members, in which each member is provided with an aperture and at least one projection disposed adjacent to a first part only of the periphery of the aperture and standing proud of one side face of said member, the projection of each member being so arranged that when the two members are placed in a predetermined relationship with their said side faces abutting, the projection of one member extends into the aperture of the other member, adjacent to a second part only of the periphery of said aperture, and the projection of said other member extends into the aperture of said one member adjacent to a second part only of the periphery of the aperture of said one member, preventing relative face-to-face movement of said two members from said predetermined relationship, subsequent to which the two members are secured together.

2. A method according to claim 1 wherein the projections co-operate with sides of the apertures to prevent relative face-to-face movement between said two members.

3. A method according to claim 2 wherein the projections also co-operate with radial abutment surfaces of the apertures, to prevent relative face-to-face movement between said two members.

4. A method according to any one of the preceding claims wherein the apertures are generally circular, and the abutments are in the form of walls of part-annular plan view.

5. A method according to any one of the preceding claims wherein each member is provided with a further projection disposed adjacent to a third part only of the periphery of the aperture, said further projections being arranged such that when the two members are placed in said predetermined relationship, the projection of one member extends into the aperture of the other member adjacent to a fourth part only of the periphery of said aperture, and the projection of said other member extends into the aperture of said one member adjacent to a fourth part only of the periphery of the aperture of said one member.

6. A method according to any one of claims 1, 2 and 3 wherein the apertures are generally rectangular, and the projections are in the form of walls extending at least part way along some of the sides of the rectangles.



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the second embodiment of this invention (in which like numerals, but with the suffix *a* have been used to identify like parts) the member 6 is provided with two projections 14a, 14a, each of which being in the form of a part of an annular switch subtends an angle of 90°, as is the member 8a. The two projections on each member bound diametrically opposite parts of their associated aperture, and when the two members are brought together in the desired face-to-face relationship, the four projections interlap with one another.

The advantage of the second embodiment is that, when terminal parts of the four projections are deformed outwardly to secure the two parts in the desired face-to-face relationship against relative orthogonal movement in the direction Y-Y, a more uniform distribution of securing forces around the two co-axial apertures 10a, 12a, is provided.

In the third embodiment, in which like numerals with the suffix *b* have been used to identify like parts, the two projections 14b, 16b do not stand proud of the surface 7a, 9a of their associated member to an extent sufficient such that the two members when in said desired relationship, terminal parts of said projections extend beyond the outer face of the two members. Thus, a terminal part 14b, of the projection 14b, extend generally flush with the outer face of the member 8b, and a terminal part 16b, of the projection 16b, extends generally flush with the outer face of the member 6b.

In the third embodiment, a securing device in the form of a rivet 20 is inserted through the aligned parts of the apertures 10b, 12b, which are not occupied respectfully by the projections 16b, 14b, a head 22 of the rivet seating against the outer face of the member 6b, and a shank 24 of the rivet being set against the outer face of the member 8b. In this manner the two members are secured together against relative orthogonal movement in the direction Y-Y by the rivet 20, and against relative movement in other directions both by the frictional engagement caused by the clamping force exerted on the two members by the rivet, and by abutment of the end faces of the two projections.

It will however be appreciated that the two members may similarly be clamped together by the use of a screw threaded device, such as a nut and bolt. Although as hereinbefore described and illustrated in Figures 1 to 13, the planar members are afforded with generally circular apertures, if desired the apertures may be of other shapes.

Thus, as illustrated in Figure 14, two generally planar members 6c, 8c which are to be secured together in a desired face to

face relationship with each other are provided, by stamping and pressing operations, with generally rectangular apertures 10c, 12c respectively, together with projections 14c, 16c respectively disposed adjacent to two sides of the rectangular apertures 10c, 12c.

WHAT WE CLAIM IS:-

1. A method of securing together two generally planar members, in which each member is provided with an aperture and at least one projection disposed adjacent to a first part only of the periphery of the aperture and standing proud of one side face of said member, the projection of each member being so arranged that when the two members are placed in a predetermined relationship with their said side faces abutting, the projection of one member extends into the aperture of the other member, adjacent to a second part only of the periphery of said aperture, and the projection of said other member extends into the aperture of said one member adjacent to a second part only of the periphery of the aperture of said one member, preventing relative face-to-face movement of said two members from said predetermined relationship, subsequent to which the two members are secured together.

2. A method according to claim 1 wherein the projections co-operate with sides of the apertures to prevent relative face-to-face movement between said two members.

3. A method according to claim 2 wherein the projections also co-operate with radial abutment surfaces of the apertures, to prevent relative face-to-face movement between said two members.

4. A method according to any one of the preceding claims wherein the apertures are generally circular, and the abutments are in the form of walls of part-annular plan view.

5. A method according to any one of the preceding claims wherein each member is provided with a further projection disposed adjacent to a third part only of the periphery of the aperture, said further projections being arranged such that when the two members are placed in said predetermined relationship, the projection of one member extends into the aperture of the other member adjacent to a fourth part only of the periphery of said aperture, and the projection of said other member extends into the aperture of said one member adjacent to a fourth part only of the periphery of the aperture of said one member.

6. A method according to any one of claims 1, 2 and 3 wherein the apertures are generally rectangular, and the projections are in the form of walls extending at least part way along some of the sides of the rectangles.



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7. A method according to any one of the preceding claims wherein each projection is in the form of a shallow wall which stands proud of the surface of the member on which it is provided.
8. A method according to claim 7 wherein each such wall stands proud of the surface an extent sufficient such that the two members when in said predetermined relationship may be secured together by upsetting terminal portions of the walls by effecting an outward deformation thereof, to restrain orthognal separative movement between the two members.
9. A method according to claim 7 wherein when the two members are brought into said predetermined face-to-face relationship, each projection extends into but not beyond the aperture of the other member, portions of each of the two apertures not occupied by the projection of the other member are in alignment, and the two members are secured together against orthognal separative movement by a separate fastening device inserted through the said apertures.
10. An assembly comprising two planar members secured together in face-to-face relationship, each member being provided with a through-extending aperture and a projection disposed adjacent to a part only of the periphery of the aperture, each projection extending through part of the aperture of the other member, and the two projections being effective to restrain relative face-to-face movement of the two members.
11. An assembly according to claim 10 wherein each projection is in the form of a shallow wall.
12. An assembly according to claim 11 wherein each projection extends through and beyond the aperture of the other member, and a terminal portion of each projection is outwardly deformed whereby relative orthognal movement between the two members is restrained.
13. An assembly according to claim 11 wherein each projection extends into but not beyond the aperture of the other member, a fastening device extending through the two apertures to restrain the two members against relative orthognal movement.
14. An assembly according to any one of claims 10 to 13 wherein one of the two members is provided with two or more projections in the form of shallow walls, said shallow walls when the two members are moved into their desired face-to-face relationship interlapping with one another.
15. An assembly according to any one of claims 10 to 14 wherein the two apertures are generally circular, and the projections are in the form of walls of part-annular plan view.
16. An assembly according to any one of claims 10 to 14 wherein the two apertures are generally rectangular, and the projections are in the form of walls extending at least part way along some of the sides of rectangles.
17. A method of securing together two generally planar members, when carried out substantially as hereinbefore described and with reference, (a) to figures 1 to 6: (b) to figures 7 to 12: or (c) figures 13 of the accompanying drawings.
18. An assembly comprising two planar members, constructed and arranged substantially as hereinbefore described with reference (a) to figures 1 to 6; (b) to figures 7 to 12; or (c) figures 13 of the accompanying drawings.

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