

FRAMEWORK ASSEMBLY SYSTEM

The present invention relates to a system of components for assembling frameworks, and is particularly concerned with such a system for the assembly of switchgear cubicle frameworks.

Framework systems of this type generally comprise horizontal and vertical structural members, corner joints, and normally, intermediate bracing members or side panels. The components are themselves provided with slots, apertures etc to facilitate construction using bolts and the like. It is a disadvantage of existing framework systems that they utilise a relatively large number of different components, which are often of complex shape and require expensive and complex tooling for their manufacture. It is often also the case that the structural members of existing systems have specially formed ends for mating with corner pieces, so that their lengths cannot be varied on-site to suit required dimensions, and frameworks have to be dimensioned in accordance with standard component ranges.

Many systems also require additional bracing or side panelling in order to achieve the required rigidity, which increases the complexity of the structure and hence its cost and the time required for assembly. A variety of differently sized nuts, bolts etc are also often required, further complicating the assembly of the framework, and some systems require special assembly tools.

It is an object of the present invention to provide a framework system which requires a minimum number of different components, so as to reduce manufacturing costs and to facilitate assembly.

It is a further object of the invention to provide a system wherein the components may be fabricated easily using conventional machinery or processes.

It is still a further object of the invention to provide a system wherein the lengths of the structural components may be easily varied.

It is still a further object of the invention to provide a system wherein both vertical and horizontal structural components share a common sectional configuration.

5 It is still further object of the invention to provide a system wherein the use of intermediate bracing or the like is not required for assembled frameworks in normal use.

10 It is still further object of the invention to provide a system which can be assembled using a single size of bolt, rivet or the like throughout.

Finally, it is a further object of the invention to provide a system wherein all bolt-heads or other projecting parts used in assembling the framework are  
15 located such that adjacent frameworks may abut one another without interference from such projecting parts.

Accordingly, the invention provides an elongate member for use as a structural component in a framework assembly system, comprising, in cross-section, a partial  
20 box-section portion having first and second side walls of a first width dimension, connected together along one edge at right angles to one another, and third and fourth side walls of a second width dimension which is less than said first width dimension each connected along one edge  
25 to an edge of one of said first and second side walls opposite said connected edges thereof and extending towards one another at right angles, and first and second elongate flange portions of a third width dimension, each connected along one edge to an edge of one of said third

and fourth side walls opposite the edges thereof connected to said first and second side walls and extending outwardly at right angles therefrom, said first and second flanges each being provided with a plurality of apertures spaced along the length thereof and said flange portions each terminating at a first predetermined distance inwardly from both longitudinal ends of said partial box-section portion.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figs. 1 and 2 are first and second side views of a vertical structural component of a framework system embodying the invention;

Figs. 3 and 4 are first and second side views of a horizontal structural member embodying the invention;

Fig. 5 is an end view of either of the components of Figs. 1 to 4, both of which are identical in cross-section;

Figs. 6, 7 and 8 are, respectively, plan, first and second side views of a corner joint component for use with the components of Figs. 1 to 5;

Fig. 9 is an isometric view of the component of Figs. 6 to 8;

Fig. 10 is a plan view of a sheet metal pressing from which the component of Figs. 6 to 9 is formed.

Fig.11 is an isometric view of a typical framework assembled from the components of Figs. 1 to 10;

Fig. 12 is an isometric detail view of one corner of the framework of Fig. 11;

5 Fig. 13 is a detail top view of one corner of the framework of Fig. 11; and

Fig. 14 is a detail top view of one corner of a typical framework, also showing nuts and bolts which secure the components together.

10 Referring now to Figs. 1 to 5 of the drawings, a vertical structural component 10 and a horizontal structural component 12 of a framework assembly system both have identical cross section as shown in Fig. 5. Each of the components 10 and 12 includes a partial box-section comprising first and second side walls 14 and 16,  
15 of identical width, extending towards each other at right angles from the outer ends of the first and second walls 14 and 16 respectively. The walls 14 to 20 can thus be regarded as a square box-section with one corner removed.

20 The components 10 and 12 each further include first and second elongate flanges 22 and 24, projecting outwardly at right angles from the free ends of the shorter side walls 18 and 20 respectively, and extending along substantially the whole length of each component 10  
25 and 12, but terminating a predetermined distance from either longitudinal end thereof. Each of the flanges 22 and 24 is provided with a series of circular apertures 26 spaced along their lengths, the apertures 26 all being of identical diameter, spaced from one another by equal  
30 distances, and all being spaced by equal distances from the respective shorter side walls 18 and 20.

In the present example, the first and second side walls 14 and 16 are 25 mm wide, the third and fourth side walls 18 and 20 are 10 mm wide, the flanges 22 and 24 are  
35 25 mm wide, and the centres of the apertures are spaced from one another by 40mm and from the shorter side walls 10 and 20 by 15mm. The apertures 26 are 6.1 mm in diameter and the

components themselves are formed from 14 SWG sheet metal (suitably zinc coated steel). These specific dimensions are given by way of example only and to facilitate the detailed description of the present embodiment, and should not be regarded as placing any limitation on the scope of the appended claims.

The vertical and horizontal components 10 and 12 differ only with regard to the distances from their longitudinal ends at which the flanges 22 and 24 terminate and at which the centres of the first and last apertures 26A and 26B of each flange 22 and 24 are located. In the vertical component 10 the flanges 22 and 24 terminate 26.3 mm from its ends (ie fractionally more than the width of the first and second side walls 14 and 16), whilst the corresponding distance on the horizontal component 12 is 24.2 mm (ie fractionally less than the width of the first and second flanges 22 and 24). In the vertical component 10 the centres of the first and last apertures 26A and 26B are located 40 mm from the component ends, (ie equal to the spacing of the apertures 26) the corresponding distance on the horizontal component 12 being 53.7 mm (ie somewhat greater than the aperture spacing). The reasons for these differences will become apparent from the description of an assembled framework which follows below.

Figs. 6 to 10 illustrate a universal corner joint 30 for use with the components 10 and 12, comprising three substantially identical faces 32, 34 and 36 arranged mutually at right angles to one another to form a corner, and provided with circular apertures 38 which in use are aligned with the apertures 26 of the components 10 and 12 for assembly using bolts, rivets or the like. The faces 32, 34 and 36 each comprise a right-angled, L-shaped, planar member, having its internal right-angle partially filled by a triangular web portion 40. The corner joint is easily formed from a sheet metal pressing 42, as shown in Fig. 10, simply by folding along the dotted lines 44 and 46. It is not necessary to weld or otherwise join the free, mating edges 48 and 50 of the pressing 42.

In this example, the limbs of each L-shaped surface 32, 34 and 36 are each 40 mm wide by 120 mm long, with the outer edge of the web portion 40 extending between points 40.16 mm inwardly from the outer ends of each limb. Each surface 32, 34 and 36 has a first aperture, 38A, 38B and 38C respectively, located in the corner thereof, with its centre spaced 29.84 mm from each adjacent outer edge. A further two apertures 38 are provided in each limb, located on lines extending through the centres of the apertures 38A, 38B and 38C parallel to the outer edges of the limbs, and centred at 40 mm intervals from the corner apertures (corresponding to the spacing of the apertures 26 of the components 10 and 12).

The apertures 38, 38B and 38C are all of 6.1 mm diameter (equal to the diameters of apertures 26), however aperture 38A is larger, being 13 mm in diameter. In use, face 32 will be the horizontal face of a corner (ie the top face in a top corner and the bottom face in a bottom corner), and the larger aperture 38A accommodates a larger bolt for attaching a lifting hook or eye (not shown) to a top corner or for attaching a bottom corner to a plinth or a wheel (not shown). It will also be seen that the unwelded edge between faces 34 and 36 constitutes the vertical edge of the corner joint 30 in use.

Figs. 11 to 14 illustrate the use of the components 10 and 12 and the corner joint 30 in assembling a typical framework 52 which, as shown in Fig. 11, comprises four vertical components 10, eight horizontal components 12, and eight corner joints 30. The components 10 and 12 are fastened to the corner joints 30 by means of nuts and bolts 54 and 56 (omitted from Figs. 11, 12 and 13 for the sake of clarity), or other suitable means such as rivets or the like, extending through the aligned apertures 26 and 38. Since all of the apertures used for assembly are of the same size, only a single size of bolt is required. As is best seen in Figs. 12 and 14, the exterior faces 32, 34 and 36 of the corner joint 30 seat against the interior faces of the flanges 22 and 24 of components 10 and 12.

Figs. 12 and 13 also show the manner in which the ends of components 10 and 12 co-operate at the corners of the framework. The distances by which the flanges 22 and 24 are recessed from the ends of the components 10 and 12, as previously discussed in relation to Figs. 1 to 4, allow the flanges of the vertical component to extend down to the end of the partial box-section of the horizontal component, and the flanges of the horizontal component to extend along to the outer edges of the vertical flanges, whilst small clearances D1, D2 and D3 are maintained between the components. The dimensions previously discussed, together with the location of the end apertures 26A, are such that a constant 40 mm spacing between the apertures 26 is maintained around each corner of the framework 52. This configuration also allows the vertical components 10 to make use of the corner apertures 38B and 38C of the corner components 30, providing three fixing points at each end of the vertical components 10 as compared with two for the horizontal components. This constant spacing of the assembly apertures is important in minimising the number of different components, since it allows the same corner joints 30 to be used for all corners in any framework. It is also of importance in allowing the structural members to be cut on-site to any required lengths (which may be accomplished using simple hand tools), and in the application of the system to switchgear cubicles since it allows switchgear equipment, busbars, wiring supports, covers and other ancillary equipment to be mounted in a wide variety of positions using the remaining apertures 26.

The configuration of the structural components 10 and 12 and the corner joint 30 also provides a very high level of structural rigidity without the need for intermediate bracing, thereby reducing the weight of the framework. The present example, which is particularly intended for switchgear applications, allows frameworks up to 3 metres high by 2 metres wide by 2 metres deep to be assembled without additional bracing, although 2 metres by 1 metre by 1 metre might be a more typical size in its intended field of application. The self-aligning nature of the corner

joints 30 and components 10 and 12 also enables the framework to be assembled without the need for temporary jigs or the like.

A further important and useful feature of the system is illustrated in Fig. 14, wherein it can be seen that the angles formed between the flanges 22 and 24 and the side walls 18 and 20 of components 10 and 12 create rebates which accommodate the heads of the bolts 54, thereby allowing separate frameworks to abut one another without the boltheads clashing or otherwise causing interference.

If required, panelling can be attached to the flanges, and can easily be sealed to the planar faces thereof using suitable gaskets or the like. The rebates described above also allow such panels to be recessed from or flush with the outer surfaces of the side walls 18 and 20 of the partial box-section. Panels could equally be attached and sealed to the planar outer surfaces of the side walls 18 and 20, and suitable apertures (not shown) may be formed therein, either during manufacture or on-site, for this purpose. These planar surfaces, together with the recessing of the heads of the bolts 54, also allow effective seals to be established between adjacent, abutting frameworks, which may also be attached to one another using suitable bolts and spacing members to connect together the flange portions of the respective frameworks.

As can be seen from the foregoing description, the present invention provides a framework assembly system utilising horizontal and vertical members having a common cross-section and whose length may easily be varied on-site, and a single type of corner connector, all of which are easily fabricated from sheet metal; which exhibits a high degree of inherent structural rigidity; and which is easily assembled using a single size of bolt.

Claims

1. An elongate member for use as a structural component in a framework assembly system, comprising, in cross-section, a partial box-section portion having first and second side walls of a first width dimension, connected together along one edge at right angles to one another, and third and fourth side walls of a second width dimension which is less than said first width dimension each connected along one edge to an edge of one of said first and second side walls opposite said connected edges thereof and extending towards one another at right angles, and first and second elongate flange portions of a third width dimension, each connected along one edge to an edge of one of said third and fourth side walls opposite the edges thereof connected to said first and second side walls and extending outwardly at right angles therefrom, said first and second flanges each being provided with a plurality of apertures spaced along the length thereof and said flange portions each terminating at a first predetermined distance inwardly from both longitudinal ends of said partial box-section portion.

2. A member as claimed in claim 1, wherein the apertures of each flange portion are spaced at equal distances from one another along the length of said flange portions.

3. A member as claimed in claim 1 or claim 2, wherein the apertures of each flange portion are located on a line extending along the length of each flange portion parallel to the longitudinal edges thereof.



4. A member as claimed in claim 1, claim 2 or claim 3, wherein the apertures of each flange portion are all of substantially equal size.

5. A member as claimed in any preceding claim wherein said width dimension is substantially equal to said first width dimension.

6. A member as claimed in any preceding claim, wherein said second width dimension is less than half of said first width dimension.

10 7. A member as claimed in any preceding claim, wherein said first predetermined distance is fractionally greater than said first width dimension.

8. A member as claimed in claim 7, wherein said apertures are spaced at equal intervals along lines parallel to the longitudinal edges of said partial box-section portion by a second distance substantially equal to the spacing of the apertures.

9. A member as claimed in any one of claims 1 to 6, wherein said first predetermined distance is fractionally less than said third width dimension.

10. A member as claimed in claim 9, wherein said apertures are spaced at equal intervals along lines parallel to the longitudinal edges of said flange portions, and wherein the first and last apertures of each flange portion are spaced from the adjacent longitudinal end of said partial box-section portion by a third distance greater than the spacing of the apertures and related to said first predetermined distance and the



location of the apertures relative to the longitudinal edges of the flange portions.

11. A member as claimed in any preceding claim, formed from folded sheet metal strip.

5 12. A member as claimed in any preceding claim in combination with a corner joint component comprising first, second and third substantially identical faces disposed mutually at right angles to one another so as to define a right-angled corner, each face being provided  
10 with a plurality of apertures located such that certain of said apertures are aligned with certain of the apertures of the flange portions of said members when the outer faces of said corner component are seated against the inner faces of the flange portions of three such  
15 members disposed mutually at right angles to one another.

13. A combination as claimed in claim 12, wherein each of said faces comprises a right-angled L-shaped planar member having its internal right angle at least partially filled by a triangular web portion.

20 14. A combination as claimed in claim 13, wherein each face is provided with a first aperture adjacent the corner thereof and spaced equidistantly from either outer edge of the L-shaped member.

15 15. A combination as claimed in claim 14, wherein each face is provided with further apertures spaced along the limbs of each L-shaped member, the spacing thereof corresponding to the spacing of the apertures of the elongate structural members.



16. A combination as claimed in claim 15, wherein two further apertures are provided on each limb of each L-shaped member.

17. A combination as claimed in any of claims 14, 15 or 5 16 wherein, in use, said first face comprises the horizontal face of the corner, and wherein the corner aperture thereof is larger than the other apertures of the component.

18. A combination as claimed in any of claims 12 to 17, 10 wherein the corner joint component is formed by folding a sheet metal pressing.

19. A framework assembly system comprising a plurality of combinations as claimed in any one of claims 12 to 18 inclusive.

15 20. A system as claimed in claim 19, wherein a plurality of elongate members as defined in claims 7 and 8 are utilised as vertical structural members and a plurality of elongate members as defined in claims 9 and 10 are utilised as vertical structural members and a plurality 20 of elongate members as defined in claims 9 and 10 are utilised as horizontal structural components in combination with a plurality of corner joint components as defined in claims 14 to 17.

21. A system as claimed in claim 19 or 20, wherein the 25 right-angles formed between the third and fourth side walls and the first and second flange portions of each structural member define rebates of sufficient depth to accommodate a projecting part of a fixing member, such as a bolt, extending through the apertures formed therein.



22. An elongate structural member substantially as hereinbefore described with reference to Figs. 1, 2 and 5 of the accompanying drawings.

23. An elongate structural member substantially as  
5 hereinbefore described with reference to Figs. 3, 4 and 5 of the accompanying drawings.

24. An elongate structural member as claimed in any one of claims 1 to 11 in combination with a corner joint component substantially as hereinbefore described with  
10 reference to Figs. 6 to 10 of the accompanying drawings.

25. A framework system substantially as hereinbefore described with reference to the accompanying drawings.

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