

PATENT SPECIFICATION

964,469

DRAWINGS ATTACHED.

Inventor:—ARTHUR JOHN CAMPBELL.



Date of Application and filing Complete Specification :
March 31, 1962. No. 12470/62.

Complete Specification Published : July 22, 1964.

© Crown Copyright 1964.

Index at Acceptance:—E1 K3A.

International Classification:—E 04 b.

COMPLETE SPECIFICATION.

Improvements in Constructional Elements.

We, TERLAN RESEARCH ESTABLISHMENT, a Company established in Liechtenstein, of Präsidial Anstalt, 26, Hauptstrasse, Vaduz/Liechtenstein, do hereby declare the 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 relates to constructional elements in the form of strips of bars of metal or other material having spaced-apart holes therein through which bolts can be passed to clamp the elements in any one of a plurality of positions relative to another constructional element.

Constructional elements of this type have been proposed in which the holes are circular and of a diameter matching the bolt to be received therein, or in the shape of elongated slots whose width matches the diameter of the bolt, or again wherein the holes comprise a mixture of circular holes and elongated slots.

Such constructional elements can be used for the erection of building frames, racks, scaffolding, all of which structures involve joining two such elements at right angles to one another. When such right angled joints are formed by passing two or more bolts through coincident circular holes in two elements, a rigid joint can be formed. However, with such circular holes, the choice of positions in which coincident holes occur is relatively small unless the holes in one or both elements are so close to each other that the constructional element is weakened. In order to increase the number of positions in which holes can be brought into coincidence, slots are commonly used alone or in conjunction with holes, but joints formed with such elements lack the rigidity provided by the use of circular holes alone.

There is thus need for a constructional element permitting a rigid joint to be formed, yet having a high strength and a large selection of bolting positions.

According to the present invention, a constructional element is provided comprising an elongated flat strip of material having a plurality of holes spaced apart along its length, each for the reception of a bolt, each hole having three straight side portions which lie along the sides of a notional isosceles triangle, each pair of adjacent ends of said straight side portions being interconnected by a segment of a circle, and wherein the holes are spaced apart in at least two parallel straight lines with the apices of the triangular holes pointing in a direction perpendicular to said lines, each hole in each line being equidistant from the two next adjacent holes in the next adjacent line with its apex pointing in a direction opposite to that of the apices of said two next adjacent holes, the spacing between the holes being such that imperforate strips of material remain therebetween, said strips being arranged in two sets, the strips of one set being parallel to, and equally spaced from, one another and extending at an acute angle to the length of the element in one direction, the strips in the other set being parallel to, and equally spaced from, one another and extending at the same acute angle to the length of the element in the opposite direction.

Hereinafter the corner of the hole contained between the two equal sides will be referred to as the apex, and the side of the hole opposite the apex will be referred to as the base.

According to a feature of the invention, the notional triangle is right-angled, so that the strips of imperforate material lie at an

angle of 45° to the length of the element.

One embodiment of constructional element according to the invention will now be particularly described, by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 illustrates the pattern and shape of the holes formed in the constructional element; and

Fig. 2 shows three right angle sectioned elements bolted together at right angles to one another to form the corner joint of a structure.

As shown in Fig. 1, each hole, such as 10, is circumscribed by a notional right angled isosceles triangle XYZ and the hole therefore has straight side portions S1, S2 and S3 lying along the sides YZ, ZX, XY of the triangle. The adjacent ends of these side portions are interconnected by circular segments C1, C2 and C3.

The segment C1 lies along a circle to which the base side portion S1 of the hole is tangential and therefore the diameter of this circle, less tolerance, defines the maximum diameter of bolt which can be passed through the hole. Such a bolt will be referred to hereinafter as a major bolt.

The circular segments C2 and C3 are segments of circles of equal diameter, and this diameter, less tolerance, is the diameter of the bolt which will fit closely into these base corners of the hole. Such a bolt will be hereinafter referred to as a minor bolt.

As will be seen from both Figs. 1 and 2, such holes are located in rows along the length of the element, the holes in each row being equally spaced apart and located with their bases lying along a common line. Where two or more such longitudinal rows are provided, the apices i.e. segment C1 of the holes in each row point laterally of the element in a direction opposite to that in which the apices of the holes in the, or each, next adjacent row point. Furthermore each hole in any one row is equally spaced from the two next adjacent holes of the next adjacent row. Again, the distance between any one hole in one row and the next adjacent hole in the adjacent row is equal to the diameter of the major bolt.

This being so, it will be seen clearly from Fig. 1 that when two longitudinal rows of such holes are provided on an element, these holes define between them two sets of imperforate strips, the strips in one set being parallel to one another and lying at 45° degrees to the length of the element in one sense, and the strips in the other set being parallel to one another and lying at 45° to the length of the strip considered in the opposite sense. Clearly therefore the strips in one set are normal to the strips in the other set and form a lattice work. The lattice work of imperforate strips imparts

very high strength to the element for resisting shear loads such as those arising at a right angled joint.

A lattice work of imperforate strips would still be formed if the triangular holes were replaced by circular holes such as holes defined by the circle of which C1 is a segment. Clearly however, the material of the strip defined between this circle and the segment C3, and again between this circle and the segment C2, would contribute little if anything to the strength of the element. By removing this material and so enlarging such a circular hole to the shape shown in Figs. 1 and 2, a hole is provided which enables a large number of alternative bolting positions to be provided. These various bolting positions are shown in Fig. 2.

Before passing on to consider Fig. 2, it will be noted from Fig. 1 that a pair of longitudinal rows of holes in which the apices of the holes of each row point towards a line joining the bases of the holes of the other row are necessary to provide the lattice work of imperforate strips here shown. Accordingly such a pair of rows constitute the basic pattern of holes in an element. However a single row may be used for certain purposes by itself or in conjunction with one or more pairs of rows. For example the constructional elements are conveniently formed from angle section material, in particular L section, and whilst a single row of holes may be used in one of the flanges of the element, one or more pairs of rows alone or in conjunction with a single row may be used in the other flange of the element.

Considering now Fig. 2, this shows a first L section element 11 having a first flange 11a containing two pairs of rows of holes, and a second element 13 having a first flange 13a containing one pair of rows and a single row of holes, the flanges 11a and 13a extending at right angles to one another and lying flat against each other. The corner joint is completed by a third L section element 15 having one flange 15b in abutment with the second flange 11b of the element 11 and its other flange 15a in abutment with the second flange 13b of the element 13. The abutment of the flanges 11a and 13a which lie in the plane of the drawing will however suffice to illustrate the principle embodied in the invention.

As will be seen from Fig. 2, the flanges 11a and 13a are in an overlapping position providing coincident holes for the reception of two major bolts and four minor bolts, although of course only two of such bolts are necessary for effecting a stable joint. By moving one of these flanges longitudinally or laterally, or both longitudinally and laterally with respect to the other, the extent to which these holes coincide can be changed to provide a multiplicity of different positions of

coincidence between the holes for receiving either major or minor bolts, and in a very large number of these positions two bolts can be inserted which will lock the flanges rigidly, that is to say the rigidity of the joint is dependent only on the position of the holes and not on the frictional engagements between the flanges which in turn would depend on the tightness of the bolts.

Although a specific number of patterns of holes have been shown in the flanges of Fig. 2, it will be evident that this number of patterns can be varied as mentioned above and the number of available bolting positions will vary accordingly.

Although this pattern of holes, whose principles have been described above, is applicable to many types of constructional element formed in metal, synthetic resin plastics or other material, it is primarily intended for use in unannealed cold rolled steel strip.

The holes are formed by punching the strip whilst flat and the strip is thereafter bent to L section. The bending will take place along a line equally spaced from two adjacent rows of holes, and for this purpose these two rows of holes are so spaced apart as to allow for a bending margin whose width is equal to the thickness of the strip.

In particular, the major bolts referred to above are of $\frac{3}{8}$ " diameter whilst the minor bolts are of $\frac{1}{4}$ " diameter, and the imperforate strips between the holes will therefore be $\frac{3}{8}$ " in width. Clearly however other suitable dimensions may be used.

WHAT WE CLAIM IS:—

1. A constructional element comprising an elongated flat strip of material having a plurality of holes spaced apart along its length, each for the reception of a bolt, each hole having three straight side portions which lie along the sides of a notional isosceles triangle, each pair of adjacent ends of said straight side portions being interconnected by a segment of a circle, and wherein the holes are spaced apart in at least two parallel straight lines with the apices of the triangular holes pointing in a direction perpendicular to said lines, each hole in each

line being equidistant from the two next adjacent holes in the next adjacent line with its apex pointing in a direction opposite to that of the apices of said two next adjacent holes, the spacing between the holes being such that imperforate strips of material remain therebetween, said strips being arranged in two sets, the strips of one set being parallel to, and equally spaced from, one another and extending at an acute angle to the length of the element in one direction, the strips in the other set being parallel to, and equally spaced from, one another and extending at the same acute angle to the length of the element in the opposite direction.

2. A constructional element according to Claim 1 wherein the notional triangle defining each hole is a right angled triangle so that the strips of imperforate material lie at an angle of 45° to the length of the element.

3. A constructional element according to Claim 1 wherein the circular segment at the apex of each hole lies on a circle to which the straight side of the hole opposite the apex is tangential.

4. A constructional element according to Claim 3 wherein the circular segment at the apex of each hole has a radius greater than that of the circular segments defining the other two corners of the hole.

5. A constructional element according to Claim 3 or Claim 4 wherein the width of each said strip is substantially equal to the diameter of the circular segment at the apex of each hole.

6. A constructional element according to Claim 1 which element is of L section or channel section, said flat strip of material defining one side of said section.

7. A constructional element according substantially as described with reference to the accompanying drawings.

MATHISEN & MACARA,
Chartered Patent Agents,
13 Dean Street,
London, W.1.
Agents for the Applicants.

coincidence between the holes for receiving either major or minor bolts, and in a very large number of these positions two bolts can be inserted which will lock the flanges rigidly, that is to say the rigidity of the joint is dependent only on the position of the holes and not on the frictional engagements between the flanges which in turn would depend on the tightness of the bolts.

Although a specific number of patterns of holes have been shown in the flanges of Fig. 2, it will be evident that this number of patterns can be varied as mentioned above and the number of available bolting positions will vary accordingly.

Although this pattern of holes, whose principles have been described above, is applicable to many types of constructional element formed in metal, synthetic resin plastics or other material, it is primarily intended for use in unannealed cold rolled steel strip.

The holes are formed by punching the strip whilst flat and the strip is thereafter bent to L section. The bending will take place along a line equally spaced from two adjacent rows of holes, and for this purpose these two rows of holes are so spaced apart as to allow for a bending margin whose width is equal to the thickness of the strip.

In particular, the major bolts referred to above are of $\frac{3}{8}$ " diameter whilst the minor bolts are of $\frac{1}{4}$ " diameter, and the imperforate strips between the holes will therefore be $\frac{3}{8}$ " in width. Clearly however other suitable dimensions may be used.

WHAT WE CLAIM IS:—

1. A constructional element comprising an elongated flat strip of material having a plurality of holes spaced apart along its length, each for the reception of a bolt, each hole having three straight side portions which lie along the sides of a notional isosceles triangle, each pair of adjacent ends of said straight side portions being interconnected by a segment of a circle, and wherein the holes are spaced apart in at least two parallel straight lines with the apices of the triangular holes pointing in a direction perpendicular to said lines, each hole in each

line being equidistant from the two next adjacent holes in the next adjacent line with its apex pointing in a direction opposite to that of the apices of said two next adjacent holes, the spacing between the holes being such that imperforate strips of material remain therebetween, said strips being arranged in two sets, the strips of one set being parallel to, and equally spaced from, one another and extending at an acute angle to the length of the element in one direction, the strips in the other set being parallel to, and equally spaced from, one another and extending at the same acute angle to the length of the element in the opposite direction.

2. A constructional element according to Claim 1 wherein the notional triangle defining each hole is a right angled triangle so that the strips of imperforate material lie at an angle of 45° to the length of the element.

3. A constructional element according to Claim 1 wherein the circular segment at the apex of each hole lies on a circle to which the straight side of the hole opposite the apex is tangential.

4. A constructional element according to Claim 3 wherein the circular segment at the apex of each hole has a radius greater than that of the circular segments defining the other two corners of the hole.

5. A constructional element according to Claim 3 or Claim 4 wherein the width of each said strip is substantially equal to the diameter of the circular segment at the apex of each hole.

6. A constructional element according to Claim 1 which element is of L section or channel section, said flat strip of material defining one side of said section.

7. A constructional element according substantially as described with reference to the accompanying drawings.

MATHISEN & MACARA,
Chartered Patent Agents,
13 Dean Street,
London, W.1.
Agents for the Applicants.

