

**A METHOD FOR MANUFACTURING A BULB BAR AND A BULB BAR
MANUFACTURED IN ACCORDANCE WITH THE METHOD**

The present invention relates to a method for manufacturing a bulb bar, and to a bulb bar manufactured in accordance with the method.

Bulb bars are comprised of a rolled single-piece sections which include a flat web part or plate and a generally rounded head part which slopes in towards the web part. Because of their rounded shapes, bulb bars can be used favourably as reinforcements in large shell or mantle sheet-metal structures with which ease of access and good adhesion are required in conjunction with surface treatment operations. Accordingly, bulb bars are often used as reinforcements in ships' hulls and in particular in twin-hull ships where the space between the hulls functions as a ballast tank, into which salt water is pumped in and from which salt water is pumped out. Ease of access and good adhesion in conjunction with surface treatment processes are therefore important.

The bulb bar is welded horizontally along the inner surface of the hull and with relevant parts forms together with the web of the bar a first essentially load-absorbing part. The bulb-part of the bulb bar forms together with the web part of said bar a second essential force-absorbing part.

The forces acting on the bulb bar are mainly tension and compression forces, wherein the bulb bar exhibits a force or load distribution which increases outwardly from the centre of gravity formed by the bulb-part, the flat strip-part and a part of the ship's hull.

Those forces acting on the ship's hull increase linearly with the distance from the water surface, where-

in the forces acting on the bulb bars become greater the further down the hull the bars are located.

Consequently, stiffenings or reinforcements which have very high bending resistance are required in the bottom part of the ship in order to take-up these forces. The requisite bending resistance of the bulb bar is obtained because the bar has an optimum relationship between bulb height and web width, or more specifically because of an accurately chosen ratio between the moment of inertia of the bulb-part and the moment of inertia of the flat strip-part.

The bending strength of a bulb bar welded to the hull of a ship is calculated in a similar manner, although with the difference that a part of the metal plate of the hull in this case forms a second end-part of the bulb bar, and the moment of inertia of this part must also be taken into account when making the aforesaid calculations.

At present, bulb bars are manufactured homogeneously in a series of standard dimensions, where the number of variants thereof are formed as a combination sequence of the total width, plate thickness and bulb height of the bulb bar, meaning that a number of different dimensional variants of the bulb bar must be incorporated in the production planning. This not only increases the costs of the manufacturer, but also the costs for the client, because it is necessary to keep in stock a large number of such variants and also because of the high tool costs entailed by the different types of rolls that are needed to produce all of these product variants.

Consequently, it is not possible at present to roll economically all bulb bars as integral structures in all of the dimensional variants required. Neither is it possible with present-day rolling mills to roll

bulb bars in those dimensions required to take-up the forces that act on the lowermost parts of the hull of a large ship, i.e. in general dimensions that range from 450-650 mm, due to the fact that the manufacturer is limited to a given number of reduction stages or passes when rolling a bulb bar from the starting billet to the final dimensions and shape of the rolled section, and also due to the fact that the manufacturer is also restricted to the use of one groove in the roll profile for production of the bulb-part of the bar.

It might be thought suitable to extend an existing bulb bar with a conventional flat bar. Although such a solution might be possible in some few cases, it is found that the resultant bulb bar will not possess the necessary mechanical strength values in the majority of cases, since the ratio of bulb height to web width is not optimal, or more specifically the ratio between the respective moments of inertia of said parts.

The problems associated with rolling sections of complicated shapes or sections of large dimensions in one single piece is generally known to the art and is described, for instance, in U.S. Patent Specification 2,263,272, although this patent specification is concerned with the manufacture of I-beams which exceed standard dimensions, the problems being solved by rolling T-sections and providing the sections with a web of suitable size. However, this method of manufacture is encumbered with a number of drawbacks. For instance, the web and the T-profiles have a dependency relationship wherein the choice of web thickness must follow the thickness of the outwardly projecting shaft-part of the T-section and wherein the dependency relationship does not afford the requisite coordination effects. Furthermore, because the shaft-part and the web-part are welded together by a local heating process and heat is only conducted away to a limited

extent, there is a risk of burning through these parts in the process of welding them together. This patent specification offers no contribution to the solution of the problems associated with the aforesaid bulb bars.

At present, constructional engineers are referred to the use of L-sections for taking-up the forces that act on the lowermost parts of the hull of a large ship, i.e. generally L-sections having dimensions ranging from 450 to 650 mm. Although these L-sections are stronger and have a higher weight ratio than a bulb bar, because of their shape the L-sections cannot be easily reached for the purpose of surface-treating the sections, while the sharp corners of the sections make it difficult to obtain good adhesion when surface-treating the sections.

The object of the present invention is to eliminate the aforesaid problems by providing a product of such configuration as to enable the bulb bar to be manufactured in desired dimensions in existing rolling mills and with the aid of conventional methods and to produce bulb bars at a lower production cost than when practicing known techniques. To this end, it is proposed that the bulb-bar components, i.e. the bulb-part and the web-part, are manufactured (rolled) separately and then welded longitudinally together to form a finished bulb bar.

More specifically, the bulb-parts and web-parts are manufactured in a standard series of different dimensions and then placed in storage, from where the bulb-parts and the web-parts are selected in a convenient manner according to customers' orders or according to prevailing production plans, therewith to provide a bulb bar which is optimum for the purpose intended, i.e. a bulb bar in which the bulb height, web width and web thickness of the bar components are chosen to

obtain optimum mechanical strength properties. Because the bulb-part is rolled to a shape which lacks a flange, i.e. has a cross-sectional shape which lacks such projections as those which are intended to be welded to a web-part when practicing the known prior art, there is no dependency relationship between the flange thickness of the different parts, thereby enabling many different variants of bulb bar to be obtained from a few available dimensions or variants of the bulb-parts and web-parts from which the bulb bar is formed. When stored, these web-parts or plates may also conceivably be used as components in other types of rolled and welded final products, for instance I-beams, L-beams, etc.

The aforesaid objects are achieved in accordance with the invention by the characteristic features set forth in the characterizing clauses of the following Claims.

The aforesaid objects and other objects of the present invention and also the advantages afforded thereby will be apparent from the following description and also from the accompanying drawings to which the description refers and, in which

Fig. 1 is a perspective view of a welded bulb bar;

Fig. 2 is an end view of a bulb-part;

Fig. 3 is an end view of a welded bulb par; and

Fig. 3A is a cross-sectional view of the weld location illustrated in Fig. 3.

The reference numeral 1 in Fig. 1 identifies generally a bulb bar which includes a bulb-part 2 and a plate or web-part 3 welded securely to the bulb-part.

According to the present invention, the bulb-part 2 illustrated in Fig. 2 has the form of a rectangle which has been bevelled heavily at one corner and which has substantially rounded corners. The bulb height is equal to the length of that side 5 which is defined by the mutually parallel sides 4, 6 which are spaced furthest apart and extend at right angles to the side 5, of which sides 4, 6 one side 4 is substantially longer than the other side 6 and wherein the pronounced chamfer forms a side 7 which extends obliquely towards the side 4 and then continues with a bevelled surface 8 that extends parallel with the side 5 and terminates at a bevelled surface 9 which slants at an angle to the side 4. The parallel bevel 8 of the aforesaid bevels forms a longitudinally extending supportive and contact region, while the bevel 9 forms a joint preparation for the web-part 3. As illustrated in Fig. 3, the web-part 3 is joined to the bulb-part 2 by means of one or more welds 10, 11, wherein each weld extends along a respective peripheral, longitudinally extending contact region between the web-part 3 and the bulb-part 2, as illustrated in Fig. 3A.

On the basis of specific customer orders or on the basis of prevailing production plans, there is chosen from the bulb-bar components a bulb height, web width and web thickness that are appropriate for the purpose intended, so that the finished bulb bar will possess optimum mechanical strength properties. The bulb bar is produced in accordance with the following method steps:

- a separate bulb-part 2 is rolled;
- a separate flat strip or web-part 3 is rolled; and
- the bulb-part 2 is welded securely to the web-part 3;

wherein in order to facilitate welding, the bulb-part 2 is suitably rolled to a flange-free shape so as to enable a web-part 3 which possesses suitably selected

dimensions for obtaining a bulb bar of requisite bending strength to be welded to a longitudinally extending edge region 8, 9 of the bulb, and to enable heat generated during the welding process to be conducted into the bulb-part, wherein said longitudinally extending edge region presents bevelled surfaces 8, 9, of which the bevel 8 forms a longitudinally extending supportive and contact region for a subsequent welding process and the bevel 9 forms a joint preparation surface. Prior to being welded, the parts 2, 3 are positioned with the bevel 8 on the rolled bulb-part 2 facing towards the longitudinally extending side of the plate or web-part 3, whereafter the parts are welded together longitudinally.

The advantages afforded by the aforescribed embodiment and the bulb bar 1 obtained thereby will be apparent from a study of the characteristic features.

The bulb bar 1 has no dependency relationship between the flange thickness of the different parts because the bulb-part is rolled to a shape which has no flanges. This enables many different variants of a bulb bar to be obtained from a few variants of the bulb and web parts 2, 3 of the bulb bar, therewith enabling bulb bars which have an optimum relationship between bulb height and web width to be readily manufactured. Because of the construction of the bulb bar, bulb bars can be produced in all requested dimensions, and even in dimensions which exceed present-day standard dimensions.

Furthermore, a bulb-part 2 which has been rolled to a flangeless shape, as illustrated in Fig. 2, will enable the weld arc to be directed advantageously onto the bulb-part and the heat generated during the welding process can be led into the bulb-part, therewith reducing the risk of burning-through the bar components, which is an additional advantage.

It will be evident that the bulb-part 2, which is often subjected to the greatest loads and stresses, can be made from a material of higher mechanical strength than the material from which the web-part 3 is made.

The present invention, however, is not restricted to the aforescribed and illustrated embodiments thereof, since changes and modifications can be made within the scope of the inventive concept as defined in the following Claims.



CLAIMS

1. A method for manufacturing a bulb bar, characterized by
 - rolling a separate bulb part (2);
 - rolling a separate flat bar or web-part (3); and
 - welding the bulb-part (2) firmly to the web-part (3).
2. A method according to Claim 1, characterized by rolling the bulb-part (2) to a flangeless shape such as to enable a web-part (3) whose dimensions have been suitably selected to obtain a bulb bar (1) of requisite bending strength to be welded to a longitudinally extending edge region (8, 9) of said bulb-part.
3. A method according to Claim 1, characterized by rolling the bulb-part (2) to a flangeless shape so that heat generated during the welding process can be conducted into the bulb-part.
4. A method according to Claims 1-3, characterized by rolling the bulb-part (2) in a manner to form a first bevel surface (8) which serves as a longitudinally extending supportive and contact region in a subsequent welding process.
5. A method according to Claims 1-4, characterized in that the bulb-part (2) is rolled so as to obtain a second bevel surface (9) which serves as a joint preparation for a subsequent welding process.
6. A bulb bar, characterized in that it is produced from a separately produced bulb-part (2) and a separately produced web-part (3) which have been welded together.
7. A bulb bar according to Claim 6, characterized in that the bulb-part (2) has a flangeless shape.



8. A bulb bar, characterized in that the bulb-part (2) includes a longitudinally extending edge region which presents first and second bevel surfaces (8, 9).

9. A bulb bar according to Claim 6, characterized in that the bulb-part (2) is made of a material which has a greater mechanical strength than the material from which the web-part (3) is made.
