The invention relates to a load-bearing steel structure of a building. The method for manufacturing a load-bearing steel structure of a building, in which method the parts (4, 5) of the steel structure are connected to each other at pre-determined points. The method according to the invention is implemented such that the parts are joined to each other by pushing the protrusion (8) or protrusions in one part (6) into the corresponding aperture (7) or apertures of a second part (4, 5). The invention also relates to a load-bearing steel structure of a building.
Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— of inventorship (Rule 4.17(iv))

Published:
— without international search report and to be republished upon receipt of that report.
METHOD FOR MANUFACTURING A LOAD-BEARING STEEL STRUCTURE OF A BUILDING, AND A LOAD-BEARING STEEL STRUCTURE OF A BUILDING

The object of this invention is a method for manufacturing a load-bearing steel structure of a building, in which method the parts of the steel structure are connected to each other at pre-determined points. The object of the invention is also a load-bearing steel structure of a building.

The invention thus relates to steel construction and more particularly to load-bearing steel structures. One particular application of the invention is the steel roof trusses of industrial halls. Roof trusses comprise, among other things, chords and the support beams connecting them. These types of steel parts are extremely heavy and connecting them so that they are accurately positioned is difficult. A support beam must be precisely positioned before it can be welded fast. The accurate positions of the parts are determined according to the strength calculations for each case.

Nowadays this placement of the support beams into their positions is done e.g. utilizing jigs suited to the purpose. The downside of this, however, is that individual jigs must always be made for the different lattice structures. Another alternative is to place the support beams accurately into position e.g. by means of a hoisting appliance and by guiding them manually. When the correct positioning is achieved, the parts are tack welded to each other. When all the support beams are tack welded accurately into position, they can be finally welded fast because the tack welding allows the structure to be turned without it collapsing. Thus welding a seam around it is possible. Tack welding has problems of its own. Placing a support beam accurately into position before tack welding is demanding and thus does not succeed by manual means alone, because the parts are extremely heavy.

The purpose of this invention is to achieve a new type of method for manufacturing a load-bearing steel structure of a building, to which method the problems of prior art are not attached. The method
according to the invention is characterized in that the parts are joined to each other by pushing the protrusion or the protrusions in one part into the corresponding aperture or apertures of a second part.

One preferred embodiment of the method according to the invention is characterized in that the protrusion in one part is shaped in essentially the same way as the aperture in the second part, in which case a shape locking is formed between the parts.

Another preferred embodiment of the method according to the invention is characterized in that a shape locking is formed between the parts to be connected together of a load-bearing steel structure of a building by shaping an indentation in the protrusion, which is essentially as high as the wall thickness of the parts.

Yet another preferred embodiment of the method according to the invention is characterized in that the apertures are 2-5 mm longer in the longitudinal direction of the parts than the protrusions, and in that the second edge of the apertures is precisely at the point of the theoretical position of the protrusion.

The purpose of the invention is also to achieve a load-bearing steel structure of a building, to which the aforementioned problems are not attached. The steel structure according to the invention is characterized in that a protrusion or protrusions are arranged in one of the parts to be fixed together and correspondingly an aperture or apertures in the other, into which the protrusions are pushed for joining the parts together.

One preferred embodiment of the steel structure according to the invention is characterized in that the protrusion of one part and the aperture of the second part are shaped in essentially the same way as each other to achieve a shape locking between the parts.

Another preferred embodiment of the steel structure according to the invention is characterized in that a shape locking is formed between the parts to be connected together of a load-bearing steel structure.
of a building by shaping an indentation in the protrusion, which is essentially as high as the wall thickness of the parts.

Yet another preferred embodiment of the joint according to the invention, which is achieved between the top chord and the bottom chord and the support beams to be fixed between them of a steel roof truss, is characterized in that one or more protrusions are formed on the ends of the support beam, and in that correspondingly one or more apertures for the protrusions are formed in the chords.

One of the advantages of the invention that can be mentioned is that the parts to be joined together are considerably easier to place into position because the apertures and the protrusions that enter them determine the position accurately. Awkward and expensive jigs, or other special arrangements for implementing precise positioning, are not needed. Also in the invention it is further possible to tack weld parts to each other before final welding, but this is not necessary in all cases.

In the following, the invention will be described in more detail by the aid of some preferred embodiments with reference to the attached drawings, wherein

Fig. 1 presents a roof truss structure, in which the invention can be utilized.

Fig. 2 presents a roof truss.

Fig. 3 presents a bottom view of a top chord according to Fig 4.

Fig. 4 presents an inclined support beam fixed to the top chord according to the invention.

Fig. 1 thus presents a load-bearing steel roof truss structure 1 of e.g. an industrial hall, which in this case comprises a number of consecutive and adjacent pairs of roof trusses 2, which are installed supported on vertical steel beams 3 with a method that is in itself
prior art.

Fig. 2 presents a steel roof truss 2, which comprises a top chord 4, a bottom chord 5 and also the inclined support beams 6 between them. This type of roof truss is typically assembled at the worksite from two or more parts, because it would be too long to transport as one piece from the factory to the worksite.

The inclined support beams 6 are welded fast at both their ends, the top end to the top chord 4 and the bottom end to the bottom chord 5. Before the final welding can be performed, the support beams 6 must be precisely positioned. For this purpose apertures 7 (Fig. 3) are formed on the bottom surface of the top chord 4, into which the protrusions 8 on the top end of the inclined support beam 6 are pushed. Correspondingly, there are protrusions on the bottom end of the inclined support beam 6, which are pushed into the corresponding apertures (not shown in the drawings) in the bottom chord 5. The same procedures are performed at the points of all the other support beams 6. In this way the roof truss is assembled precisely correctly and if necessary each joint can still be lightly tack welded together before the actual welding with which the final rigidity of the structure is achieved.

The apertures 7 made in the chords 4 and 5 and the protrusions 8 of the support beams corresponding to them are preferably shaped such that shape locking is produced between the parts, which further facilitates the accurate positioning and the staying in position of the support beams before final welding. The shapes that achieve shape locking can be varied and can easily be constructed according to need by a person skilled in the art. For example, shape locking is formed by shaping an indentation 9, which is essentially as high as the wall thickness of the parts 4, 5, in the protrusion 8.

The apertures 7 can, within the scope of the tolerance requirements set for the dimensions of the structure, also be larger than the protrusions 8, in which case the protrusions can easily be pushed into the apertures and the parts are sufficiently accurately in the correct
positions for welding. The apertures can also be shaped longer in the longitudinal direction to facilitate installation such that the second edge of the aperture is precisely at the point of the protrusion. Preferably the apertures are in this case 2-5 mm longer than the protrusions.

The apertures 7 of the chords 4 and 5 are preferably cut with a laser cutter. Likewise the ends of the support beams are cut and at the same time protrusions 8 are shaped in them with a laser cutter. Of course, the protrusions 8 can also be welded onto the ends of the support beams. The number of protrusions is not limited, but instead is selected according to the individual need. For example an embodiment is presented in the drawings in which there are two units of protrusions at one end of each support beam and correspondingly two apertures for them in the chords 4 and 5. There could just as well be one or more than two apertures (and protrusions).

The steel structures, such as the chords 4, 5 and the support beams 6, of roof trusses are generally closed profiles, such as pipe-shaped parts of rectangular cross-sectional shape, but also open profiles, such as I beams, are possible. The invention is not in this respect limited to any specific cross-sectional shape.

Generally the support beams are smaller in their cross-section than the chords, in which case they are joined to the chords such that they can be welded together with one fillet weld around the whole seam.

It is obvious to the person skilled in the art that the invention is not limited to the embodiments presented above, but that it can be varied within the scope of the claims presented below. The invention is described above particularly in connection with steel load-bearing roof trusses, but the invention can also be utilized in other load-bearing steel structures comprising a number of parts. Also the aperture/protrusion joint in the roof truss according to the invention can additionally be used to connect different fixing plates. These kinds of fixing plates can be used e.g. to extend chords or to fix other structures to the lattice. Although a number of contexts above refer
to inclined support beams, the steel structures connected to each other can also be perpendicular with respect to each other. The positions and attitudes of parts in roof trusses, as in other load-bearing steel structures, must be determined by means of precise strength calculations.
CLAIMS

1. Method for manufacturing a load-bearing steel structure of a building, in which method the parts (4, 5; 6) of the steel structure are connected to each other at pre-determined points, characterized in that the parts are joined to each other by pushing the protrusion (8) or the protrusions in one part (6) into the corresponding aperture (7) or apertures of a second part (4, 5).

2. Method according to claim 1, characterized in that the protrusion (8) in one part (6) is shaped in essentially the same way as the aperture (7) in the second part (4, 5), in which case a shape locking is formed between the parts.

3. Method according to claim 2, characterized in that a shape locking is formed between the parts (4, 5; 6) to be connected together of a load-bearing steel structure of a building by shaping an indentation (9) in the protrusion (8), which is essentially as high as the wall thickness of the parts (4, 5).

4. Method according to any of claims 1-3, characterized in that the apertures (7) are 2-5 mm longer in the longitudinal direction of the parts (4, 5) than the protrusions (8), and in that the second edge of the apertures is precisely at the point of the theoretical position of the protrusion (8).

5. Method according to any of claims 1 - 4, characterized in that after connecting the parts (4, 5; 6) of a load-bearing steel structure of a building, a final joint is formed between the parts e.g. by welding.

6. Load-bearing steel structure of a building, in which there is a joint between the parts (4, 5; 6) of the structure, with which the parts are connected to each other at pre-determined points,
8. **characterized** in that a protrusion (8) or protrusions are arranged in one of the parts (6) to be fixed together and correspondingly an aperture (7) or apertures in the other (4, 5), into which the protrusions are pushed for joining the parts together.

7. Steel structure according to claim 6, **characterized** in that the protrusion (8) of one part (6) and the aperture (7) of the second part (4, 5) are shaped in essentially the same way as each other to achieve a shape locking between the parts.

8. Steel structure according to claim 7, **characterized** in that a shape locking is formed between the parts (4, 5; 6) to be connected together of a load-bearing steel structure of a building by shaping an indentation (9) in the protrusion (8), which is essentially as high as the wall thickness of the parts (4, 5).

9. Steel structure according to any of claims 6-8, in which a joint is achieved between the top chord and the bottom chord (4, 5) and the support beams (6) to be fixed between them of a steel roof truss (2), **characterized** in that one or more protrusions (8) are formed on both ends of the support beam (6), and in that correspondingly one or more apertures (7) for the protrusions are formed in the chords (4, 5).

10. Steel structure according to any of claims 6-9, characterized in that the apertures (7) are 2-5 mm longer in the longitudinal direction of the parts (4, 5) than the protrusions (8), and in that the second edge of the aperture (7) is precisely at the point of the theoretical position of the second edge of the protrusion (8).

11. Steel structure according to any of claims 6-10, **characterized** in that the shapes of the protrusions (8) and of the apertures (7) are cut with a laser cutter.
12. Steel structure according to any of claims 6-11, characterized in that a more robust joint, e.g. a welded joint, is finally made between the parts (4, 5; 6) of the steel structure.