Claims

1. A metal structural fastener for fastening a connection between construction structures for buildings, the structural fastener comprising:

an elongated body comprising a head end portion, a tail end portion, and a plurality of stepped sections between the head end portion and the tail end portion;

each stepped section extending immediately from an end of a preceding stepped section or the head end portion; and

each stepped section defining a respective cross-sectional diameter, such that the cross-sectional diameters decrease along the stepped sections from the head end portion to the tail end portion,

wherein the structural fastener is configured to insert into the connection beginning from the tail end portion;

wherein the stepped sections are arranged to engage with respective sets of aligned connection holes of the construction structures, each set of aligned connection holes having hole diameters corresponding to the cross-sectional diameters of the respective stepped section.

2. The structural fastener according to claim 1, wherein the tail end portion comprises a locking hole for receiving a locking pin.

3. The structural fastener according to claim 2, further comprising the locking pin for insertion into the locking hole to secure the structural fastener inserted into the connection.

4. The structural fastener according to claim 3, wherein the locking pin is a split pin.

5. The structural fastener according to any one of claims 1 to 4, wherein the elongated body comprises a first stepped section, a second stepped section, and a third stepped section arranged from the head end portion to the tail end portion.

6. The structural fastener according to claim 5, wherein the first stepped section has a cross-sectional diameter of 60 mm, the second stepped section has a cross-sectional diameter of 55 mm, and the third stepped section has a cross-sectional diameter of 50 mm.

7. The structural fastener according to any one of claims 1 to 6, wherein the elongated body has an overall length of 300 mm.

8. A computer program comprising computer executable instructions that, when executed by a processor, cause the processor to control an additive manufacturing apparatus to manufacture a product comprising the structural fastener according to any one of claims 1 to 7.

9. A method of manufacturing a product via additive manufacturing, the method comprising:

obtaining an electronic file representing a geometry of the product wherein the product comprises the structural fastener according to any one of claims 1 to 7; and

controlling an additive manufacturing apparatus to manufacture, over one or more additive manufacturing steps, the product according to the geometry specified in the electronic file.

10. A building construction assembly comprising:

a plurality of assembled construction structures, each construction structure comprising a plurality of connection plates, each connection plate comprising a set of connection holes, and for each construction structure, the connection holes having hole diameters decreasing across the connection plates of the construction structure;

a connection between the assembled construction structures, the connection comprising a plurality of sets of aligned connection holes; and

a set of metal structural fasteners inserted into the connection, each structural fastener comprising an elongated body comprising a head end portion, a tail end portion, and a plurality of stepped sections between the head

end portion and the tail end portion, each stepped section extending immediately from an end of a preceding stepped section or the head end portion, each stepped section defining a respective cross-sectional diameter, such that the cross-sectional diameters decrease along the stepped sections from the head end portion to the tail end portion,

wherein for each structural fastener, the stepped sections are engaged with respective sets of aligned connection holes, each set of aligned connection holes having hole diameters corresponding to the cross-sectional diameters of the respective stepped section.

11. The construction assembly according to claim 10, wherein the tail end portion of each structural fastener comprises a locking hole for receiving a locking pin.

12. The construction assembly according to claim 11, further comprising a set of locking pins, each locking pin inserted into the locking hole of the respective structural fastener to secure the structural fastener inserted into the connection.

13. The construction assembly according to claim 12, wherein each locking pin is a split pin.

14. The construction assembly according to any one of claims 10 to 13, wherein the elongated body of each structural fastener comprises a first stepped section, a second stepped section, and a third stepped section arranged from the head end portion to the tail end portion.

15. The construction assembly according to claim 14, wherein the first stepped section has a cross-sectional diameter of 60 mm, the second stepped section has a cross-sectional diameter of 55 mm, and the third stepped section has a cross-sectional diameter of 50 mm.

16. The construction assembly according to any one of claims 10 to 15, wherein the elongated body of each structural fastener has an overall length of 300 mm.

17. A method for fastening a connection between construction structures for buildings, the method comprising:

assembling a plurality of construction structures, each construction structure comprising a plurality of connection plates, each connection plate comprising a set of connection holes, and for each construction structure, the connection holes having hole diameters decreasing across the connection plates of the construction structure;

forming a connection between the assembled construction structures, the connection comprising a plurality of sets of aligned connection holes; and

arranging a set of metal structural fasteners for fastening the connection, each structural fastener comprising an elongated body comprising a head end portion, a tail end portion, and a plurality of stepped sections between the head end portion and the tail end portion, each stepped section extending immediately from an end of a preceding stepped section or the head end portion, each stepped section defining a respective cross-sectional diameter, such that the cross-sectional diameters decrease along the stepped sections from the head end portion to the tail end portion;

for each structural fastener, partially inserting the structural fastener into the connection until the stepped sections stop at respective sets of aligned connection holes, each set of aligned connection holes having hole diameters corresponding to the cross-sectional diameters of the respective stepped sections; and

for each partially inserted structural fastener, fully inserting the structural fastener into the connection, thereby engaging the stepped sections with the respective sets of aligned connection holes.

18. The method according to claim 17, further comprising, for each structural fastener, inserting a locking pin into a locking hole of the structural fastener to secure the structural fastener inserted into the connection.