It is desirable that there be provided an apparatus or method for forming a perforated tube that avoids one or more of the above limitations, or at least provides a useful alternative.

Summary

In accordance with the present disclosure there is provided an apparatus for forming a perforated tube, comprising:

a main support; and

a die assembly mounted to the main support and comprising two opposed die members, the two opposed die members including a first die member and a second die member, the first die member having an axis and being configured to be at least partially inserted into a tube, the tube comprising a swaged section, wherein the die assembly comprises a first die support for pivotally supporting the first die member on the main support;

wherein the apparatus is operable to perform a repetitive punching operation, by bringing the two opposed die members together, to punch at least one perforation in the tube, and subsequently moving the two die members apart, the apparatus further comprising:

a rotation assembly comprising a rotation member rotationally mounted to the main support, the rotation member rotating the tube, by a predetermined amount, between successive punching operations to punch a predetermined pattern of perforations in the tube.

In accordance with the present disclosure there is also provided a method for forming a perforated tube, comprising:

forming a swaged section in a tube;

at least partially inserting a first die member into the tube;

performing a repetitive punching operation, by bringing the first die member together with a second die member to punch at least one perforation in the tube, and subsequently moving the first die member and second die member apart; and

rotating the tube, by a predetermined amount, between successive punching operations to punch a predetermined pattern of perforations in the tube, wherein the first die member and the second die member forms part of a die assembly mounted on a main support, the die assembly comprising a first die support for pivotally supporting the first die member on the main support.

In accordance with the present disclosure there is further provided a perforated tube formed by the apparatus described above, the tube comprising a plurality of perforations arranged such that any line drawn longitudinally of the tube will intersect at least one perforation.

In accordance with the present disclosure there is further provided a perforated tube formed by using the method described above, the tube comprising a plurality of

Claims

1. **An apparatus for forming a perforated tube, comprising:**
   a main support; and
   a die assembly mounted to the main support and comprising two opposed die members, the two opposed die members including a first die member and a second die member, the first die member having an axis and being configured to be at least partially inserted into a tube, the tube comprising a swaged section, wherein the die assembly comprises a first die support for pivotally supporting the first die member on the main support;
   wherein the apparatus is operable to perform a repetitive punching operation, by bringing the two opposed die members together, to punch at least one perforation in the tube, and subsequently moving the two die members apart, the apparatus further comprising:
   a rotation assembly comprising a rotation member rotationally mounted to the main support, the rotation member rotating the tube, by a predetermined amount, between successive punching operations to punch a predetermined pattern of perforations in the tube.

2. **The apparatus according to Claim 1, wherein the rotation assembly is configured to rotate the tube about the axis of the first die member.**

3. **The apparatus according to Claim 1 or 2, wherein one of the two opposed die members comprises at least one punch, and the other of the two opposed die members comprises a corresponding aperture for each punch, each aperture being located to receive a respective punch during punching operations.**

4. **The apparatus according to Claim 3, wherein the first die member comprises the one or more apertures.**

5. **An apparatus according to Claim 4, wherein the first die member comprises a slug collection recess for collecting slugs punched from the tube during punching the predetermined pattern of perforations.**

6. **An apparatus according to Claim 5, wherein the slug collection recess comprises an elongate through-hole extending axially of the first die member.**

7. An apparatus according to any preceding Claim, wherein the die assembly comprises a guide assembly for guiding movement of the two opposed die members as they are brought together.

8. An apparatus according to Claim 7, wherein the guide assembly comprises a stripper moveable with the second die member for contacting the tube to maintain a position of the tube as the two opposed die members are brought together.

9. An apparatus according to Claim 7 or 8, wherein the guide assembly comprises at least one pilot pin receivable in a corresponding pilot pin aperture as the two opposed die members are brought together.

10. An apparatus according to Claim 9, wherein the corresponding pilot pin aperture is located towards an end of the first die member.

11. An apparatus according to Claim 9, wherein the guide assembly comprises two pilot pins receivable in two corresponding pilot pin apertures, the corresponding pilot pin apertures being located toward respectively opposite ends of the first die member.

12. An apparatus according to Claim 1, wherein the first die member is connected to the first die support by a hinge.

13. An apparatus according to Claim 1 or 12, wherein the first die member is pivotally movable between a loading condition, in which a perforated tube can be removed from the first die member and the first die member can be received in a further tube, and a punching condition, in which the first die member is in a position in which the further tube is retained over the first die member.

14. An apparatus according to any one of Claims 1 to 13, wherein the die assembly comprises a second die support, the first die support and second die support supporting portions of the first die member at opposite ends of the further tube during punching operations.

15. An apparatus according to Claim 14, wherein the second die support has an upper surface configured to receive the first die member.

16. An apparatus according to Claim 14 or 15, wherein the further tube is retained, in use, between the first die support and a second die support, the first die member being in contact with the second die support when in the punching condition and being not in contact with the second die support when in the loading condition.

17. An apparatus according to any one of Claims 14 to 16, wherein the first die support and second die support maintain the first die member in alignment with the second die member during punching operations.

18. An apparatus according to any preceding Claim, wherein the apparatus is operable to perform a repetitive punching operation by bringing the second die member down upon the first die member, thereby capturing the tube between the two die members during each punching operation.

19. An apparatus according to Claim 18, wherein the second die member comprises a plurality of punches each of which is configured to form a respective perforation in the tube during each punching operation.

20. An apparatus according to any preceding Claim, wherein the rotation member comprises an indexing wheel and the rotation assembly further comprises an indexer, the indexing wheel having an index position for each punching operation to be performed on the tube and the indexer being for rotating the indexing wheel, with the tube, to successive indexing positions between respective punching operations.

21. An apparatus according to Claim 20, wherein the rotation assembly further comprises a pitch guide movable into contact with the indexing wheel to maintain the indexing wheel in a respective indexing position during punching of holes in the tube, and movable out of contact with the indexing wheel to permit rotation of the indexing wheel to another of the indexing positions.

22. An apparatus according to Claim 21, wherein the indexing wheel comprises a sawtooth peripheral edge and the pitch guide comprises a triangular notch, the triangular notch receiving a tooth of the sawtooth peripheral edge to maintain the indexing wheel in the respective indexing position.

23. An apparatus according to Claim 22, wherein the indexing wheel comprises a peripheral edge having a plurality of spaced notches, and the pitch guide comprises a

rounded end, the rounded end being receivable in a respective one of the spaced notches to maintain the indexing wheel in the respective indexing position.

24. A method for forming a perforated tube, comprising:

forming a swaged section in a tube;

at least partially inserting a first die member into the tube;

performing a repetitive punching operation, by bringing the first die member together with a second die member to punch at least one perforation in the tube, and subsequently moving the first die member and second die member apart; and

rotating the tube, by a predetermined amount, between successive punching operations to punch a predetermined pattern of perforations in the tube, wherein the first die member and the second die member forms part of a die assembly mounted on a main support, the die assembly comprising a first die support for pivotally supporting the first die member on the main support.

25. A perforated tube formed by the apparatus of any one of Claims 1 to 23, the tube comprising a plurality of perforations arranged such that any line drawn longitudinally of the tube will intersect at least one perforation.

26. A perforated tube formed by using the method of Claim 24, the tube comprising a plurality of perforations arranged such that any line drawn longitudinally of the tube will intersect at least one perforation.