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(54) Title: FLEXIBLE MAXILLO-MANDIBULAR FIXATION DEVICE

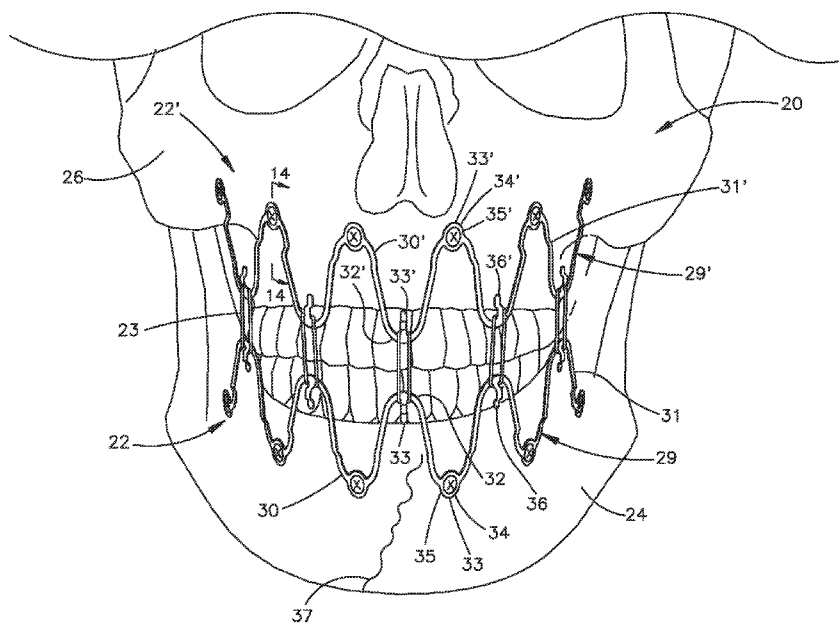


Fig.10

(57) Abstract: A system for achieving maxillo-mandibular fixation includes a bone fixation device including a bone fixation body formed from a plurality of links. The links define corresponding crests and valleys so as to impart flexibility into the bone fixation body. Thus, the bone fixation body can be aligned with the dental arch of the mandible and maxilla as necessary, and subsequently fastened to the underlying bone. Each bone fixation device includes at least one securement location on the fixation body that can attach to a securement device, such that the securement device fixes or stabilizes the mandible and the maxilla with respect to each other.



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What is claimed:

1. A bone fixation system comprising:
  - a fixation body having a plurality of links spaced from each other along a first direction, the links defining respective crests and valleys offset from each other along a second direction that is perpendicular to the first direction, and side members that extend between the crests and valleys, such that at least some of the links, in combination, define a plurality of securement locations and a plurality of attachment locations that are spaced from each other at least along the first direction, wherein the side members each define an offset region that offsets the securement locations from the attachment locations along a third direction that is substantially perpendicular to each of the first and second directions; and
  - a plurality of fasteners each configured to be inserted into an underlying jaw bone at respective ones of the attachment locations, thereby attaching the fixation body to the underlying jaw bone,
  - wherein the securement locations are configured to engage with a respective securement device that secures the fixation body to complementary securement locations of an identical second fixation body.
2. The bone fixation system as recited in claim 1, wherein at least some of the attachment locations and the securement locations are aligned with each other with respect to the first direction.
3. The bone fixation system as recited in claim 1, wherein at least some of the securement locations and the attachment locations are offset from each other along the second direction.
4. The bone fixation system as recited in any one of the preceding claims, wherein when the fasteners are inserted into the jaw bone at respective ones of the attachment locations, the attachment locations are disposed closer to the jaw bone along the third direction than a distance that the securement locations are spaced from the jaw bone along the third direction.
5. The bone fixation system as recited in any one of the preceding claims, wherein as the side members extend from the respective attachment locations to the securement locations, the side members each extend along a respective first plane from the attachment location, bend outward away from the first plane along the third direction to a respective second plane that is parallel to the first plane, and extend in the second plane to the respective securement locations.

6. The bone fixation system as recited in any one of the preceding claims, wherein the side members, the securement locations, and the attachment locations are monolithic with each other.
7. The bone fixation system as recited in any one of the preceding claims, wherein the side members define crests that each supports a respective one of the securement locations, and valleys that each defines a respective one of the attachment locations, and the valleys are offset from the crests along the third direction.
8. The bone fixation system as recited in claim 7, wherein the crests and valleys define respective outer surfaces that lie in respective planes that are offset from each other along the third direction and are parallel with each other.
9. The bone fixation system as recited in any one of the preceding claims, wherein the securement locations and the attachment members are alternatingly arranged along the fixation body.
10. The bone fixation system as recited in claim 9, wherein the securement locations comprise tangs that extend from the respective ones of the crests toward a gap between adjacent ones of the valleys.
11. The bone fixation system as recited in any one of the preceding claims, wherein the fixation body is movable from a first configuration to a flexed configuration, wherein the first direction is a straight longitudinal direction when the fixation body is in the first configuration, and the first direction is curved when the fixation body is in the flexed configuration.
12. The bone fixation system as recited in any one of the preceding claims, wherein the attachment locations comprise threaded bone fixation holes, and the fasteners comprise screws having threaded heads configured to threadedly mate with the attachment locations in the bone fixation holes.
13. The bone fixation system as recited in any one of the preceding claims, wherein the attachment locations comprise bone fixation holes, and the fasteners comprise screws having heads configured to compress the attachment locations against the jaw bone when the screws are driven through the bone fixation holes and into the jaw bone.
14. The bone fixation system as recited in any one of the preceding claims, wherein the attachment locations are configured as bone fixation holes, and at least one of the fasteners comprises:

a body that is elongate along a central axis from a proximal end to an opposed distal end;  
and

a head that extends out from the proximal end at least along a radial direction that is perpendicular to the central axis,

wherein the body includes a shaft configured to extend through a respective one of the bone fixation holes and into the underlying jaw bone, and a stop member that extends radially outward away from the central axis, the stop member disposed between the shaft and the head along the central axis such that the body defines a neck disposed between the head and the stop member, the neck recessed with respect to at least the head along a radially inward direction toward the central axis.

15. The bone fixation system as recited in claim 14, wherein the neck is further recessed with respect to at least a portion of the stop member in the inner radial direction.

16. The bone fixation system as recited in any one of claims 14 to 15, wherein the stop member defines a helical thread and at least one of the attachment locations is internally threaded so as to mate with the helical thread of the stop member.

17. The bone fixation system as recited in any one of claims 14 to 16, wherein the neck is unthreaded.

18. The bone fixation system as recited in any one of claims 14 to 17, wherein the body defines a recess between the head and the stop member, the recess sized so as to receive a wire that is configured to be wrapped around the body at the recess and further attached to at least another one of the fasteners.

19. The bone fixation system as recited in any one of claims 14, 15, 17 and 18, wherein the fixation body defines an inner surface that faces the underlying jaw bone when the fixation body is attached to the underlying jaw bone, and an outer surface opposite the inner surface, such that the bone fixation holes extend from the outer surface to the inner surface, and the stop member defines a shoulder sized greater than the bone fixation holes, such that the stop member is configured to abut the outer surface when the shaft is inserted into the underlying jaw bone.

20. The bone fixation system as recited in any one of claims 14 to 19, wherein the body defines a first cross-bore that extends through the neck along a first direction perpendicular to the central axis, the first cross-bore sized to receive a wire so as to attach the at least one fastener member to another one of the fastener members.