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E. C. BOOTH  
TUBULAR STRUCTURE  
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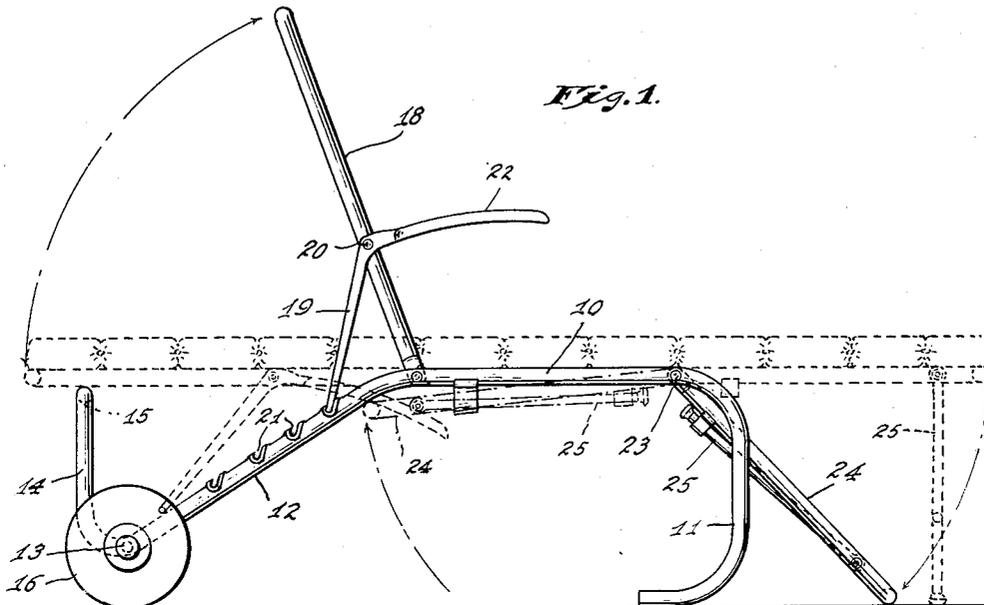


Fig. 1.

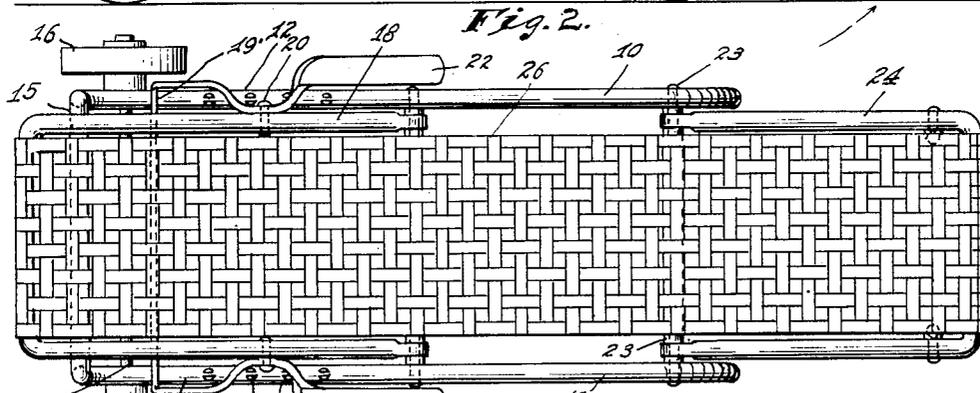


Fig. 2.

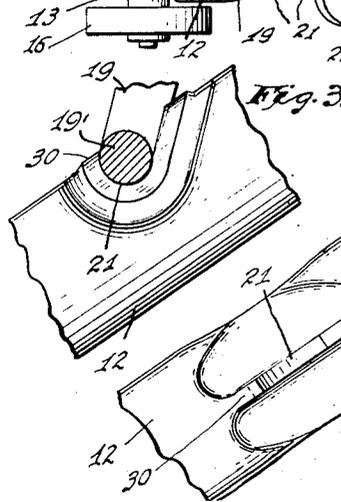


Fig. 3.

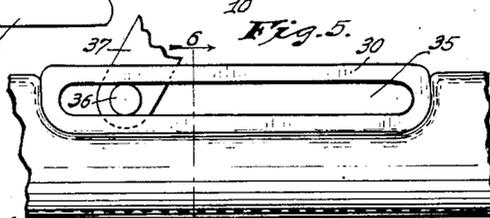


Fig. 5.

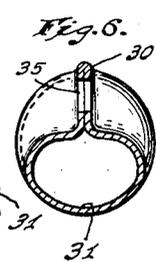


Fig. 6.

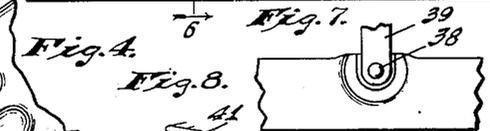


Fig. 7.

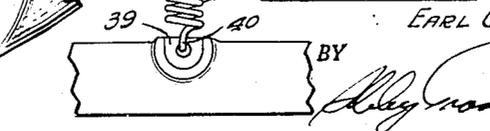


Fig. 8.

INVENTOR.  
EARL C. BOOTH,

BY *Ally*  
ATTORNEYS.

# UNITED STATES PATENT OFFICE

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## TUBULAR STRUCTURE

Earl C. Booth, Columbus, Ohio, assignor to Arvin Industries, Inc., a corporation of Indiana

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5 Claims. (Cl. 155—194)

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My invention relates to articles, and more especially to articles of furniture, made of metal tubing. As a material for the structural elements of metal furniture or other articles, metal tubing has the advantage of lightness, strength, rigidity, and attractive appearance; but in many situations it possesses the disadvantage that other structural elements cannot be readily attached to it. The piercing of metal tubing by an economical punching operation in order to provide for the passage of bolts, rivets, or other connecting means frequently presents a problem because of the difficulty of supporting the tubing interiorly during the punching operation.

It is an object of my invention to adapt metal tubing for use in situations to which it has previously been regarded as unadapted. Another object of my invention is to facilitate the attachment of other elements to a stretch of metal tubing. Still another object of my invention is to produce an improved article of furniture embodying metal tubing.

In carrying out my invention, I distort the metal of the tubing for a portion only of its circumference, forcing such metal inwardly from opposite sides of the tubing until the distorted portions are brought into parallelism and preferably until they meet to form a web of double thickness, such a web in most instances lying in a diametral plane of the tubing. The double-thickness web thus formed may be pierced, slotted, notched or otherwise treated to facilitate its attachment to another element or elements.

One article in which my invention may be employed to advantage is a so called sun-tan cot which, by relative adjustment of its frame-positions, can be converted from a cot into a chaise longue or chair. In employing my invention in such an article, the frame is formed of tubular side members each including a portion extending obliquely downward from a point adjacent the rear edge of the seat. A back pivotally connected to such side members near the rear edge of the seat has secured to it an intermediate point a swingable yoke engageable with any of a series of notches in the obliquely extending portions of the side members; such yoke being integral with arms projecting forwardly from the back. An extension, pivotally secured to the side members at the front edge of the seat, may be swung from a position at the end of the seat to provide a foot rest.

The accompanying drawing illustrates my invention: Fig. 1 is a side elevation of the improved sun-tan cot, the parts being shown in chain lines

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in the positions they occupy when the article is being used as a chair and in dotted lines in the positions occupied when it is being used as a cot; Fig. 2 is a plan view of the article with the frame adjusted to cot-forming condition; Figs. 3 and 4 are a fragmental side elevation and a fragmental plan on an enlarged scale illustrating the manner in which the tubing is distorted to provide the yoke-receiving notches; Fig. 5 is an elevation illustrating the manner in which the tubing may be distorted to provide a sliding connection; Fig. 6 is a transverse section on the line 6—6 of Fig. 5; and Figs. 7 and 8 are elevations illustrating further modifications.

The cot illustrated in Fig. 1 comprises a pair of side members formed of metal tubing each bent to provide a generally horizontal, seat-supporting stretch 10, a vertical portion 11 forming a front leg, an oblique portion 12 extending downwardly and rearwardly from the rear of the seat to an axle 13, and a back-supporting portion 14 extending generally upward from the axle. The upper ends of the two back-supporting portions may be bent into alignment and joined together in any suitable manner to form a cross-member 15; or, if desired, both side members may be formed of a single length of tubing the ends of which form the lower portion of the front legs 11. The axle 13 projects beyond the side members and is there provided with wheels 16 to facilitate movement of the cot.

Adjacent the junction of the stretches 10 and 12 of the side members, the frame is provided with a cross member upon which the back 18 is pivotally mounted. To hold the back in any of various positions of adjustment, I employ a yoke 19 which is pivoted to the back as indicated at 20 and which possesses an intermediate portion 19' adapted to be received in any of a series of notches 21 in the stretches 12 of the side members. The end portions of the yoke 19 are respectively rigid with arms 22, which extend forwardly from the back in the manner illustrated in Fig. 1.

At the front end of the seat-forming portions 10 of the side members, I provide a second cross member 23 upon which I pivotally mount an extension 24. The extension 24 is swingable from a position, illustrated in chain lines in Fig. 1, beneath the side of the chair to a position, illustrated in dotted lines in Fig. 1, in which it projects forwardly in extended position to support the feet. Legs 25 pivotally connected to the extension 24 may be employed to support it in any extended position.

The frame as so far described, including the

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back 18, the seat-forming portion 10, and the extension 24, is covered with any suitable upholstery or other supporting material 26.

With the back 18 in the full-line position shown in Fig. 1, and with the extension 24 either in the full-line or retracted chain-line position, the article is adapted for use as a chair. By swinging the extension 24 into the dotted line position, the article becomes a chaise longue. When used either as a chair or a chaise longue, the back 18 can be adjusted to any inclination provided by the notches 21. The rigid interconnections of the yoke 19 and the arms 22 facilitate such adjustment, as both the back 18 and the yoke can be manipulated by forces applied to the arms by the occupant of the chair. With the extension 24 in the dotted-line position shown, the back 18 can be lowered until supported on the cross-member 15, thus converting the article into a cot.

The manner in which the tubing is treated to provide the notches 21 is illustrated on an enlarged scale in Figs. 3 and 4, and also in Fig. 6, which latter may be regarded as a representative cross-sectional illustration of all the modifications illustrated. As will be clear from those figures, portions of the tube-wall lying adjacent each other and on opposite sides of a diametral plane are displaced toward each other to form a web 30 of double thickness. Such displaced portions, in the aggregate, occupy considerably less than the entire circumference of the tube-wall, with the result that a portion of such tube-wall, indicated at 31 in Fig. 6, remains substantially undistorted. In forming the web 30, the tubing adjacent the portion to be distorted is supported between dies which grip it exteriorly. Such dies are provided with openings for receiving opposed punches which enter the dies and move toward each other to force that portion of the tube-wall between the punches inwardly to form the double-thickness web 30.

The web 30, once formed, may be treated in any desired manner to effectuate the connection of the tube to some other element. In the case of the article illustrated in Figs. 1 to 4, several of the webs 30 are formed at spaced intervals along the tubing and each of them is notched to provide for the reception of the intermediate portion of the yoke 19. In Fig. 5, the web 30 has considerable extent longitudinally of the tube, and is provided with an elongated slot 35 adapted to receive slidably a stud or pin 36 on a link 37. In Fig. 7, the web is punched for the reception of a rivet 38 by which the tube is connected to a strip or strut 39; and in Fig. 8 I have illustrated the web as pierced for the reception of the hooked end 40 of a helical spring 41.

It will be apparent that my method of form-

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ing tubing to facilitate its attachment or connection to other structural elements has a wide application; and it is accordingly to be understood that the structural elements in the drawing are merely shown by way of example. Since the distortion is confined to a portion only of the circumference of the tube, a tubular section is still left at the side of the distortion. Preferably, the circumferential extent of the distorted portions are such in the aggregate that the outer edge of the web 30 projects to only a slight extent beyond the limits of the tube, thus contributing to a pleasing appearance.

I claim as my invention:

1. In an article comprising an element formed of metal tubing, adjacent portions of the wall of said tubing lying adjacent and on opposite sides of a diametral plane being distorted inwardly into contact with each other to form a web of double thickness, said distorted portions being continuous with each other at their outer edges for at least a portion of their longitudinal extent occupying in the aggregate materially less than the entire circumference of the tubing whereby a portion of the tubing wall diametrically opposite the web will substantially retain its original curvature, said web being provided with an opening, and a second element received in said opening.

2. The invention set forth in claim 1 with the addition that said opening is a notch in the outer edge of said web.

3. The invention set forth in claim 1 with the addition that said opening is spaced inwardly from the outer edge of the web, and a third element overlying said web and provided with an opening aligned with that of the web, said second element extending through both openings to provide an interconnection between the tubing and the third element.

4. The invention set forth in claim 1 with the addition that said opening is spaced inwardly from the outer edge of the web.

5. The invention set forth in claim 1 with the addition that said opening is an elongated slot spaced inwardly from the outer edge of the web.

EARL C. BOOTH.

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