

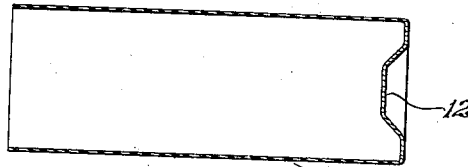
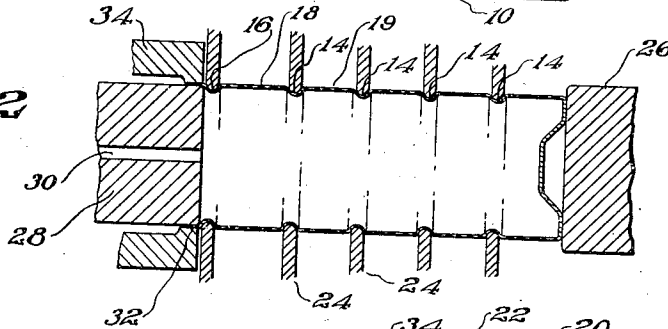
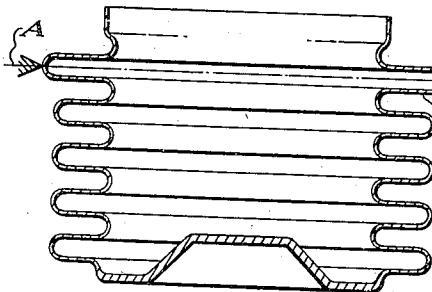
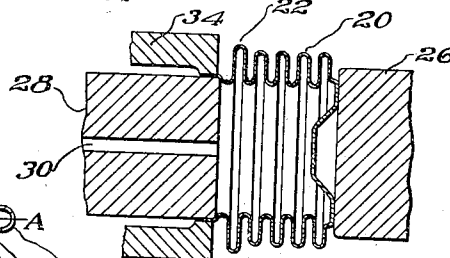
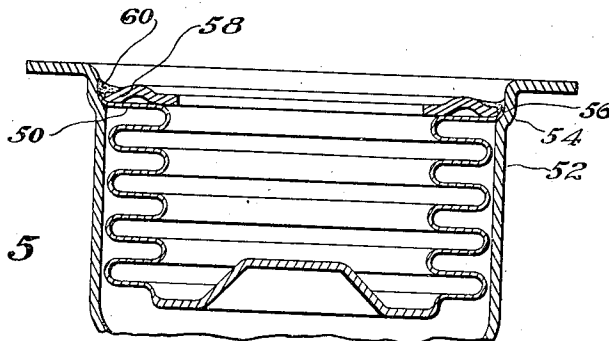
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W. B. CLIFFORD

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METHOD OF PRODUCING BELLOWS UNITS

Filed March 19, 1935



Witness

Paul F. Bryant

Inventor

Inventor
Walter B. Clifford
by his attorneys
Fish, Hildreth, Cory & Jewett

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METHOD OF PRODUCING BELLOWS UNITS

Walter B. Clifford, Boston, Mass., assignor to
Clifford Manufacturing Co., Boston, Mass., a
corporation of Delaware

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3 Claims. (Cl. 113-116)

The present invention relates to a method of producing a bellows unit suitable for use either as a thermostat, a seal or similar purposes for which said unit may be employed.

5 The principal purpose and object of the invention is to produce a bellows unit having an attaching flange at the open end by a new, simplified and improved method which dispenses with joints and permits the formation of the
10 flange in the usual process of manufacture of the bellows unit without requiring a special form of tube or the like.

With this and similar objects in view, the invention consists primarily in the production of a
15 substantially enlarged flange at the open end of the bellows tube, produced during the formation of the bellows folds by fluid pressure. The production of this enlarged fold at the open end is accomplished in the preferred and simplified form
20 of the invention by pre-rolling a series of grooves in the tube to locate the forming members, the bulk of the grooves being uniformly spaced to determine bellows folds of uniform diameter and characteristics, the two grooves at the end of the
25 tube which determine the end fold having a spacing substantially greater than that of the remaining grooves, the groove immediately adjacent the open end of the tube being spaced therefrom a sufficient distance to permit engagement
30 of the tube wall for forming.

In the accompanying drawing illustrating the preferred form of the invention, Fig. 1 represents a section of a thin wall tube having a closed bottom formed in an appropriate manner; Fig.
35 2 is a view of the same tube having the non-uniformly spaced grooves rolled therein and assembled with the forming members in position for the production of bellows folds with fluid pressure; Fig. 3 is a view of the same tube substantially
40 at the completion of the operation; Fig. 4 is a view of the finished unit with the enlarged fold ready for severance; and Fig. 5 is a view of the completed unit illustrating the manner in which it may be assembled within a housing
45 through the employment of the integral attaching flange.

Referring particularly to the illustrated embodiment of the invention, the tube as shown in Fig. 1 is what is known as a thin wall cupped
50 tube formed from a sheet of the desired thickness by a series of cupping and drawing operations. This tube, which is provided with a peripheral wall of uniform thickness and a bottom portion of somewhat greater thickness determined by the initial thickness of the sheet, is of

the form commonly and universally employed for the production of bellows units. The tube indicated at 10 may have the integral bottom or end wall indented to provide a centrally disposed
5 recess 12, as indicated. The purpose of this formation, which may be varied as desired, is to facilitate securing operating members in accurate relationship to the end of the bellows for any desired service.

After the formation of the bottom wall and its
10 conversion if desired from the initial flat condition and the tube is formed, the peripheral wall of the tube is provided with a series of depressed and uniformly spaced grooves or recesses 14,
15 which mark off the wall of the tube and determine the number and diameter of the resulting bellows folds. As will be noted from Fig. 2, these grooves are uniformly spaced from the closed end of the tube lengthwise thereof, and in
20 addition a groove 16 is formed in the tube adjacent the open end which has a spacing from the next adjacent groove 14 which is substantially greater than the spacing of the intermediate
25 grooves. The spacing between the last two grooves may be indicated at 18, and the uniform spacing as 19. By virtue of this wider spacing the formation of bellows folds through
30 fluid pressure creates a series of uniform folds lengthwise of the tube wall, and a substantially enlarged fold adjacent the open end, as more particularly indicated in Fig. 3, where the uniform or working folds are indicated at 20, and the enlarged or attaching fold at 22.

Referring again to Fig. 2, it will be evident that the pre-rolled or grooved tube is inserted within
35 a series of forming members 24, which are located within the grooves and have their position determined thereby. The tube mounted within the members is engaged at the closed end by a contracting member 26, and at its open end by a
40 source of fluid pressure constituting a head 28 provided with a fluid pressure passage 30. The head 28 slides within and supports the extended portion 32 of the tube wall beyond the groove 16, and bears against the shoulder formed by
45 the groove. The outer portion of the wall may be engaged and held in sealing engagement with the cylindrical head by fingers 34.

With the tube so assembled and held, fluid
50 pressure is introduced thereinto through the head to first bulge the tube between the forming members, and to thereafter form and complete bellows folds through maintenance of the fluid pressure and simultaneous contraction of
55 the tube lengthwise. At the completion of the

operation the bellows unit assumes approximately the shape and condition shown in Fig. 3.

The pre-rolling of the tubes with subsequent forming may be carried out approximately as indicated in my earlier Patent No. 1,842,148, dated January 19, 1932, and the apparatus employed for forming may be that described in my Patent No. 1,880,184, dated September 27, 1932, employing the clutch mechanism at the fluid pressure end shown in my Patent No. 1,865,678 dated July 5, 1932.

At the completion of the bellows formation the cupped unit is substantially as shown in Fig. 5, having a series of uniform folds extending from the closed end and terminating in a substantially larger fold which may serve effectively as an attaching flange. It is preferable that the enlarged fold when serving as an attaching flange be severed and this may be conveniently accomplished along the plane A—A of Fig. 4, the outer convolution being engaged by the point of a cutting or skiving tool which severs the open end of the bellows, leaving the extended and integral flange 50, as indicated. This flange forms an ideal attaching means due to its freedom from solder joints, and as an example of the manner in which the unit may be employed and anchored through the flange, an outer housing portion 52 is provided with a circumferential seating shoulder 54 in which the flange 50 is received and fits, the upturned edge 56 fitting the recess and aiding in the accurate positioning of the unit within the housing. The opposite side of the flange may, if desired, be engaged by a ring 58 which has sufficient surface contact with the flange itself to reinforce and prevent undue flexing of the flange in use. The whole assembly may be anchored and sealed to the housing at the rim by a solder joint 60, as indicated.

It will be understood that the method of attaching the bellows unit at the open end to a support through a radial flange has been disclosed and used heretofore, but in all cases commercially such a flange has been separately attached, requiring the use of a joint which presented a source of weakness at the point of flexure. It has also been suggested that the tube from which the bellows unit is made be formed with a radially extending flange. However, experience has indicated that in the case of the latter suggestion the production of such a flange in the forming of the tube and its retention during the forming of the bellows is not a satisfactory or practical expedient, and as the result, although many such suggestions have heretofore been made, in no case so far as I am aware have they represented a contribution to the practical manufacture of such units. In the case of the present invention, no modification in the forming of the tube is required, the tube being the standard tube commonly employed, and the production of the enlarged fold at the open end is accomplished in the regular formation of bellows folds without additional time or expense or requiring unusual or difficult operations. The fact that the enlarged fold when severed presents a radial flange, flat throughout its major area, facilitates in the support of this flange in

use when so desired. Furthermore, the flange is used in almost precisely the form in which it emerges from the forming operation, and because it does not require modification in shape or re-working, difficulties otherwise incident to the handling of this thin wall material are completely avoided.

What is claimed is:—

1. The method of producing a bellows unit with an integral attaching flange at the open end which comprises the formation of a series of bellows folds in a thin wall cupped tube uniform in diameter and spaced relation, and an enlarged fold at the open end of the tube which extends radially substantially beyond the outer diameter of the working folds, and splitting the enlarged radial fold through the outer convolution to provide a generally radially extending attaching flange at the open end integral with the tube wall and having a turned-up rim and capable of attachment at its periphery to a suitable support without interference with the flexing of the bellows folds.

2. The method of producing a bellows unit with an integral attaching flange at the open end which comprises the formation of a series of uniformly spaced and depressed grooves in a thin wall cupped tube with a similar depressed groove adjacent the open end of the tube but separated therefrom to permit engagement of the tube end and spaced from the next adjacent groove by a distance substantially greater than the spacing between the remaining grooves, assembling the grooved tube within forming members which engage the grooves, forming bellows folds in the tube through fluid pressure introduced internally thereof and endwise contracting pressure to produce a series of uniform folds with an enlarged radial fold adjacent the open end, and splitting the enlarged fold at the outer bend to leave a generally radial and integral flange larger than the remaining folds with a turned-up portion at the end.

3. The method of producing a bellows unit with an integral attaching flange at the open end which comprises the formation of a series of uniformly spaced and depressed grooves in a thin wall cupped tube with a similar depressed groove adjacent the open end of the tube but separated therefrom to permit engagement of the tube and spaced from the next adjacent groove by a distance substantially greater than the spacing between the remaining grooves, assembling the grooved tube within forming members which engage the grooves, forming bellows folds in the tube through fluid pressure introduced internally thereof and endwise contracting pressure to produce a series of uniform folds with an enlarged radial fold adjacent the open end, splitting the enlarged fold at the outer bend to leave a generally radial and integral flange with a turned-up portion at the rim, and assembling the cup-shaped bellows with the radial flange seated against a supporting shoulder at one side, and with a supporting and retaining member engaging the opposite side of the flange throughout a sufficient area to prevent substantial flexing of the flange during use.

WALTER B. CLIFFORD.