Dec. 11, 1934. M. H. WARD 1,984,002

METHOD OF AND APPARATUS FOR CORRUGATING METTALIC TUBES

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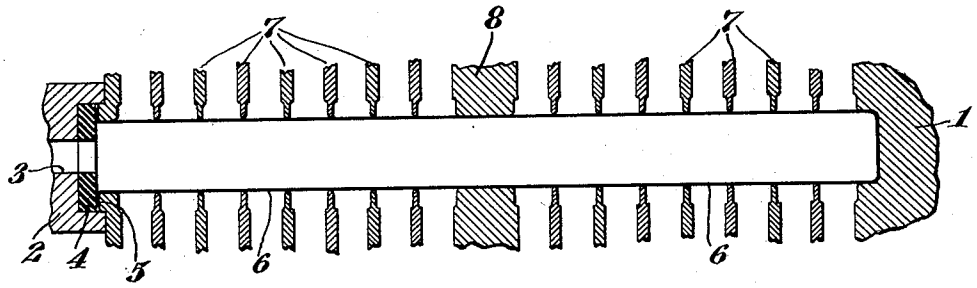


Fig. 1.

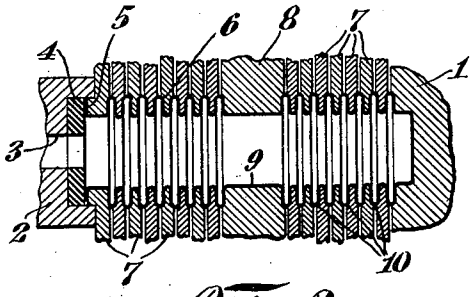


Fig. 2.

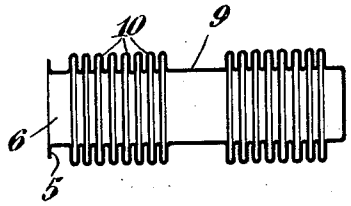


Fig. 3.

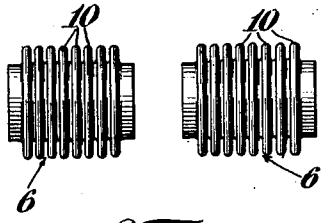


Fig. 4.

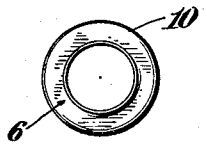


Fig. 5.

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METHOD OF AND APPARATUS FOR CORRUGATING METALLIC TUBES

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Application June 23, 1931, Serial No. 546,198

6 Claims. (Cl. 153—73)

This invention relates to a new and improved method and apparatus for corrugating metallic tubes to form resilient bellows-like articles or diaphragms and the like. Usually, these tubes are thin-walled and when corrugated provide a more or less resilient and thermal responsive element depending upon the thickness and character of the material used.

Articles of this kind have been made in the past by various means and methods, such as the Hollerith and Metcalf Patent No. 349,718 of September 28, 1886; the Bezzenberger Patent No. 1,506,966 of September 24, 1924; and as shown in my copending application filed January 23, 1929, Serial No. 334,454. The blank used is in the form of a metal tube which is placed between a plurality of suitably spaced dies or mold sections and then subjected to fluid pressure within and a longitudinal pressure without, which results in the expansion of the portions or sections of the tube between the dies or mold sections as the external longitudinal pressure continues.

The principal object of this invention is the provision of a method and apparatus whereby a plurality of such articles may be made or formed at one time or at one operation. This, of course, has obvious advantages in factory production, as it materially decreases the cost of producing each element or article and enables them to be manufactured much more speedily.

In the drawing—

Figure 1 represents a diagrammatic longitudinal sectional view of an apparatus such as disclosed in my above-mentioned copending application, arranged to practice the method of this invention, with the tubular blank in position and before any expansion thereof has taken place.

Figure 2 is a diagrammatic longitudinal sectional view of the same apparatus after the forming or shaping operation has been completed.

Figure 3 is a longitudinal sectional view of the completely formed tubular blank after it has been removed from the apparatus.

Figure 4 is a side elevation of the same after it has been separated into the individual articles.

Figure 5 is an end view of the latter.

Referring now to the drawing and particularly to Figure 1, the numeral 1 designates a movable head and the numeral 2 a stationary head provided with an opening 3 adapted to be placed in communication with a suitable source of hydraulic or other fluid pressure and also having the gasket or washer 4 against which the end flange 5 of the tubular blank 6 fits. In the form shown, this tubular blank is closed at its other end and suitably connected to the movable head 1.

A plurality of dies or mold sections 7 are arranged in spaced relation about the tubular blank, it being understood that two adjacent dies or mold sections cooperate to form a complete corrugation between them. A sufficient number of these dies or mold sections are provided for each article to be formed and each set of said dies or mold sections is separated by a suitable blank or spacing member 8. This may be constructed so as to cooperate with the adjacent dies or mold section to complete the last corrugation, but its primary function is to provide a blank or unformed section in the tubular blank as indicated clearly in Figure 2 and designated 9 in Figure 3 of the drawing.

The operation of this apparatus generally, includes the application of hydraulic or other fluid pressure into the interior of the tubular blank 6 and then the longitudinal pressing movement of the movable head 1. The combination of these forces causes the metal of the blank, where not restrained by the contacting edges of the dies or mold sections, to expand or flow outwardly into the spaces between these dies or mold sections, which, as they move together, assist in forming the corrugations, until at the completion of the movement of the movable head, the corrugations 10 are completely formed, see Figures 2 and 3. The movable head is then slightly withdrawn and the pressure released from within the tubular blank and the mold sections or dies are then separated so as to permit the removal of a formed blank in substantially the form shown in Figure 3.

It is to be noted that according to the disclosure of the drawing, two complete articles only are formed by the apparatus and from the blank shown, these articles being separated by the blank section 9 of Figure 3. It is, of course, to be understood that two or more articles may be made from one blank and by one single operation, the only limit being the size of the machine and the number of corrugations for each article.

The formed blank of Figure 3 may then be cut and trimmed in order to provide the complete separate articles shown in Figure 4. It may be necessary or desirable to expand or contract the article as a whole, and this can be done either with the blank in the form shown in Figure 3 or later, if desired.

What I claim is:

1. An apparatus of the character described, including in combination, head members for hold-

ing a tubular blank, a plurality of spaced sets of movable dies or forming members with a blank member positioned between adjacent sets and adapted to receive said tubular blank, and means for applying a deforming pressure to said tubular blank whereby a plurality of spaced sets of corrugations are formed in said tubular blank at one operation.

2. An apparatus of the character described, including, in combination head members for holding a tubular blank, a plurality of spaced sets of movable dies or forming members with a blank member positioned between adjacent sets and adapted to receive said tubular blank, one of said head members being movable to apply a longitudinal pressure to said tubular blank so as to force portions of said tubular blank outwardly between said dies or forming members and thus form a plurality of spaced sets of corrugations in said tubular blank.

3. An apparatus of the character described, including in combination, means for holding and applying a longitudinal deforming pressure to a tubular blank, a plurality of sets of movable dies or forming members adapted to receive and surround said tubular blank, a non-forming spacing member interposed between said sets of forming members, whereby when said deforming pressure is applied the tubular blank will be formed into a plurality of spaced sets of corrugations at one operation.

4. A method of forming resilient walled corrugated tubular elements, which comprises, positioning a tube within a plurality of sets of spaced die members and a spacing blank member therebetween, subjecting the tube to internal fluid pressure and external longitudinal pressure, and collapsing the tube into a corrugated tube having an unformed space between the sets of corrugations.

5. A method of forming resilient walled corrugated tubular elements, which comprises, positioning a tube within a plurality of sets of spaced die members and a spacing blank member therebetween, subjecting the tube to internal fluid pressure and external longitudinal pressure, and collapsing the tube into a corrugated tube having an unformed space between the sets of corrugations, and then cutting the corrugated tube through the unformed zone to form a plurality of individual flexible corrugated tubular elements.

6. A method of forming resilient walled corrugated tubular elements, which comprises, arranging an elongated tubular member within a plurality of sets of spaced movable dies separated by a blank member, subjecting the tubular member to deforming pressure so as to form a plurality of spaced sets of corrugations in the tubular member at one operation and thus forming a plurality of flexible corrugated tubular elements separated by an unformed zone.

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