May 9, 1933. B. J. LINDGREN 1,908,521

METHOD OF BEADING A CYLINDRICAL SHEET METAL SHELL

Filed April 8, 1930 2 Sheets-Sheet 1

Fig. 1.

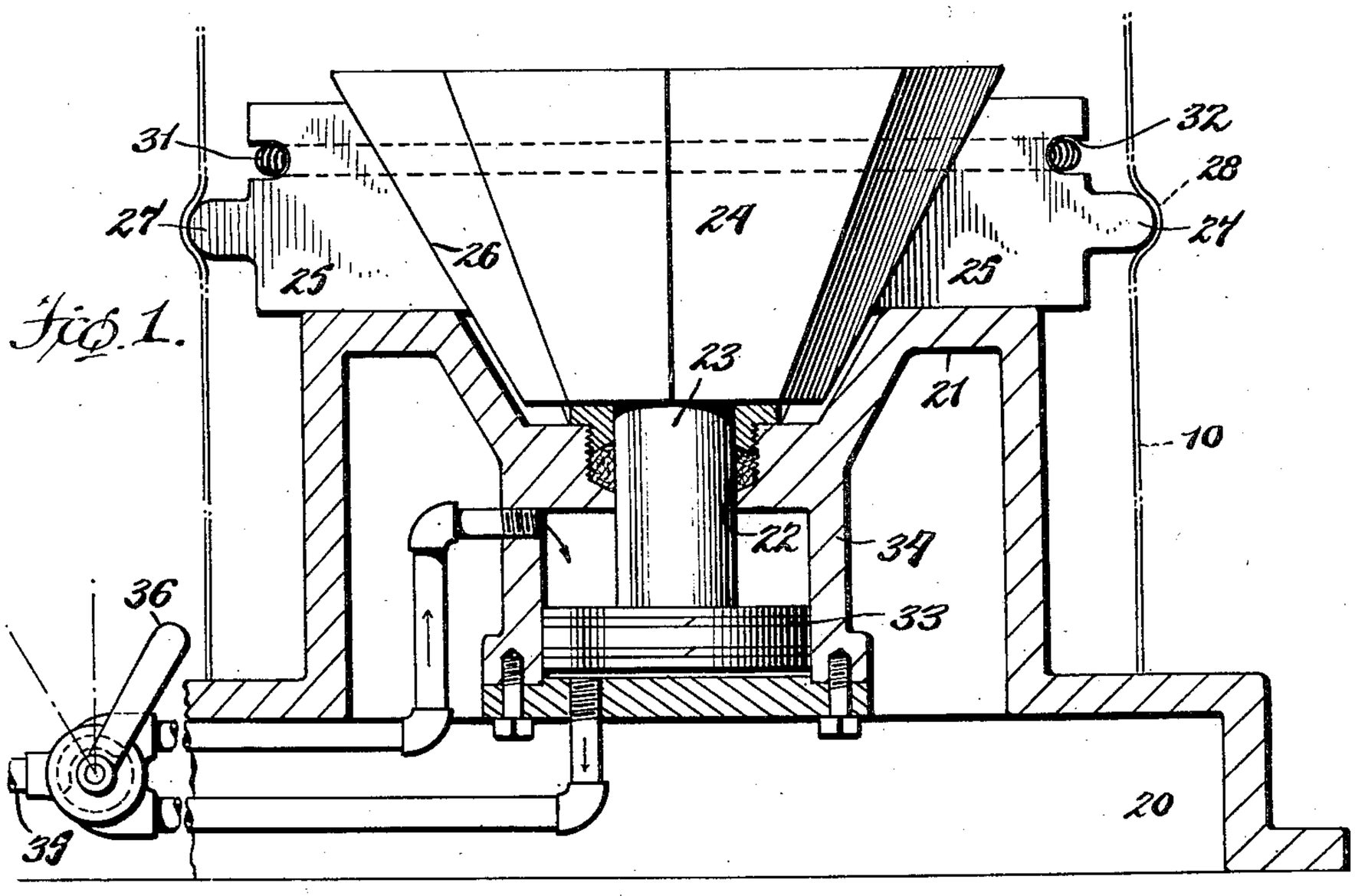
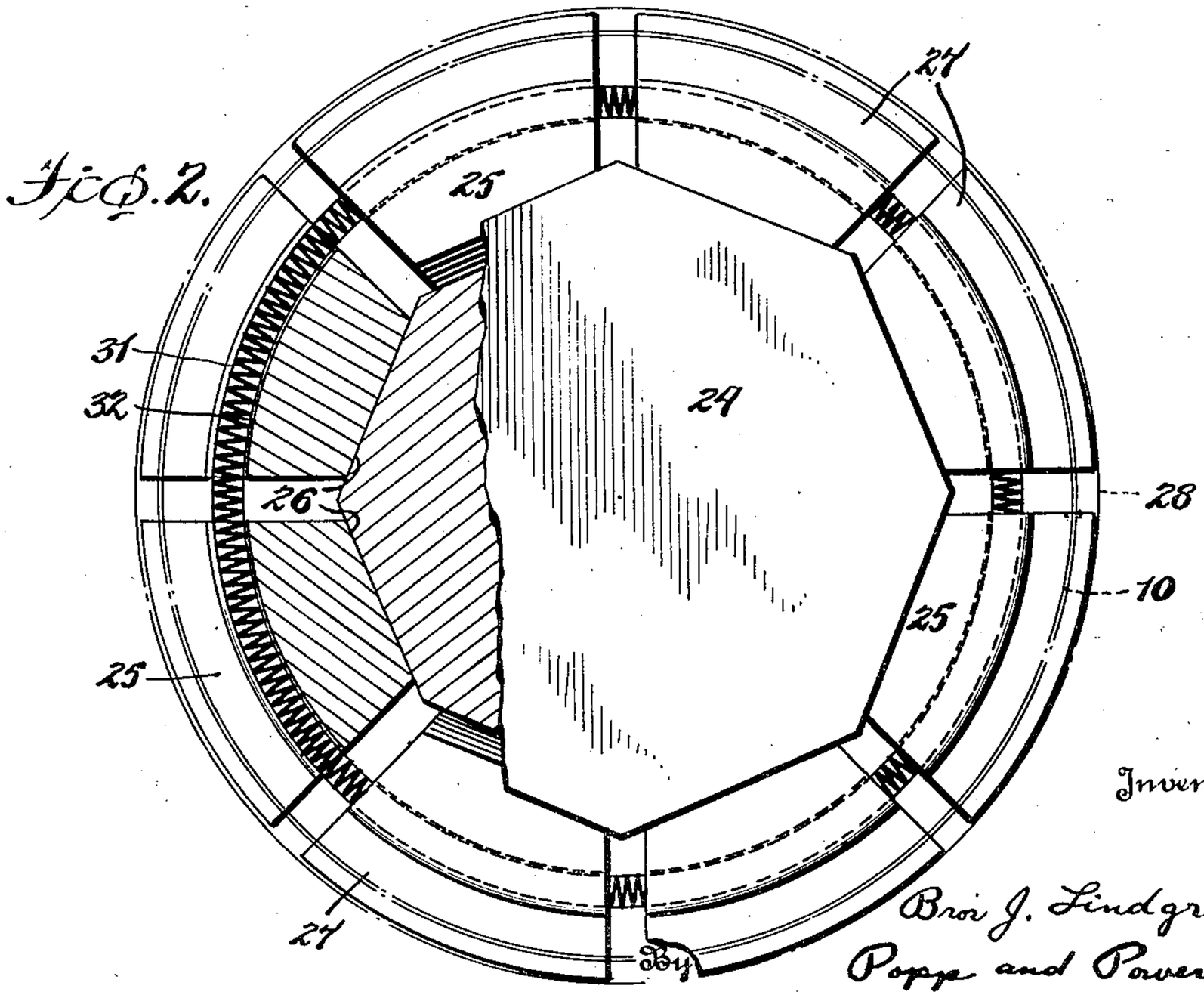


Fig. 2.



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METHOD OF BEADING A CYLINDRICAL SHEET METAL SHELL

Filed April 8, 1930 2 Sheets-Sheet 2

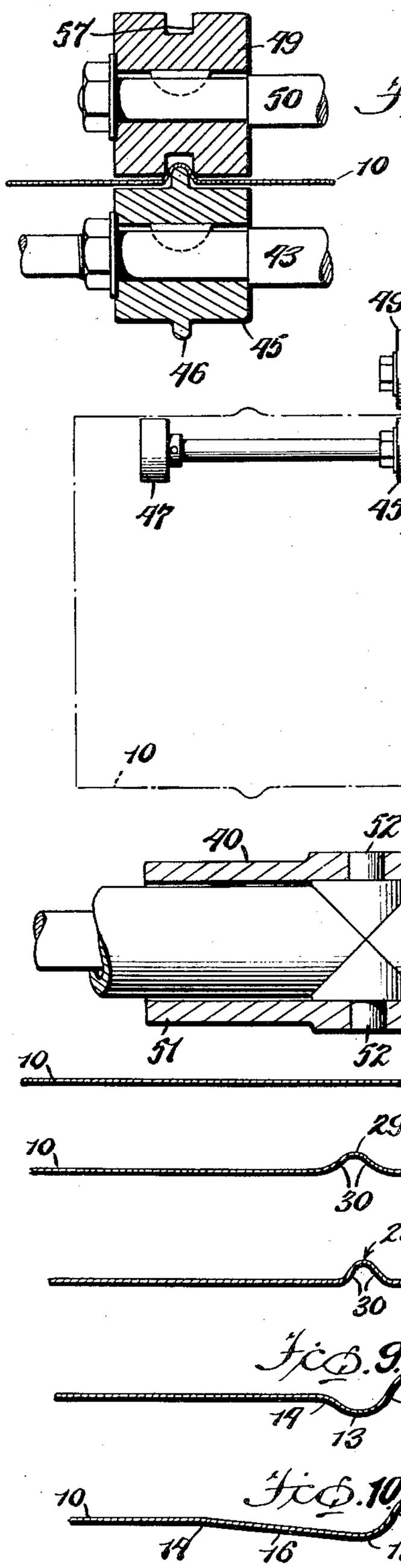

Fig. 4.

Fig. 3

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE

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METHOD OF BEADING A CYLINDRICAL SHEET METAL SHELL

Application filed April 8, 1930. Serial No. 442,558.

This invention relates to a method of beading metal barrels, and more particularly to that type of barrel the shell of which is composed of a cylinder of relatively thin sheet metal which is provided with annular outwardly extending beads, which beads strengthen the shell, round it up, render it easier to roll the same, and form shoulders which make the tipping and handling of the barrel easier.

In the beading of such thin sheet-metal barrel shells as heretofore practiced it has been the custom to roll or form the annular beads in one operation. Beads provided by this previous method had several disadvantages. In the first place the beads by this process could not be rolled to extend more than one-half inch from the body of the barrel shell and this limitation limited the strengthening effect of the beads and also rendered them less useful as rollers in rolling the barrels or as shoulders for grasping or tipping the barrels than if a higher bead could be provided. If the rolling of higher beads were attempted on thin-gage metal barrels according to the prior practice, the metal at the crown of the bead would be drawn so thin that the bead would be dangerously weak and the barrel rendered frail and subject to leakage in use. Another disadvantage of the old practice of rolling the beads in the barrel shell in one operation was that by this method and inward indentation of the barrel body at the sides of the bead was required. Such indentations, whether in the form of abrupt beads or in the form of a gradual rise, provided a catch pocket which would hold back a part of the contents of the barrel being emptied and therefore effect a loss in discharging the contents of each barrel. The beads made according to the prior practice were also limited as to form in that they had to be made in the form of shallow rounded beads having widely flared sides. Beads made on barrel shells in accordance to the present invention can be formed to have abrupt sides which form a stronger bead which imparts greater strength to the barrel shell.

It is therefore the object of the present invention to provide method of beading thin gage barrel shells which, by forming the beads in two operations, avoids the above disadvantages, i. e., will provide beads on a barrel shell in which there is no marked stretching of the metal of the bead, particularly at the crown, and hence permits the bead to be projected outwardly over five-eighths of an inch and still provides a strong bead having uniformly thick walls and crown; avoids the necessity of indenting the barrel shell inwardly at the sides of the beads and thereby avoids the catch-pocket effect of former beaded barrel shells, and provides a bead which can be made with abrupt sides and a small crown thereby greatly increasing the strength and rigidity of the barrel.

In the accompanying drawings:

Figure 1 is a vertical section through a simple form of expanding machine suitable for use in carrying out the first step of the operation of beading a barrel in accordance with the present invention.

Figure 2 is a top plan view thereof partly broken away.

Figure 3 is a vertical section through a simple form of rolling machine suitable for use in carrying out the second step of beading a barrel in accordance with the present invention.

Figure 4 is a vertical section through the male and female forming rolls of the machine shown in Fig. 3, showing the side wall of the bead of a metal barrel shell being drawn together thereby.

Figure 5 is a horizontal section taken on line 5—5, Fig. 3.

Figure 6 is a longitudinal section through the wall of a barrel shell blank.

Figure 7 is a similar view showing the same blank following the first step of the present invention, the blank having a low arched bead expanded outwardly from the shell.

Figure 8 is a similar view showing the same blank after the completion of the final step of the present invention which consists in rolling the bead shown in Fig. 7 to bring its side walls closer together and its crown farther from the barrel shell body.

Figure 9 is a longitudinal section through

a wall of a barrel shell in which the bead has been rolled in one operation in accordance with standard practice.

Figure 10 is a similar view showing another form of bead rolled in a barrel in accordance with standard practice.

Similar reference numerals refer to like parts in each view.

In its general organization this invention comprises a small gage sheet-metal barrel shell having beads which extend outwardly a comparatively great distance from the body of the barrel shell and have a substantially uniform thickness of metal throughout, which beads also have a comparatively small crown and steep sides and which beads are also formed without the usual inward indentations at the sides of the beads by first expanding comparatively broad, shallow rounded beads in the shell and then rolling the shell between rolls which operate to bring the sides of the beads together and shorten the barrel shell and to extend the beads farther from the body of the barrel without further stretching of the metal forming the beads.

In Figures 9 and 10 are illustrated two forms of beads which are rolled in one operation in accordance with standard practice. The bead when rolled in a barrel shell 10 to produce the bead shown in Fig. 9 is shallow and rounded throughout, having a comparatively broad crown 11 and broad sides 12 which slope outwardly at a small angle. The production of this form of bead in one rolling operation requires the production also of a pair of beads 13 at either side of the outwardly extending beads, these beads 13 extending inwardly from the body of the barrel and forming pockets 14. The form of bead shown in Fig. 10 is similar to the form shown in Fig. 7 except that instead of the comparatively abrupt beads 13, each of the inwardly projecting beads 15 have one side in the form of a broad flat wall 16. This form still has a pair of inwardly projecting beads at the sides of each outwardly projecting bead, however, and still forms a catch pocket 14.

With each of the forms of beads formed by a single rolling operation shown in Figs. 9 and 10, the bead must be relatively shallow and cannot be projected outwardly from the barrel a great distance, since the rolling of the bead draws or stretches the metal at the crown 11 of the bead and the farther the bead is projected outwardly, the greater will be the stretching and weakening of the metal at the crown of the bead. Such beads are therefore definitely limited as to the distance they can be extended outwardly. Such beads must also substantially conform to the shape shown and must be of broad, rolling form and hence of less strength, since if it were attempted to roll a bead with abrupt or steep sides, which would of course impart greater rigidity to the barrel shell, the stretching and weakening of the metal at the crown of the bead would be more pronounced. Each of these forms also has the undesirable catch pockets 14 which render draining of the barrel difficult.

The present invention proposes to eliminate these disadvantages by first expanding a broad rounded bead in the barrel shell, which operation does not materially weaken the metal at the crown of the bead, and then subjecting the bead to a rolling operation which draws the sides of the bead together and into abrupt form and at the same time raises the crown of the bead.

The expanding operation is performed by a machine, a simple form if which is shown in Figs. 1 and 2, although the machine shown is purely by way of example of one form suitable for the present purpose. As there shown the expanding machine includes a base 20 which supports the lower edge of the unformed barrel-shell blank 10 and a circular elevated table 21 which projects upwardly into the barrel. Arranged in a vertical central slideway 22 in this table is a rod 23 to the upper end of which is secured an inverted expanding pyramid or cone 24. A plurality of annularly disposed segmental forming and expanding dies 25 are arranged on the table 21 and each is provided with an inner inclined face 26 which engages a corresponding flat face of the inverted pyramid 24 so that when the pyramid is drawn downwardly the expanding or forming dies 25 are moved radially outward in unison. Each of these expanding and forming dies 25 is provided with a horizontal corrugation 27 so that when the several expanding and forming dies are forced outwardly, these corrugations 27 engage the inside of the barrel shell 10 and form a comparatively shallow, rounded bead 28 in the barrel shell. This bead, as shown in Fig. 7, has a broad crown 29 and low, inwardly curved broad sides 30 which join directly with the barrel body and not with an inwardly indented bead, such as with the beads shown in Figs. 9 and 10. The withdrawal or contraction of the expanding or forming dies 25 upon upward movement of the inverted pyramid 24 is effected by a circular spring 31 formed of the usual helical convolutions and lying in an annular groove 32 formed in the outer sides of the group of expanding members 25, this spring yieldingly holding the expanding members against the flat faces of the inverted expanding pyramid 24. The downward and upward movement of this inverted pyramid to expand and contract the forming dies 25 can be effected in any suitable manner, as by a piston 33 connected to the lower end of the rod 23 and arranged in an enclosed cylinder 34 formed in the table 21. Air is alternately admitted to one end of this cylinder from an air pres-

sure line 35, and exhausted from the other end by means of a three-way valve 36.

After the shallow, broad and rounding beads 28, as shown in Fig. 7, are formed on opposite ends of the barrel shell the beads are subjected to a second rolling operation. A simple form of machine suitable for use in this second operation is shown in Fig. 3, although it will be understood that a production machine such as shown in my Patent No. 1,782,994, granted November 25, 1930, can be used. The form of rolling machine shown in Fig. 3 includes a standard 40 having two horizontal arms 41 and 42 arranged one above the other. In the lower of these two arms is journaled a horizontal drive shaft 43 which carries a driving pulley 44 at its rear end and a male forming roll 45 at the outer end of the supporting arm 42. This forming roll is provided with a rounded and relatively high and narrow corrugation 46 and is preferably keyed to the drive shaft 43, and the drive shaft is also preferably extended outwardly beyond the male roll 45 and carries a supporting roll 47 at its outer end. The barrel shell 10 is slipped over the end of the drive shaft 43 onto the two rolls 45 and 47, and to insure the corrugation 46 of the male forming roll 45 entering the corresponding bead 28 in the barrel a gage 48 is provided which is preferably movable along the arm 42 and against which the end of the barrel shell is placed. The corrugation 46 of the male forming roll 45 is sufficiently narrow so that it engages only the crown 29 of the barrel-shell bead 28 and at no time engages the sides 30 thereof.

The upper forming roll 49 is similarly keyed to an upper movable forming-roll shaft 50 which is journaled in a pivoted arm 51. This arm 51 is pivoted within the upper stationary arm 41 by the provision of trunnions 52 on opposite sides of the arm 51 and journaled in suitable bearings formed in the upper fixed arm 41, and is moved downwardly by means of a screw 53 connecting the outer end of the upper fixed arm with the pivoted arm 51. This screw is turned by means of a hand-wheel 54 and the arm 51 returned by means of a helical compression spring 58 which is interposed between this arm 51 and the lower stationary arm 42. At its rear end the upper forming-roll shaft 50 carries a pinion 55 which meshes with an equal-sized pinion 56 on the power or drive shaft 43. By this means both forming rolls 45 and 49 are rotated in opposite directions at the same rate of speed and the barrel shell is revolved therebetween.

The upper or female roll 49 is formed to provide a deep annular groove 57, which groove is arranged above the corrugation 46 of the male forming roll 45 and is provided with straight sides. When therefore, the barrel shell blank 10, formed with a rounding, shallow bead as shown in Fig. 7, is placed in the rolling machine, the corrugation 46 of the male forming roll 45 engages the inside of the crown 29 of the bead 28 and upon turning the hand wheel 54, the female forming roll is screwed down so that the edges or rims of its annular groove 57 engage the side walls 30 of the bead 28. Since the barrel shell is being rotated between the rolls, the groove 57 in the upper forming roll draws together the side walls 30 of the bead 28 and hence extends the crown 29 of the bead 28 farther from the barrel body. The barrel shell is incidentally shortened. This operation which raises the bead 28 and makes the side walls 30 of the bead steeper and hence stronger, is a pure bending action and hence there is no stretching of the crown 29 of the bead during this operation. At the same time there is no tendency to form an inwardly indented bead at each side of each bead 28 such as the beads 13 and 15 in the forms shown in Figs. 9 and 10. Any stretching of the crown 29 occurs during the expanding operation and as this expansion is comparatively slight, the stretching of the metal during this operation is as little or less than the stretching which occurs with the relatively low beads shown in Figs. 7 and 8.

From the foregoing it is apparent that the present invention, by the two-step expanding and rolling process, provides a bead which is raised higher from the body of the barrel than beads heretofore rolled and at the same time there is less weakening of the metal at the crown of the bead through stretching. The bead of the present invention can also be formed to provide abrupt sides which give the bead greater strength, and there is no necessity for providing the undesirable inwardly indented beads at the opposite sides of each outwardly extending bead, which inwardly indented beads form undesirable catch pockets in draining the barrel.

By the term "expanding" as used in the following claims is meant the direct radial displacement of the metal in forming the bead by means of a suitable non-rotating die or dies moved radially of the shell, such as the dies of the expander shown in Figs. 1 and 2, in contradistinction to a rolling operation, such as is performed on the roller shown in Figs. 3–5.

I claim as my invention:

1. The method of beading a cylindrical sheet metal shell which comprises engaging an annular zone of the shell, displacing the said zone radially outward to form a shallow bead while permitting the unrestricted movement of the body of the shell, whereby substantially to prevent thinning of the bead and thereafter displacing the connecting portions between the crown of said bead and the tubular body of the shell toward one another.

2. The method of beading a cylindrical sheet metal shell which comprises first raising a relatively shallow bead exclusively by means of a male forming member applied to one side only thereof and thereafter moving the side walls of said bead toward one another thereby forming a relatively high bead of substantially uniform thickness of metal throughout, and having a small crown and steep sides.

3. The method of beading a cylindrical sheet metal shell which comprises first raising a relatively shallow annular bead exclusively by means of a male forming member applied to one side only thereof and thereafter applying male and female forming members to opposite sides of said bead to draw the side walls of said bead toward one another thereby forming a relatively high bead of substantially uniform thickness of metal throughout, and having a small crown and steep sides.

4. The method of beading a cylindrical sheet metal shell which comprises first raising a relatively shallow annular bead exclusively by means of a plurality of radially movable male expanding dies applied to the inside only of said shell and thereafter rolling the side walls of said bead toward one another thereby forming a relatively high bead having a small crown and steep sides.

In testimony whereof I affix my signature.

BROR J. LINDGREN.