

Dec. 5, 1950

E. F. HULBERT, SR., ET AL

2,532,844

BEADING MACHINE

Filed Jan. 8, 1947

5 Sheets-Sheet 1

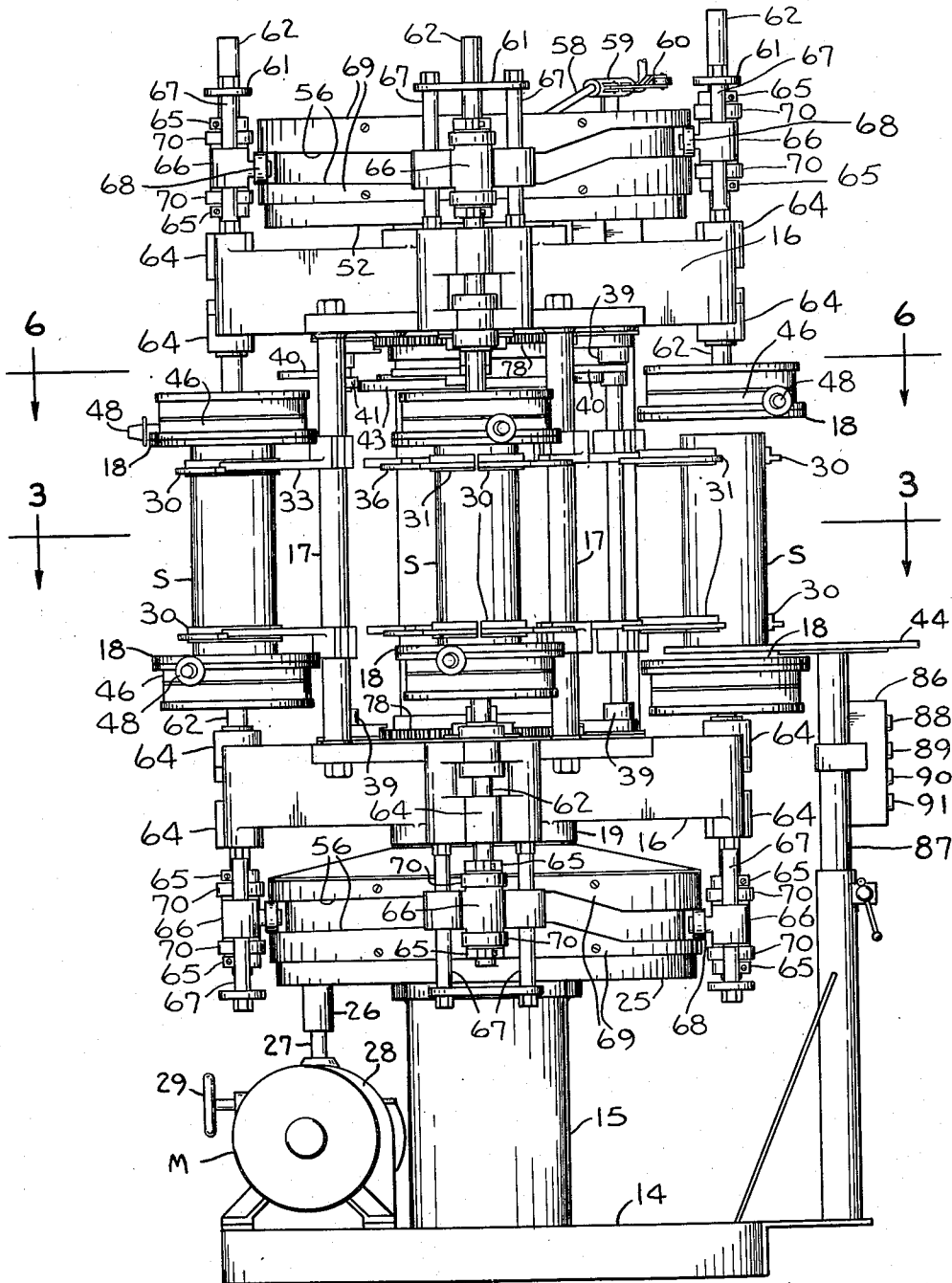


FIG. 1

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5 Sheets-Sheet 2

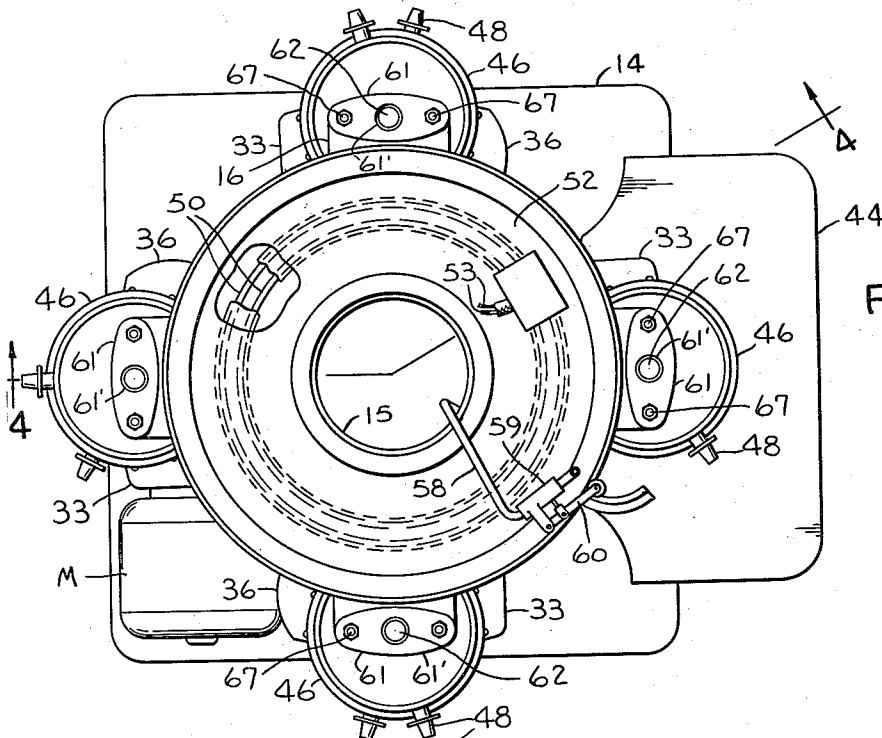


FIG. 2

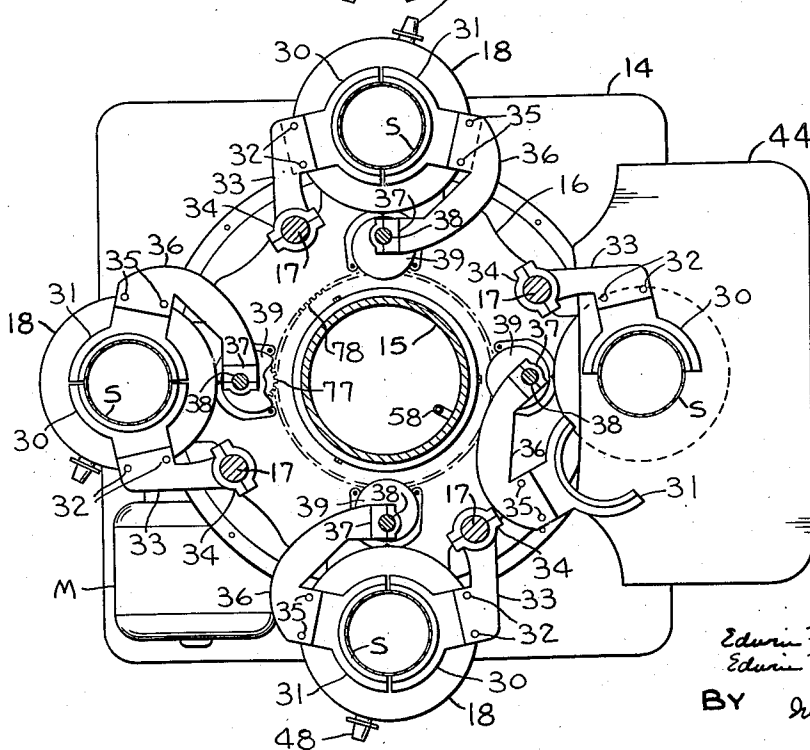


FIG. 3

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5 Sheets-Sheet 3

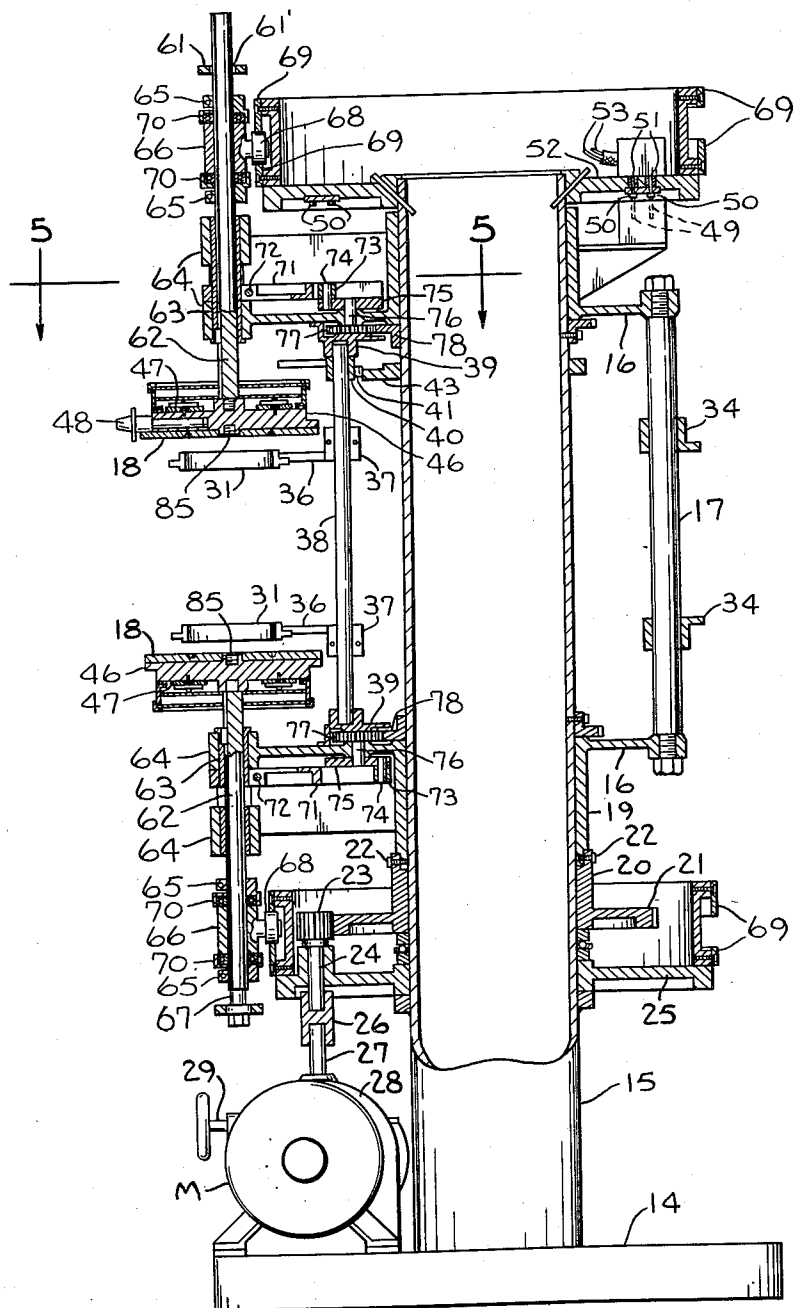


FIG. 4

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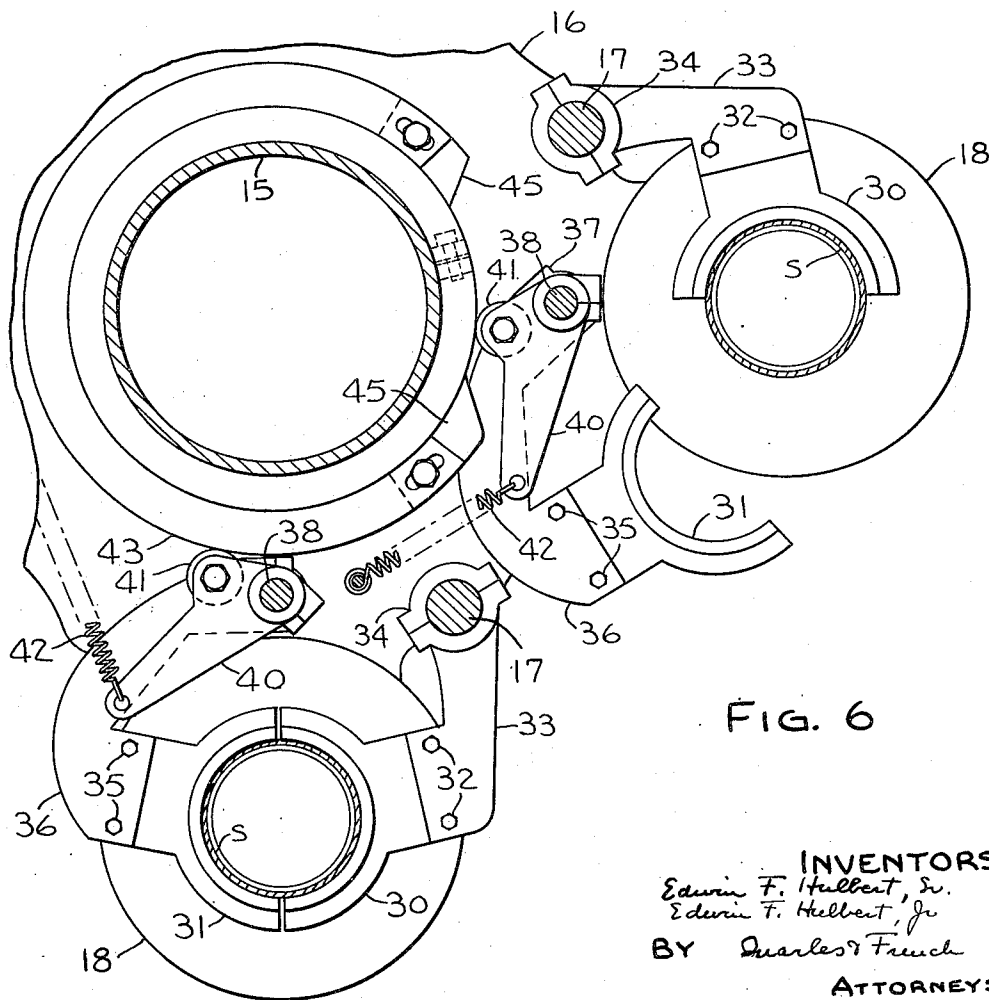
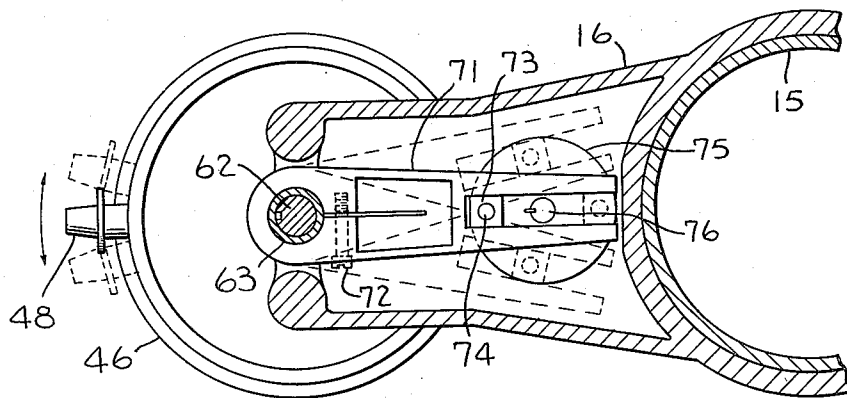
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5 Sheets-Sheet 4



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5 Sheets-Sheet 5

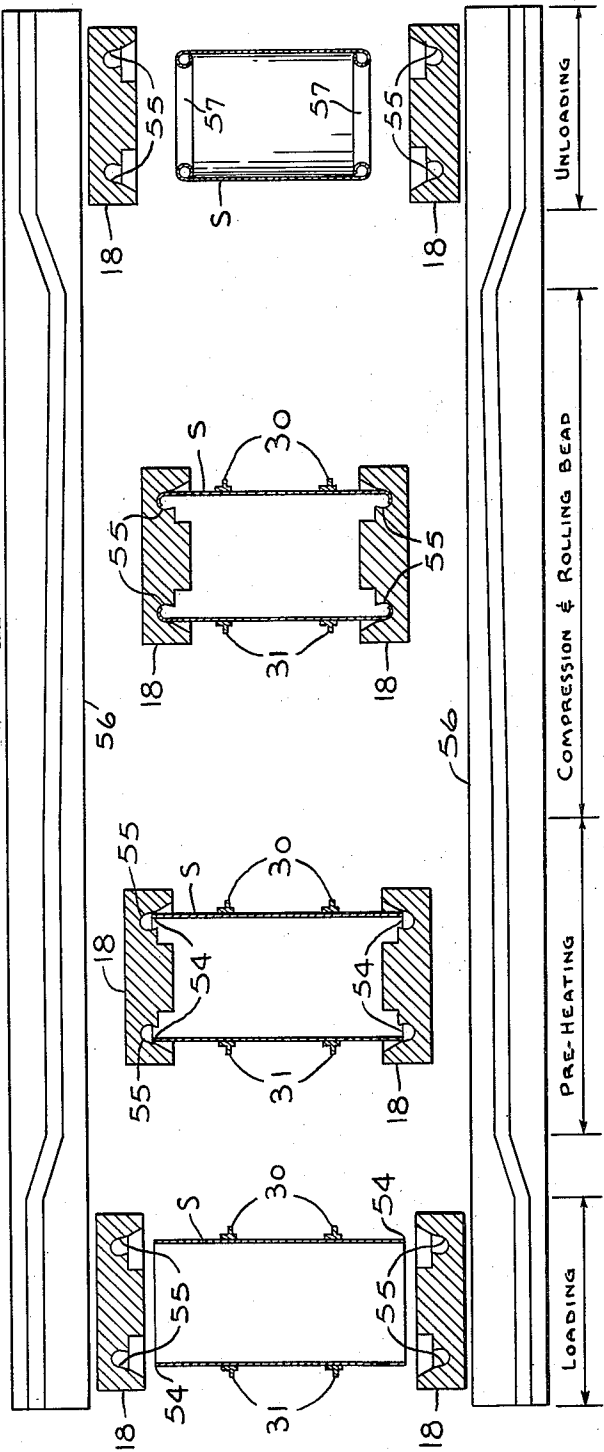


FIG. 7

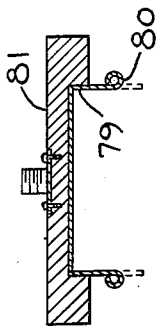


FIG. 8

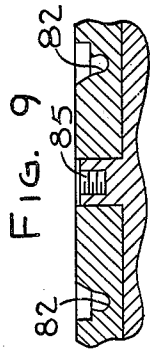


FIG. 9

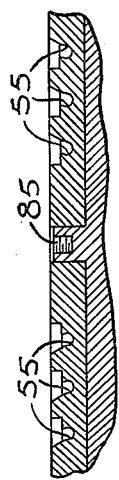


FIG. 10

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UNITED STATES PATENT OFFICE

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BEADING MACHINE

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8 Claims. (Cl. 18—19)

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The invention relates to a machine for beading an edge or edges of cylinders such as are used for the siding and tops of containers made from such plastic sheet materials as plasticized paper or fiber, ethyl cellulose, vinyl acetate, cellulose acetate, cellulose nitrate, and other similar thermoplastic materials.

Heretofore the beading of the edges of tubular shells or cylinders and cylindrically flanged caps or tops has been done by hand which has limited their production and has entailed considerable loss due to the scrapping of imperfect products. One object of the present invention is to provide a machine for automatically forming the beaded edges of cylinders at a high production rate and with little or no spoilage.

A further object of the invention is to provide a beading machine for simultaneously beading the top and bottom edges of a thin walled thermoplastic tubular shell or cylinder, something that it has been heretofore impossible to do by hand.

A further object of the invention is to provide a beading machine in which a thin walled thermoplastic cylinder is first subjected at its end edges to a preheating step and thereafter beaded by the forcing of the preheated edges into the beading recesses of a pair of dies to form a cylinder beaded at both its ends.

A further object of the invention is to provide a beading machine for thin walled thermoplastic cylinder in which the ends of the cylinder are contacted with a pair of heated beading dies to preheat said ends and are then beaded by moving the dies toward each other while said dies are oscillated in opposite directions relative to each other. The oscillation of the bead forming dies results in the production of a uniform bead as it prevents localized heating of the edge, and their oscillation in opposite directions relieves the clamping means of the necessity for tightly holding and possibly deforming the shell during the beading operation.

A further object of the invention is to provide a beading machine capable of beading cylinders having a relatively wide range of thicknesses and heights or lengths.

The invention further consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation view of a bead forming machine embodying the invention;

Fig. 2 is a top plan view of the machine, parts being broken away;

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Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view taken on the broken line 4—4 of Fig. 2;

Fig. 5 is a detailed horizontal sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a detailed horizontal sectional view taken on the line 6—6 of Fig. 1, parts being broken away;

Fig. 7 is a diagrammatic view showing the cycle of operations of the machine and a development of the die movement control cams;

Fig. 8 is a detailed vertical sectional view through a head that may be used on the machine for making covers;

Fig. 9 is a detailed vertical sectional view through a cover beading die;

Fig. 10 is a centering plug for use in cover beading;

Fig. 11 is a vertical sectional view through a die plate provided with a plurality of bead forming grooves.

Referring to the drawings, and particularly to Figs. 1 and 4, the machine includes a base support 14 carrying a fixed pedestal 15, a pair of turrets 16 operatively connected together by the bars 17 and mounted to revolve on said support, means for revolving said turrets, cylinder positioning means mounted on said turrets, one or more heated bead forming dies 18 mounted on said turrets, means for opening and closing said cylinder positioning means, means for moving said dies toward and away from each other, means for oscillating said dies in opposite directions, and means for supplying electric current to the heating units associated with the dies.

Referring to Fig. 4, the lower turret 16 has its hub 19 connected to the hub 20 of a gear 21 by bolts 22, said gear meshing with a drive pinion 23 whose shaft 24 is journaled in a frame member 25 fixed to the pedestal and is connected by a suitable coupling 26 with the output shaft 27 of a suitable manually controlled variable speed transmission unit 28 of known construction driven by an electric motor M and in which the speeds of the shaft 27 are varied by the turning of a control shaft 29.

The cylinder positioning means, except as hereinafter described, comprises a pair of cylinder embracing members 30 and 31 as shown in Figs. 3 and 6, the member 30 being relatively fixed through its bolted connection 32 with an arm 33 adapted to be clamped by a split collar clamp connection 34 to one of the tie bars 17. The member 31 has a bolted connection 35 with an

arm 36 having a split collar clamp connection 37 with one of the oscillatory shafts 38 whose ends are mounted in socketed members 39 secured to the turrets 16. Movement of the shafts 38 is effected in each instance by a crank arm 40 secured to it and carrying roller 41 urged by a spring 42 into engagement with a cam 43 fixedly mounted on the pedestal, see Fig. 4. Thus as the turrets 16 revolve, the members 31 under the action of the cam 43 are opened and closed at appropriate times during each cycle of operation of the machine, these members being open as each forming unit passes by a feed table 44 and being thereafter closed until this unit again comes to said table. The members 30 and 31 through the bolted connections 32 and 35 are interchangeable with other similar members of larger or smaller diameter to accommodate cylindrical stock of different sizes, and the nose portions 45 of the cam 43 are also detachably secured to the body of the cam for interchangeability with other similar nose portions of different lengths to permit said cam to accommodate the different sizes of the members 31.

The drawings show two sets of members 30 and 31 for positioning the tubular stock, but it will be understood that for very short tubular stock only one of these sets of members is necessary, and that for very thin stock a positioning mandrel may be substituted therefor.

Referring to Fig. 4, each die 18 is secured to the face of a hot plate type of heating unit in which a plate 46 is heated by a suitably mounted and insulated electrically heated resistance member 47 which receives current from a terminal 48 connected by conductors (not shown) to contacts or brushes 49 carried by the upper turret and engageable with suitably insulated commutator rings 50 whose terminals 51 are mounted in a top frame member 52 and connected with the current supply wires 53, so that as the turrets revolve, the dies are heated by the hot plates 46. The heating current for the plates 46 is preferably regulated by a manually adjustable thermostat (not shown) in the circuit connections for each plate.

Referring now to Fig. 7, as a pair of heated dies 18 are carried past the table 44, the operator places a piece of tubular stock S to be beaded upon the table and against the curved face or faces of the members 30. Thereafter the members 31 are operated as previously described to move inwardly to the closed position shown in Fig. 6 whereby the stock is accurately centered relative to the dies 18. Shortly thereafter the dies 18 are moved inwardly toward each other to bring the end portions 54 of the edges of the tube into contact with the walls formed by the annular curved recesses 55 of the heated dies, while the same are being oscillated, to preheat the edge portions of the stock for a predetermined period determined by die control cams 56 and the setting of the speed control shaft 29. Thereafter, the dies 18 are moved closer together while being oscillated in opposite directions to force the heated edges of the stock further into the recesses 55 to form the completed beaded edges 57 and then the dies are moved apart, the members 31 are swung away from the material and the beaded product is carried out onto the table 44 as by a blast of air from a pipe 58 provided with a valve 59 operable by a lever 60 which is moved inwardly

by a part 61 of one of the forming units as it passes said lever.

Referring to Figs. 1 and 4, the means for moving the dies 18 toward and away from each other comprises complementary cam operated means for each die. For this purpose each plate 46 carries a centrally disposed vertically extending shaft 62 which is vertically slidably keyed in a sleeve bearing 63 mounted in spaced bosses 64 formed on its turret 16 and which is clamped at its upper end by split collars 65 against lengthwise movement relative to a block or yoke 66 which is vertically slidably mounted on guide rods 67 anchored at one of their ends to the turret and connected together at their opposite ends by the tie plate or part 61 which has an aperture 61' in which the shaft 62 is freely movable. The block or yoke 66 carries a cam roller 68 working in the double faced or grooved stationary control cam 56 whose tracks 69 are interchangeable with other tracks to vary the extent of vertical travel of the roller 68. Ball thrust bearings 70 are interposed between the collars 65 and the yoke 66. With this arrangement as the turrets 16 turn about the pedestal carrying the dies 18 with their shafts 62 and yokes 66 with them, the rollers 68 riding in the cams 56 are moved up and down according to the development of the cams as shown in Fig. 7, thereby moving the dies 18 to accomplish the vertical movement of said dies as previously described.

As shown in Figs. 4 and 5, for oscillating the dies 18 of each unit, each sleeve bearing 63 has a split socket scotch yoke 71 secured to it by a screw 72, and a sliding block 73 is slidably mounted in the arms of said yoke and pivotally connected to a crank pin 74 secured to a crank disk 75 connected to a shaft 76 journaled in the turret 16 and carrying a pinion 77 meshing with a ring gear 78 fixed to the pedestal, so that as the turret revolves, the gear or pinion 77 is revolved relative to the turret, thus turning or oscillating the crank pin and the yoke 71 through the angle shown by the dotted line positions in Fig. 5, and thus oscillating the die carrying shaft 62. The crank pin 74 for the upper die 18 is displaced one hundred eighty degrees from the pin 74 for the lower die as shown in Fig. 4, so that the upper and lower dies oscillate in opposite directions. This has been found to be of considerable importance since by it the tubing does not need to be fixedly clamped in the positioning means which might tend to crush or deform it. Several oscillations are imparted to the dies 18 during each complete cycle of the machine, and their movement relative to the cylinder or shell being treated results in a uniform heating of the edges of the cylinders with the resultant uniform beading thereof.

Thus far the beading of both ends of a cylindrical tube of thermoplastic material has been described, and it will be noted that the beaded edge is turned inwardly of the wall of the tube to form the siding or body portion of a container. Various types of covers may be used with the tubular body so formed, and one of them is shown in Fig. 8 wherein a sheet of thermoplastic material which has previously been drawn in a flanged cover 79 has its lower edge provided with an outwardly turned bead 80. This beading is done in the machine perviously described by substituting for one of the dies 18, preferably the lower die a die 31 which forms an exterior mandrel in which the drawn cover is placed at the loading station of the machine, and during the operation of the machine, the upper die 18 shown in Fig. 9 whose

bead forming recess 82 is formed as shown turns the lower edge of the drawn cover into an outwardly extending bead. Fig. 10 shows a centering mandrel 83 which has a screw shank 84 that may be screwed into a centrally disposed threaded bore 85 in the blocks 46 carrying the dies 18 of this machine and used for positioning the members 30 and 31 during assembly. The thicknesses of the walls of the cylinders or shells which may be handled by the machine above described may be .005" or greater.

A control switch panel 86 is mounted on the vertically adjustable support 87 for the table 44 and is provided with a start push button 88, a stop push button 89, a reverse push button 90, and jog push button 91, each of these buttons operating switches in the circuits associated with the drive motor for the variable speed transmission drive previously described.

Where the members 30 and 31 are used to act as previously noted to position the shells centrally relative to the dies, they may also grip the outside of the shells with a slight pressure which, however, is not sufficient to deform the shells but which will hold the bodies of the shells relatively fixed while the dies 18 oscillate relative thereto in the preheating and bead forming operations. Thus the shell travels in a constant plane during the rotary travel about the pedestal and remains at all times in a fixed position relative to the members 30 and 31.

It is also to be noted that the split clamping collars 65 permit raised manual setting of the dies 18 relative to each other to accommodate varying lengths or heights of tubular shells that may be acted upon by this machine. It will be further noted that the die plate 18 may have a series of concentrically disposed grooves 55 formed therein, so that a single set of die plates accommodates shells of different diameters without the necessity for removing said die plates and substituting others. This is shown in connection with one of the die plates in Fig. 11.

We desire it to be understood that this invention is not to be limited to any particular form or arrangement of parts except in so far as such limitations are included in the claims.

What we claim as our invention is:

1. In a bead forming machine for thermoplastic cylindrical articles, the combination of a bodily movable heated bead forming die, means for positioning an end edge of said article adjacent said die, cam means for moving the die into contact with said end edge for preheating the same for a predetermined period and for further moving the heated die to curl said preheated edge into a bead, and means for oscillating said die during the preheating and bead forming steps.

2. In a bead forming machine for thermoplastic cylinders or shells, the combination of a pair of heated bead forming dies movable toward each other, releaseable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between said dies, cam means for moving said dies into preheating engagement with the ends of said cylinder for a predetermined period and thereafter moving said dies to form beads on said preheated edges, means for oscillating said dies in opposite directions during the preheating and bead forming operations, and power operated means for releasing said clamping means.

3. In a bead forming machine for thermoplastic cylinders or shells, the combination of a pair of heated bead forming dies movable vertically to-

ward each other, releaseable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between said dies, means for moving said dies into preheating engagement with the ends of said cylinder and thereafter moving said dies to form beads on said preheated edges, means for oscillating said dies in opposite directions during the preheating and bead forming operations, vertically spaced rotary turrets for carrying said dies, means for rotating said turrets, a feed and delivery station between said turrets, and power operated means for releasing said clamping means at said station.

4. In a machine for beading cylinders of thermoplastic material, the combination of a vertical support, vertically spaced turrets operatively connected together and mounted to revolve on said support, a forming unit comprising a die carried by and movable vertically relative to each turret, releaseable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between said dies, means operable in cyclic synchronism with said turrets for releasing said clamping means, fixed cams mounted on said support, cam operated members connected with the dies for moving said dies toward and away from each other in conformity with the profile development of the cam, said cam development providing for a loading position of the cylinder, a preheating inward positioning of the dies during which the edges of the cylinder are in contact therewith, a further inward movement of the dies during which beads are formed at opposite edges of said cylinder, and a release position of the dies for the removal of the beaded cylinder, and means for revolving said turrets to effect the above cycle in one revolution of said turrets.

5. In a machine for beading cylinders of thermoplastic material, the combination of a vertical support, vertically spaced turrets operatively connected together and mounted to revolve on said support, a bead forming unit comprising a die carried by and movable vertically relative to each turret, releaseable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between said dies, means operable in cyclic synchronism with said turrets for releasing said clamping means, fixed cams mounted on said support, cam operated members connected with the dies for moving said dies toward and away from each other in conformity with the profile development of the cam, said cam development providing for a loading position of the cylinder, a preheating inward positioning of the dies during which the edges of the cylinder are in contact therewith, a further inward movement of the dies during which beads are formed at opposite edges of said cylinder, and a release position of the dies for the removal of the beaded cylinder, means for revolving said turrets to effect the above cycle in one revolution of said turrets, and means for variably controlling the speed of said turret-revolving means to accommodate the weight, thickness, and size of the cylinders being acted upon.

6. In a machine for beading cylinders or shells of thermoplastic material, the combination of a vertical support, a pair of vertically spaced turrets connected together and rotatably mounted on said support, a shaft movable vertically lengthwise in each associated turret, a heated bead forming die carried by each vertically movable

shaft, releasable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between the dies, means operable in cyclic synchronism with the turrets for releasing said clamping means, cams, members operated by said cams and lengthwise adjustably secured to each of said vertically movable shafts for moving said dies toward and away from each other and for accommodation of such movement to shells of different lengths, means for rotating said turrets at variable speeds, said cams adapted to move said dies into preheating engagement with the end portions of the cylinders and thereafter move the same to form beads on the preheated ends of said cylinders as said turrets revolve.

7. In a machine for beading cylinders or shells of thermoplastic material, the combination of a vertical support, a pair of spaced vertically disposed turrets connected together and rotatably mounted on said support, a shaft movable vertically lengthwise in each associated turret, a heated bead forming die carried by each vertically movable shaft, releasable clamping means engaging the exterior of the cylinder to be treated for positioning and frictionally holding the same between the dies, means operable in cyclic synchronism with the turrets for releasing said clamping means, cams, members operated by said cams and lengthwise adjustably secured to each of said vertically movable shafts for moving said dies toward and away from each other and for accommodation of such movement to shells of different heights, means for rotating said turrets at variable speeds, said cams adapted to move said dies into preheating engagement with the end portions of the cylinders and thereafter move the same to form beads on the preheated ends of said cylinders as said turrets revolve, and means operable through the turning of the turrets for oscillating the shaft of one turret in the

opposite direction to that of the other turret during the preheating and bead forming positions of the dies.

8. In a bead forming machine for thermoplastic cylinders or shells, the combination of a rotary turret, a heated bead forming die carried by the turret and movable lengthwise relative thereto, a fixed cam, means operated by the cam and connected to said die for reciprocating the same as the turret moves relative to said cam, a fixed gear, means carried by the turret and operatively connected to said die and engageable with said gear for oscillating said die during the movement of the turret, means carried by said turret for positioning an end edge of the article to be treated adjacent said die, the movement of said turret relative to said cam acting first to move said die into contact with said end edge for preheating the same and thereafter advancing said die to curl said preheated edge into a bead during a single cycle of movement of said turret about said cam, said die being oscillated by the means above described during the preheating and forming steps.

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