

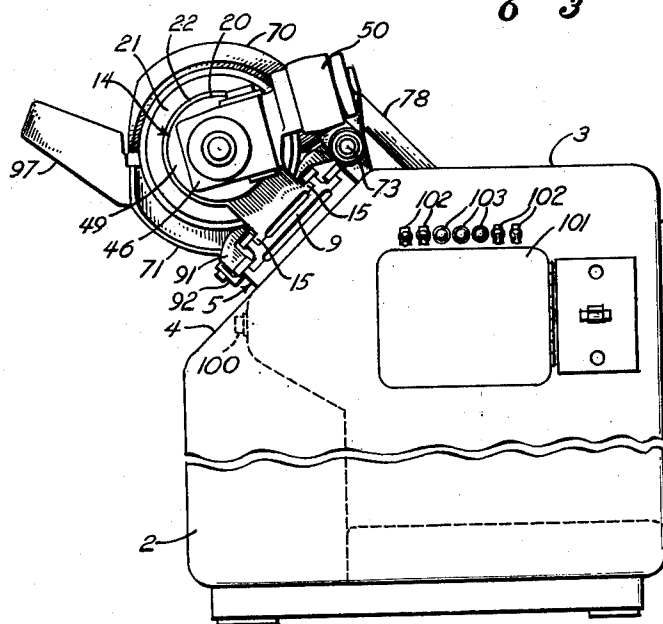
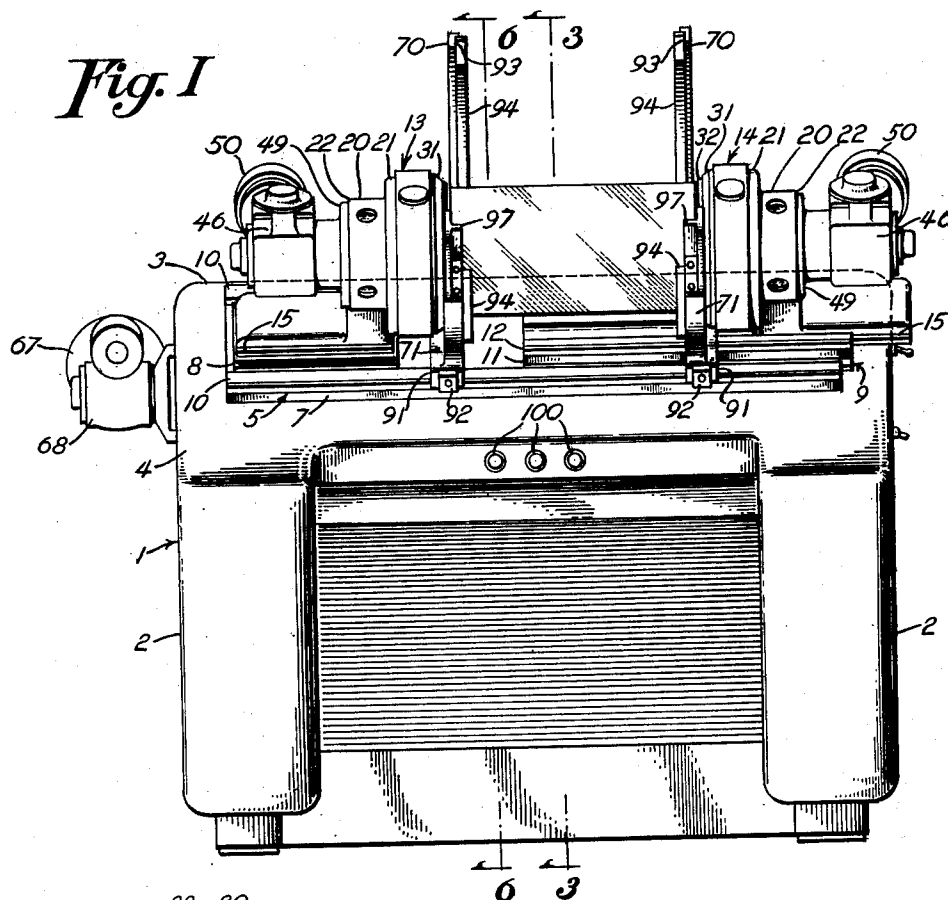
April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 1



INVENTOR
Ralph F. Taber
BY *Alfred T. Smith*
ATTORNEY

April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 2

Fig. 3

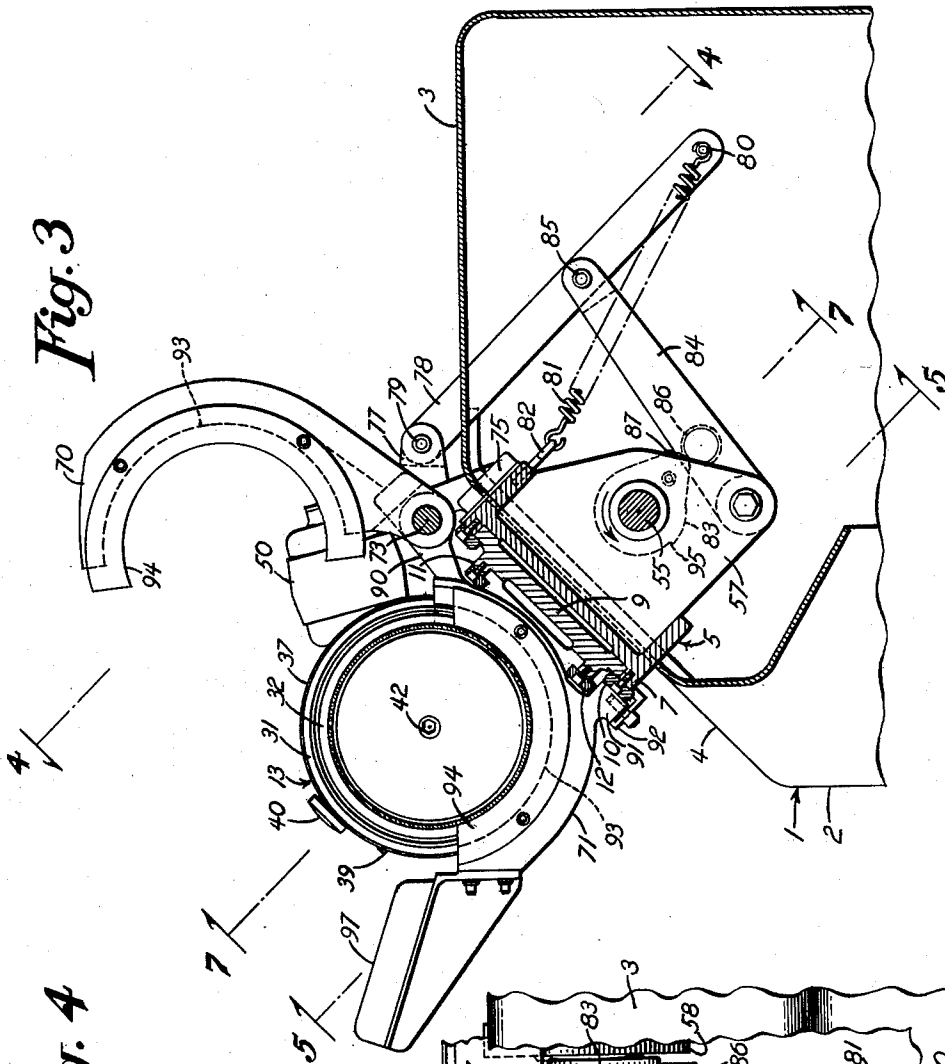
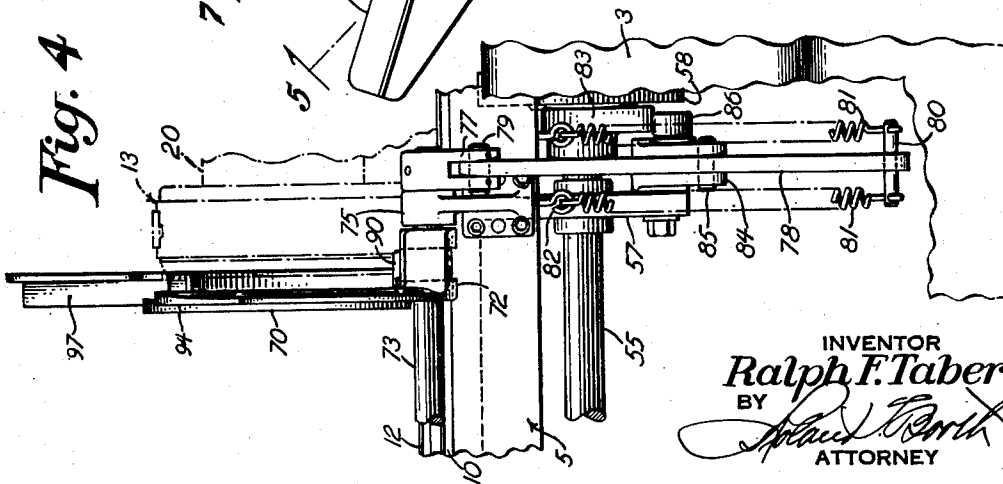


Fig. 4



INVENTOR
Ralph F. Taber
BY *Ralph F. Taber*
ATTORNEY

April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 3

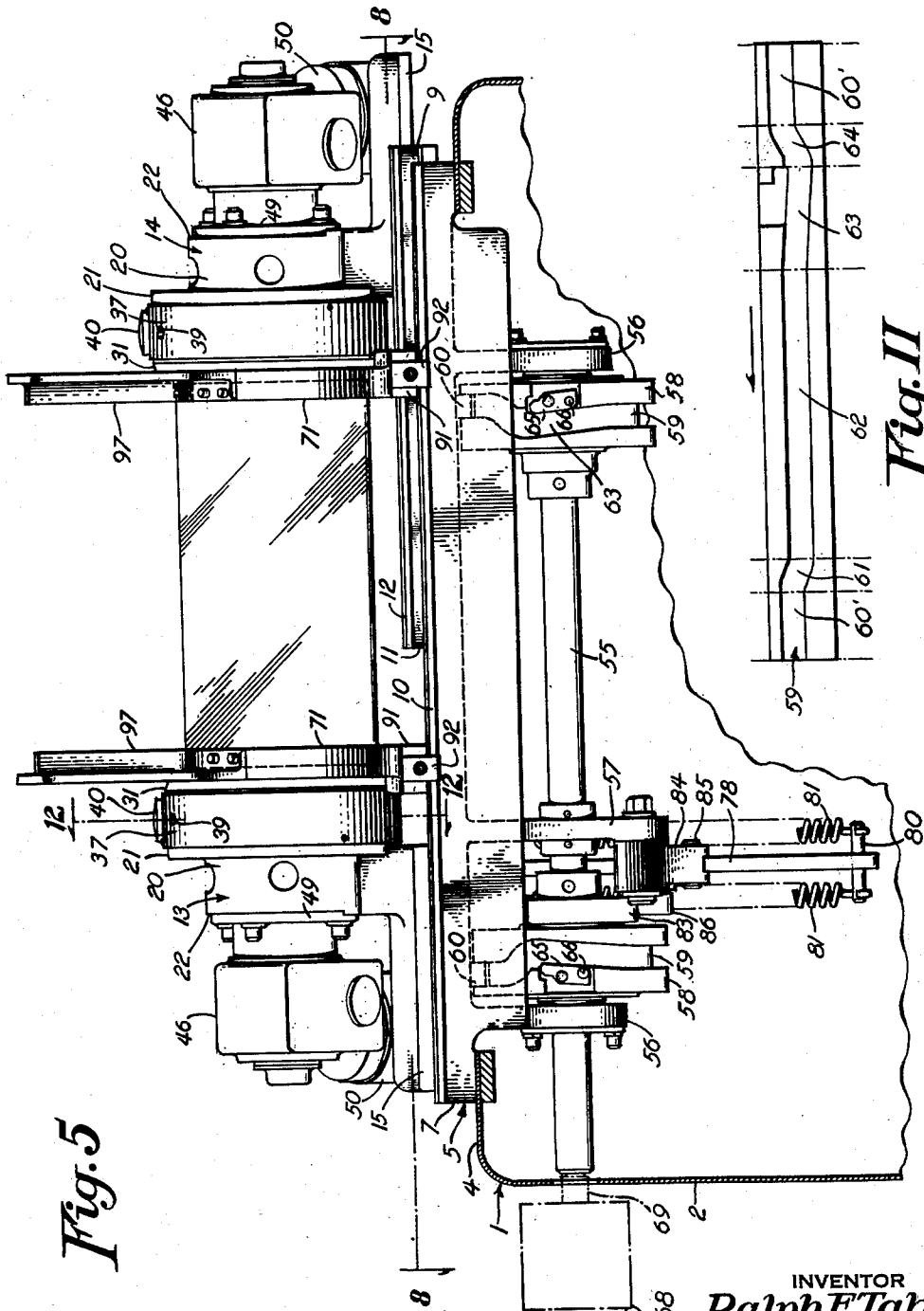


Fig. 5

Fig. II

INVENTOR
Ralph F. Taber
BY *Wm. T. Corix*
ATTORNEY

April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 4

Fig. 7

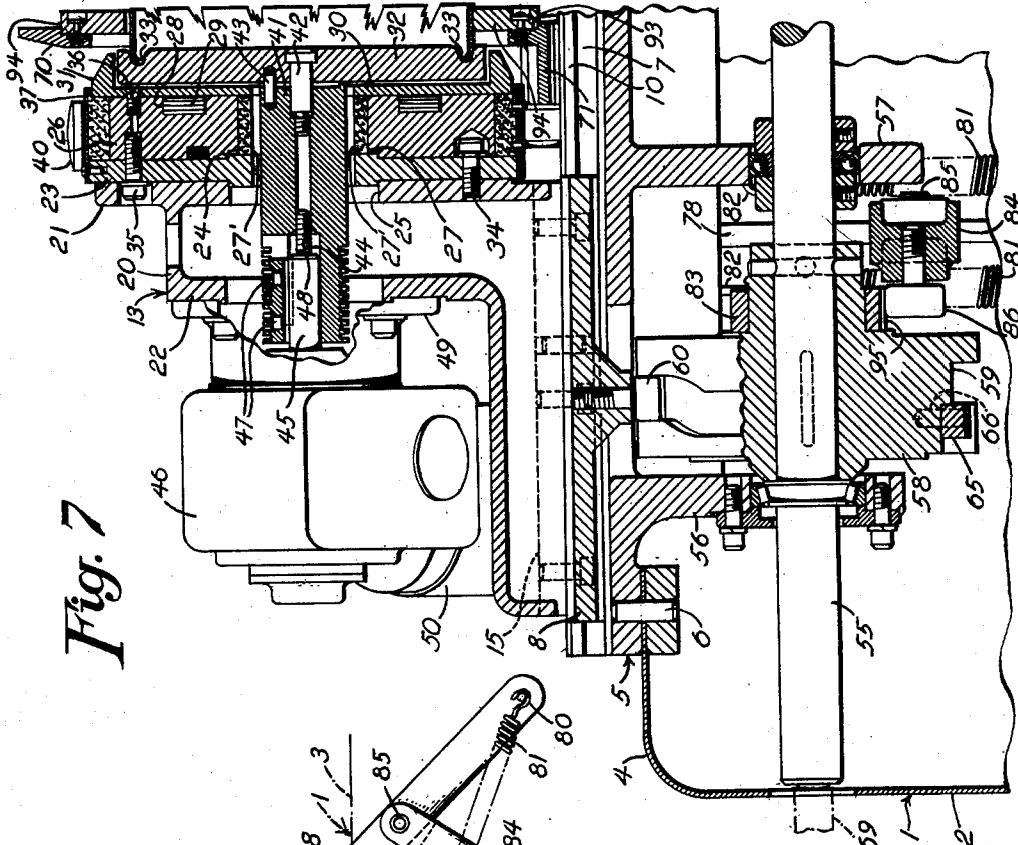


Fig. 6

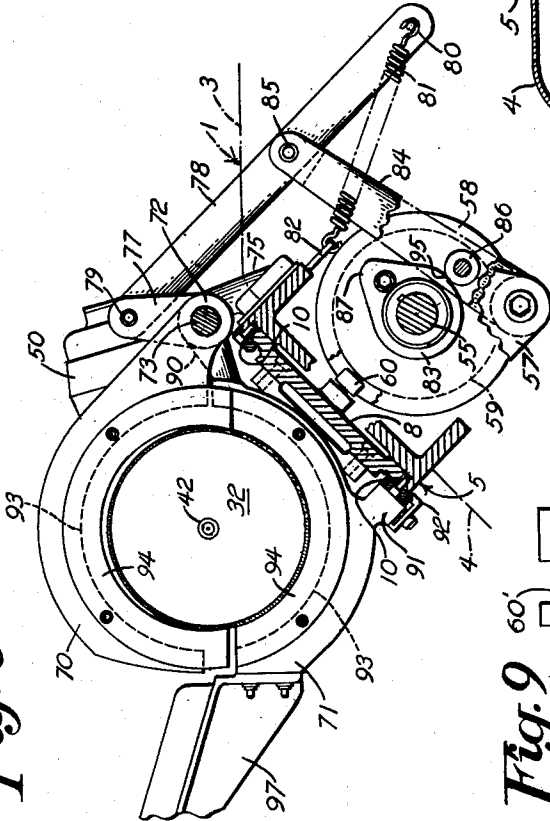


Fig. 9

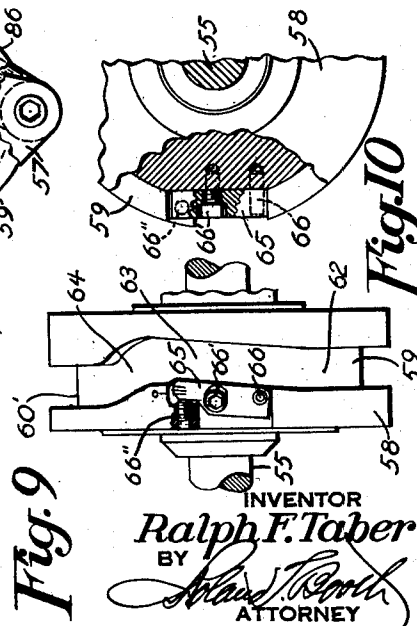


Fig. 10

INVENTOR
Ralph F. Taber
BY
Wm. T. Smith
ATTORNEY

April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 5

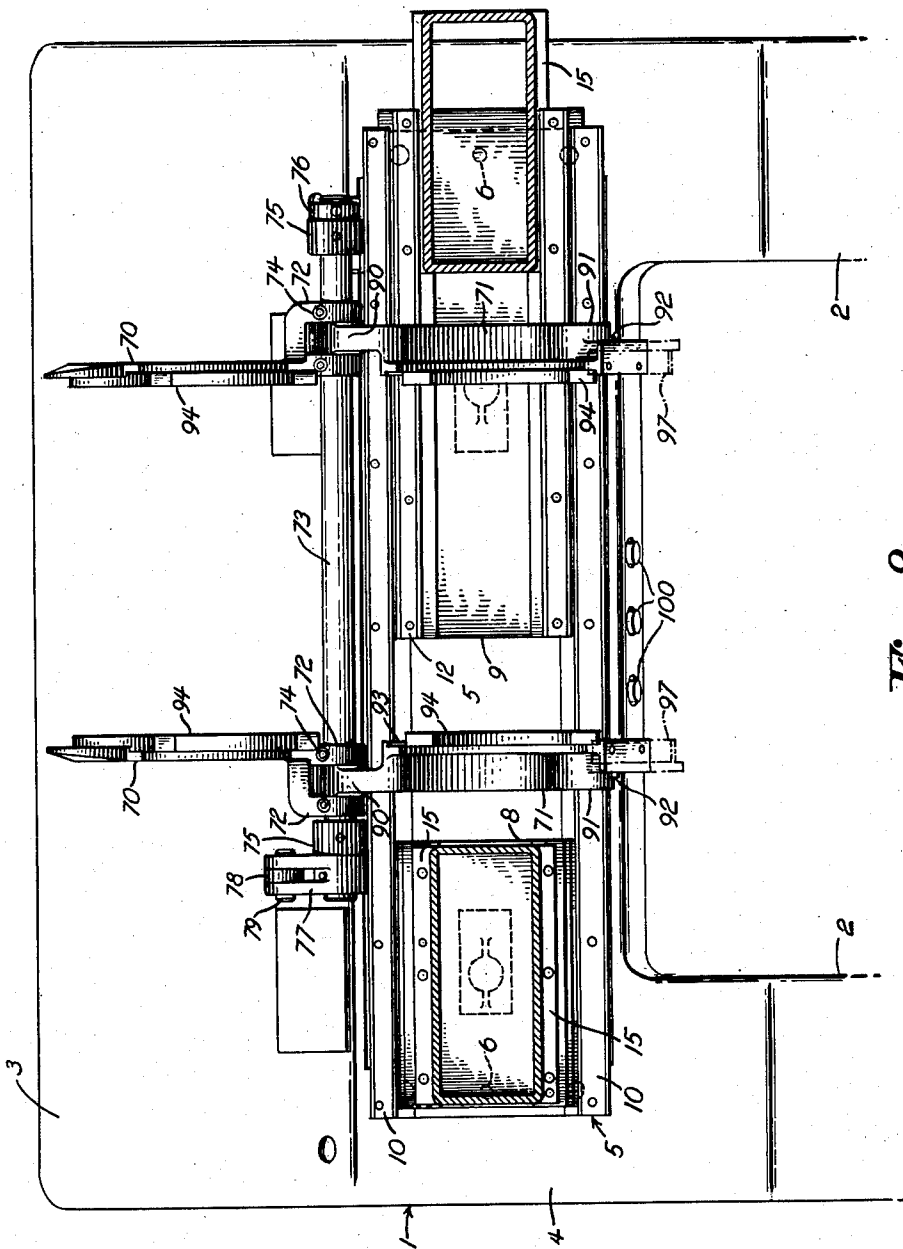


Fig. 8

INVENTOR
Ralph F. Taber
BY *Ralph F. Taber*
ATTORNEY

April 21, 1953

R. F. TABER
METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

2,635,287

Filed Feb. 4, 1950

6 Sheets-Sheet 6

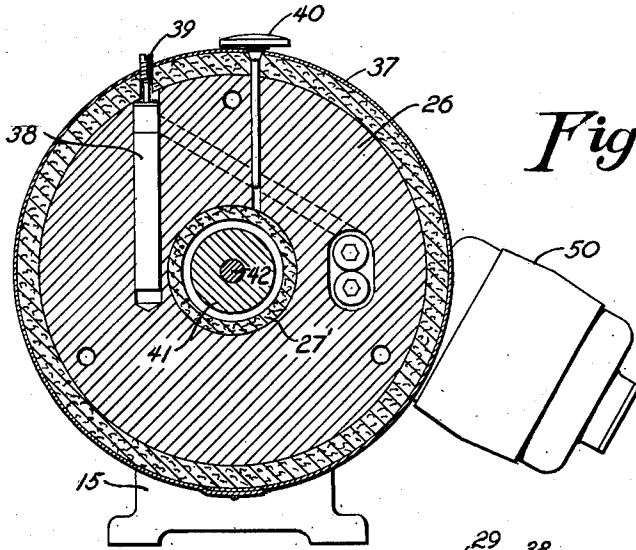
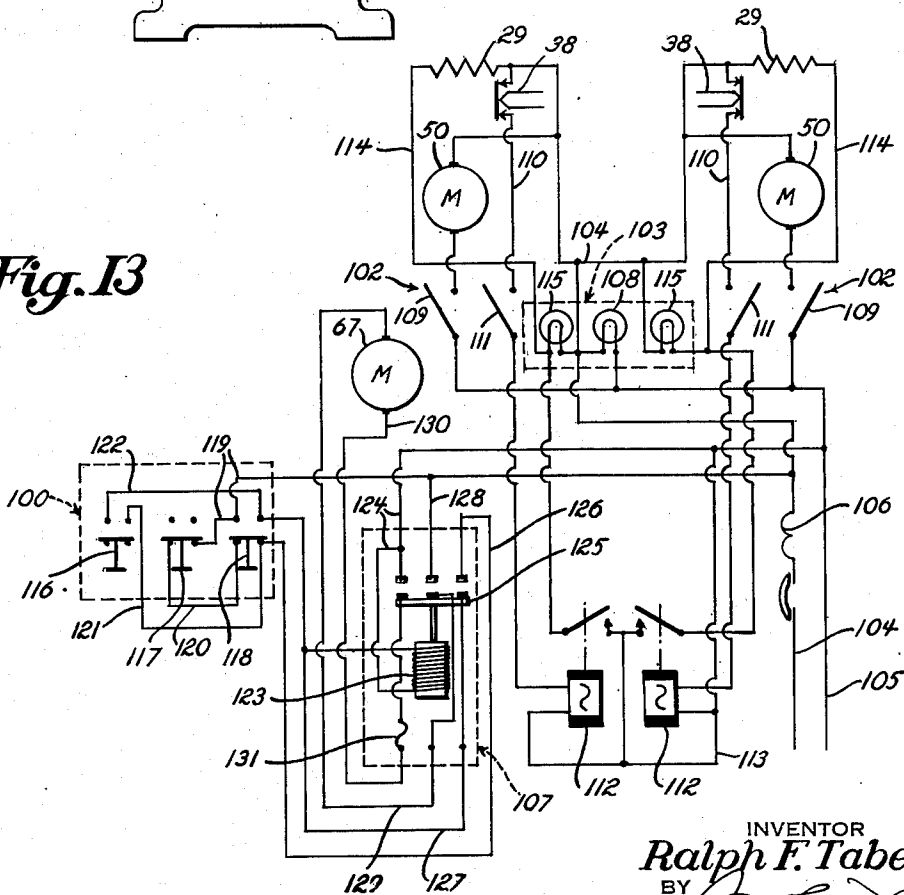


Fig. 12

Fig. 13



INVENTOR
Ralph F. Taber
BY
[Signature]
ATTORNEY

UNITED STATES PATENT OFFICE

2,635,287

METHOD AND MACHINE FOR BEADING
SHEET MATERIAL CYLINDERS

Ralph F. Taber, Buffalo, N. Y., assignor to Taber
Instrument Corporation, North Tonawanda,
N. Y., a corporation of New York

Application February 4, 1950, Serial No. 142,369

13 Claims. (Cl. 18—19)

1

The invention relates to a machine for forming beads on opposite ends of cylinders formed of sheet material, particularly thermo-plastic sheet material, such as Celluloid.

According to the invention, cylinders made of thermo-plastic sheet material, such as Celluloid, are fed into position between a pair of beading dies with the axis of the cylinder and the beading dies in horizontal relation. The dies are positioned in separated relation so that the cylinder will freely engage between the dies and be received and supported by gripping members, one of which is movable into closed position relative to the other for engaging and holding a cylinder in true cylindrical shape. The gripping members frictionally hold the cylinder, lightly at first, while suitable mechanism moves the beading dies together to engage and center the cylinder in the gripping members uniformly between and in contact with the beading dies. Following this preliminary gripping and centering of the cylinder, the gripper members move into full closed position to firmly grip and hold the cylinder in true cylindrical shape as well as in coaxial relation with the beading dies. After an interval of time during which the heated beading dies are engaged with opposite ends of the cylinder for softening the plastic material at the ends by heating for a sufficient length of time, the beading dies are then moved toward each other to turn opposite ends of the cylinder inwardly and back toward the remaining body portion of the cylinder in forming an annular tubular bead on both ends of the cylinder. This gives the cylinder substantial strength and retains it in substantially true cylindrical shape. The beading dies are subsequently moved apart to a starting position for disengaging the beaded cylinder whereupon the gripping members move to the open position with suitable means gripping the cylinder sufficiently to remove it from between the beading dies in the opening movement of the movable gripping member for discharge from the machine.

The invention provides a machine having the heated beading dies rotatably mounted on die heads that are slidably mounted on a bed plate so they may be moved back and forth toward and from each other a limited distance in beading cylinders while the dies are rotated in opposite directions to prevent sticking of the material thereto. A cam shaft mounted on the bed plate carries a plurality of cams that have followers associated therewith for moving slidable die heads toward and from each other in timed relation to the operation of the gripper members by another cam on this shaft. The timing of the operation of the movable gripper member to a partially closed position to grip and align a cylinder between the beading dies with the movement of the dies toward each other to center the

2

cylinder therebetween secures an operation of the machine along with the accurate shaping of the cylinder by the gripping members in the full closed position to accurately align the ends of the cylinder with the beading dies. The mounting of the die heads and the cam shaft on a bed plate provides for the positioning of the cylinder accurately with substantial precision to obtain a uniform beading operation on opposite ends simultaneously. The shaft for mounting the movable gripping members is also mounted on the bed plate and operated by another cam on the cam shaft providing additional means of obtaining accuracy in the beading of cylinders.

The invention provides a machine for handling cylinders of various lengths and for this purpose one of the die heads is adjustably mounted on a slide member slidably mounted on the bed plate. By adjusting the position of the die head on the slide member it may be set for beading cylinders of different lengths while the slide member is connected with the cam on the cam shaft to secure the operation of the die heads and beading dies toward and from each other for the beading operation on opposite ends of a cylinders.

The invention provides a desirable method of beading opposite ends of a cylinder simultaneously wherein a cylinder is positioned horizontally between spaced beading dies, the dies are moved toward each other to engage and center the cylinder therebetween while the cylinder is only lightly gripped so that it can slide through and relative to the gripping members. Then, the movement of the gripping means to tightly grip and hold the cylinder prevents its rotation and firmly holds it in position and in cylindrical shape while the beading dies simultaneously form the beads on opposite ends. This eliminates waste in the manufacture of beaded cylinders and uses the beading dies along with the gripping means to provide for the centering of the cylinder between the dies by first lightly holding the cylinder and then finally tightly holding it in true cylindrical shape while the beading dies form the beads. The gripping means for the cylinders not only holds them in true cylindrical shape and properly aligned between the beading dies, but also provides a means for ejecting finished cylinders in a convenient manner from between the beading dies.

The invention provides a machine wherein all of the essential parts of the mechanism are easily assembled and removed from the bed plate making all parts of the machine readily accessible for adjustment, repair and replacement with the bed plate arranged with its longitudinal dimension in a horizontal position so that cylinders may be fed in a horizontal position into and between the beading dies in a convenient manner, the bed plate being mounted on a suitable base for support of the beading mechanism at a suitable posi-

tion above the floor for convenient manual operation and observation in connection with the feeding and forming of the cylinders in the machine.

In the drawings:

Fig. 1 is a front elevation of the machine built according to the invention showing the movable gripper members in open position.

Fig. 2 is a fragmentary end elevation of the machine looking from the right as shown in Fig. 1.

Fig. 3 is an enlarged transverse fragmentary cross-section taken on line 3—3 of Fig. 1.

Fig. 4 is a fragmentary cross-section taken on line 4—4 of Fig. 3.

Fig. 5 is a longitudinal cross-section taken on line 5—5 of Fig. 3.

Fig. 6 is an enlarged vertical transverse cross-section taken on line 6—6 of Fig. 1, the movable gripping members being shown in preliminary closed position.

Fig. 7 is a transverse cross-section taken on line 7—7 of Fig. 3.

Fig. 8 is a horizontal cross-section taken on line 8—8 of Fig. 5.

Fig. 9 is an enlarged fragmentary detail showing one of the cams for operating the die heads in the beading operation with portions broken away and shown in cross-section to illustrate the mounting and adjustment of the adjustable cam plate for controlling and adjusting the extent of the beading operation.

Fig. 10 is a view of the cam shown in Fig. 9 taken at right angles from the illustration in Fig. 9, with portions broken away and shown in cross-section to illustrate the mounting of the cam plate on the cam member.

Fig. 11 is a diagram of the cam layout.

Fig. 12 is a cross-section through one of the die heads taken on line 12—12 of Fig. 5.

Fig. 13 is a wiring diagram.

The machine has a base generally designated 1, provided at opposite ends with pedestals 2 connected by a top portion having a flat horizontal top wall 3 at the rear and an inclined top wall 4 at the front of the base. Inclined top wall 4 extends horizontally across the base between the ends and is inclined downwardly from the central portion toward the front. A bed plate 5 is mounted on inclined top wall 4 in an elongated aperture formed therein. Bed plate 5 has its longitudinal dimension extending horizontally and is of a length to extend nearly the full length of the base having opposite ends terminating over the pedestals and overlapping inclined top wall 4 at opposite ends. Bed plate 5 is inclined transversely of the base in parallel relation to inclined top wall 4 with the side edges adjacent the edges forming the sides of the aperture in wall 4. Dowel pins 6, Fig. 7, accurately locate the position of bed plate 5 at opposite ends on base 1 for properly aligning all parts carried by base 1 and the bed plate. The bed plate is secured by bolts or other suitable means to inclined top wall 4 at opposite ends to rigidly and detachably mount the bed plate on the base.

The upper face of bed plate 5 has guide ribs 7 projecting upwardly along opposite longitudinal side margins to provide a guide-way extending the full length of bed plate 5 for slidably receiving die head mounting plate 8, see Fig. 6, on one end portion for longitudinal sliding movement. A slide member 9 is slidably mounted on the opposite end of bed plate 5 in the guide-way. Gibs 10 are mounted on the upper edges of guide

ribs 7 with the inner marginal portions extending over the channel formed in bed plate 5 for slidably engaging the upper marginal portions along the side edges of die head mounting plate 8 and slide member 9 for slidably retaining these parts attached to bed plate 5 for relative longitudinal sliding movement.

Slide member 9 is formed on the upper surface along opposite longitudinally extending marginal portions with guide ribs 11, Fig. 3, having gibbs 12 secured to the outer edges thereof to provide guide channels along opposite longitudinal side margins thereof.

A pair of die heads 13 and 14 are of duplicate but opposite construction. Die head 13 is located at the left-hand end of the machine while die head 14 is located at the right-hand end. Each die head has a base portion formed with guide ribs 15 along opposite side edges. The left-hand die head 13 has the base portion with ribs 15 engaged against the upper surface of die mounting plate 8 and rigidly secured thereto by suitable means, such as bolts. The base portion of die head 14 has the guide ribs on opposite side edges slidably engaged between guide ribs 11 on slide member 9 and retained in slidable relation by gibbs 12. Die head 14 is mounted in opposed relation to die head 13 at the right-hand end of the machine for adjustment between opposite ends of slide member 9. This adjustment is for the purpose of changing the distance between the die heads in operating on cylinders of different lengths.

When die head 14 is adjusted to the desired position it may be rigidly secured in position by tightening the screws securing gib 12 to guide ribs 11 of slide member 9. Ribs 11 are formed to have a dimension slightly less than the thickness of ribs 15 to rigidly secure the die head on the slide member when gibbs 12 are tightly secured on the ribs.

The construction of die head mounting plate 8 and slide member 9 is such that when die heads 13 and 14 of duplicate construction are mounted on the mounting plate and slide member respectively, the die heads have guide ribs 15 arranged in coplanar and aligned relation to secure an alignment of the beading units in a manner that will be hereinafter described.

Each of the die heads has an annular housing 20 projecting upwardly from the base portion formed to provide spaced parallel supporting plates 21 and 22 respectively, extending in perpendicular relation to the base portion and bed plate 5. Supporting plates 21 of each die head 13 and 14 face each other in opposed spaced parallel relation. Plates 21 and 22 are joined by a partially cylindrical portion 20 to form a rigid head structure. Beading die assemblies are mounted on the opposed faces of supporting plates 21 and the description of one will suffice for both.

Each beading die assembly includes an insulating plate 23 of suitable material that is non-conductive to heat. Insulating plate 23 is of annular form and has a central aperture and annular shoulders 24, one of which has seating engagement in aperture 25 in supporting plate 21. Plate 22 has an aperture aligned with aperture 25, as shown in Fig. 7. A cylindrical die body 26 has a central aperture and a recessed portion in one face about the aperture to form a positioning shoulder 27 for engagement with annular shoulder 24 on the opposite face of insulating plate 23. This positioning shoulder 27

5

engaging shoulder 24 accurately aligns die body 26 with insulating plate 23 and supporting plates 21 and 22 so that the apertures in the several parts are in coaxial relation, as shown in Fig. 7. The aperture in the center portion of die body 26 is larger in size than the aperture in insulating plate 23 for receiving an insulating sleeve 27'. The face of die body 26 opposite to that engaged with insulating plate 23 is formed with an annular groove 28 for receiving and mounting an electrical heating element 29 therein having the outer face flush with the face of die body 26. Die body 26 may be formed of suitable metal, such as aluminum, that has good heat absorbing and conducting qualities so that the heating element in groove 28 can uniformly heat the die body and transfer the heat to cover plate 30.

Cover plate 30 is of annular form and has one face engaged with the face of die body 26 opposite that engaged with insulator plate 23. Cover plate 30 is of larger size than die body 26 and slightly smaller than the size of insulating plate 23. Cover plate 30 has an annular flange 31 projecting laterally from the outer marginal portion thereof to form a housing for receiving and enclosing annular beading die 32. Beading die 32 is in the form of a disc having the inner face formed with an annular beading groove 33 of suitable shape for forming an annular tubular bead on the end of a sheet material cylinder of thermo-plastic sheet material, such as Celluloid. The bead may be formed by turning the sheet material inwardly or outwardly into tubular form relative to the body of the cylinder.

Insulating plate 23 is detachably secured to supporting plate 21 in any suitable manner such as by bolts, one of which is indicated at 34 in Fig. 7. Die body 26 is recessed for receiving the heads of bolts 34. Insulating plate 23 is formed with a series of apertures for receiving assembly bolts or screws 35 having the heads engaged in apertures in supporting plate 21, as shown in Fig. 7, while the shanks threadedly engage in threaded sockets in die body 26. Flat-head screws 36 secure cover plate 30 in assembled relation on die body 26 by having the threaded ends of the screws engage in threaded sockets in die body 26 aligned with the threaded sockets receiving screws 35. Suitable insulating material is engaged about the periphery of die body 26 as shown in Fig. 7, and is retained in position by an annular cover band 37 having one marginal portion thereof secured to the periphery of insulating plate 23 in a suitable manner.

Annular heating element 29 is a conventional form of electrical heating element. It is connected to a suitable source of current supply through lead-in wires, not shown, that extend through die body 26, insulating plate 23 and into housing 20 between plates 21 and 22. The lead-in wires are then extended into the base and connected to suitable control panel contacts. A conventional form of thermostat control is provided for maintaining the temperature of heating element 29, die body 26 and beading die 32 substantially uniform and at the desired temperature. For this purpose the conventional thermostat control 38, Fig. 12, is mounted in a recess in die body 26 extending inwardly from the periphery thereof immediately in the rear of annular groove 28 and heating element 29. This thermostat control has an adjusting screw 39 for varying the temperature at which the control operates. Adjusting screw 39 projects through an aperture in cover band 37 so as to be

6

readily available for adjustment. A conventional thermometer 40 is also mounted on the die assembly with a heat sensitive portion projecting into a recess formed in die body 26 extending inwardly from the outer periphery thereof adjacent to annular heating element 29. It will be obvious that by adjusting screw 39 of thermostat control 38 the temperature can be varied as read on thermometer 40 to secure the operation of the beading die at a desired temperature.

Beading die 32 is rotatably mounted in cover plate 30 with one face in close but spaced relation to the outer face of plate 30 while the opposite face is formed with annular beading groove 33. Beading die 32 is mounted in coaxial relation to cover plate 30, die body 26 and insulating plate 23. The periphery of beading die 32 is covered by annular flange 31 on cover plate 30 and prevents accidental contact with die 32 and directs the heat toward the die. Beading die 32 is mounted on the end of beading shaft 41 by means of a suitable bolt 42 and retained thereon against relative rotation by pin 43 engaging in aligned sockets in beading die 32 and shaft 41, as shown in Fig. 7. The opposite end of beading shaft 41 is formed with a plurality of ribs for radiating heat to reduce the temperature thereof at the opposite end while an axial socket 44 is formed therein to receive the end of stub shaft 45 of a conventional speed reducing unit 46. Set screws 47 threaded in the end of shaft 44 in radial relation provide means for firmly securing beading shaft 41 in coaxial relation on stub shaft 45 for rotatably mounting beading die 32 in the die head. The spacing of the face of beading die 32 relative to cover plate 30 may be varied by adjusting set screw 48. Stub shaft 45 and beading shaft 41 may have a key-way formed therein to receive a key for preventing relative rotation between the two shafts when they are rigidly secured together by set screws 47. Any other suitable conventional means for rigidly mounting and securing the shafts together may be used if desired.

Speed reducing unit 46 has a housing formed with an annular flange 49 engaged with a shouldered portion on supporting plate 22 about the aperture therein axially aligning shaft 45 with the die head assembly, as shown in Fig. 7. Bolts or other suitable means secure the speed reducing unit to supporting plate 22 in a convenient manner. A conventional electric motor 50 is mounted on speed reducing unit 46 for rotating beading die 32. Each die head has the beading die driven by a separate motor and speed reducing unit. It is well known that conventional speed reducing units having adjustable means for varying the speed are available so that adjustment of the speed reducing units on die heads 13 and 14 can be made to secure rotation of beading dies 32 at the same uniform speed. In the present structure the beading dies are rotated in opposite directions at a substantially uniform speed. Beading dies 32 are removable from beading shaft 41 so that they may be replaced with similar dies having beading grooves of different diameter formed therein for beading operations on cylinders of different size as well as for producing beads of different size, shape and amount of material formed into the bead.

Die heads 13 and 14 with the assembled beading dies are reciprocated back and forth in opposed coaxial relation to each other by slidable movement of die head supporting plate 8 and slide member 9 on bed plate 5. The mechanism for sliding supporting plate 8 and slide member

7

9 on bed plate 5 is mounted on the underside of the bed plate. A cam shaft 55 has opposite end portions rotatably mounted in suitable roller thrust bearings mounted in bearing plates 56 depending from opposite end portions of bed plate 5. An intermediate bearing plate 57 rigidly formed on bed plate 5 in spaced parallel relation to bearing plates 56 also supports an intermediate portion of cam shaft 55 in ball bearings, as illustrated in Fig. 7. The ball and roller bearing mountings used for cam shaft 55 are of conventional form sufficient to freely and rotatably mount cam shaft 55 and retain it against endwise movement relative to bed plate 5.

Die head operating cams 58, one for each die head, formed in duplicate but opposite relation, are mounted on the opposite end portions of cam shaft 55 adjacent bearing plates 56. Each cam 58 has the cylindrical periphery formed with an annular cam groove 59 for receiving cam follower 60, Fig. 7, in the form of a roller mounted on a stub shaft secured to supporting plate 8 for die head 13 and to slide member 9 for die head 14. Cam groove 59 is formed in the periphery of each cam 58 for moving the die heads on bed plate 5 longitudinally back and forth between outwardly spaced inoperative position and inward movement from this position into centering, heating and beading positions. These positions are determined and fixed by the shape and position of cam groove 59 on the periphery of cam 58, as illustrated in the cam layout diagram in Fig. 11.

The cam follower will engage in the outermost portion of cam groove 59 in each cam 58 when the die heads are moved to their greatest spaced relation and to their inoperative position, as indicated by the numeral 60' in Fig. 11. With the cam rotating in the direction of the arrow, as shown in Fig. 11, and in a counter-clockwise direction, as shown in Figs. 3 and 6, follower 60 will travel through portions 60' when the die heads are in their inoperative spaced apart relation. As operating cams 58 rotate in the direction of the arrow, the follower will engage inclined portion 61 of cam groove 59 in each cam, as shown in Fig. 11, for moving the die heads toward each other in coaxial relation. This movement moves the die heads toward each other sufficiently to engage and center the sheet material cylinder to be formed between the die heads so that the ends will engage in the outer portions of annular beading grooves 33 in beading dies 32.

The cam follower will then travel in the portion 52 of the cam groove, as shown in Fig. 11, during which time the heat of beading dies 32 will heat opposite end portions of a cylinder to be formed so the material will be softened for easy formation into tubular beads. When the material is preheated to the desired extent, the cams are rotated so that the cam follower will engage in the angular bead forming portions 63 of cam grooves 59. As the cam followers are moved through the portions 63 of operating cams 58 the die heads and beading dies will be moved toward each other to cause the ends of the heated and softened sheet material cylinder to be simultaneously formed either inwardly or outwardly into tubular annular beads on opposite ends of the cylinder. When the formation of the beads is completed the follower engages in the return angular portion 64, as shown in Fig. 11 of cam groove 59, whereupon the die heads are moved apart to their inoperative positions in which the follower engages again in portion 60' of cam

8

groove 59 in each of the operating cams 58. As clearly shown in the drawing the movement of die heads 13 and 14 and beading dies 32 is in opposed relation toward and from each other in uniform timed relation.

Each of the operating cams 58 has the outer peripheral portion recessed to receive cam plate 65 adjustably mounted at the outer side of cam groove 59 in the angular bead forming portion 63, see Figs. 9 and 10. Adjustable cam plate 65 is pivoted in a recess in cam 58 at the leading end relative to portion 63 of the cam groove on pin 66. A locking bolt 66' extends radially through a slot in the central portion of cam plate 65 for limiting pivotal movement on pin 66 and rigidly retaining the cam plate in adjusted position. Cam plate 65 is adapted to have its position changed slightly so as to control the extent of the beading operation on a cylinder. By adjusting the position of cam plate 65 of each operating cam 58, the end of a sheet material cylinder can have the edge curved inwardly to form a greater or smaller amount of each end of a sheet material cylinder into a tubular bead. An adjusting screw 66'', Fig. 9, controls the adjusted position of cam plate 65 in cooperation with bolt 66'. Varying the amount of material formed into the bead provides a means of obtaining greater stiffness in the bead as the amount of the material is increased for retaining the cylindrical shape. It also provides for adjustment to form a sufficient amount of material into the bead to compensate for minor variations in the length of the cylinder. It will be noted that cam plate 65 is positioned so that its following end extends to the end of the inclined slot 63 providing the maximum movement of beading dies 32 toward each other in the completion of the beading operation. As soon as the followers 60 become disengaged from cam plate 65 they will move into the return portions 64 of cam grooves 59 so that operating cams 58 will move the heads apart into the inoperative position.

Cam shaft 55 is driven by a suitable electric motor 67 mounted on a speed reducing unit 68 having a flange portion secured to base 1 at the outer side of left-hand pedestal 2, as shown in Fig. 1, with a stub shaft extending through an aperture in the pedestal wall in axially aligned relation with cam shaft 55. This stub shaft is shown at 69 in Fig. 5, and has the end of the shaft engaged in a socket with a key-way, splined or other suitable connection for positively driving cam shaft 55 in the rotation of stub shaft 69. Speed reducing unit 68 is of the same character as unit 46, is of conventional form and preferably has suitable conventional means for adjusting the speed reduction to change the speed of stub shaft 69 so that its speed may be timed to obtain the desired speed of sliding movement of die heads 13 and 14 toward each other in beading cylinders.

Means is provided for guiding, gripping, centering and holding sheet material cylinders in position between the beading dies in true cylindrical form so that when opposite ends of the cylinders are beaded they will retain a substantially true cylindrical shape. For this purpose suitable gripping members are provided, two pairs being shown in the drawings, each pair including a movable gripping member 70 and a stationary gripping member 71. Each movable gripping member 70 has a bifurcated projection 72 on the rear end thereof formed with aligned apertures for slidably receiving gripper operating shaft 73 in transverse relation. Locking members 74 of

a suitable character, such as screws, are mounted on bifurcated projection 72 at opposite sides of the bifurcation, as shown in Fig. 8, operable for rigidly securing movable gripping members 70 in adjusted position both lengthwise and radially on gripper operating shaft 73 for movement in the rotation of said shaft.

Opposite ends of shaft 73 are rotatably mounted in bearing brackets 75 secured on the rear side of bed plate 5 at opposite end portions thereof, as clearly shown in Fig. 8. A collar 76 is secured on the right-hand end of shaft 73 for limiting endwise movement in bearing brackets 75 while a radial operating arm 77 has one end rigidly secured to the opposite end of shaft 73 and cooperates with adjacent bearing bracket 75 for limiting endwise movement of shaft 73 in the other direction. The free end of operating arm 77 is bifurcated and has a link 78 pivoted in the bifurcated end on pin 79, as shown in Figs. 3 and 8. The opposite end of link 78 carries a cross-bar 80 having the center portion secured to the end of the link while opposite end portions provide an anchor for one end of a pair of tension springs 81 on opposite sides of link 78. The opposite ends of springs 81 are connected to eyes 82 secured to the rear side portion of bed plate 5, as shown in Fig. 3. Tension springs 81 normally operate to move movable gripping members 70 toward the closed position and in a counter-clockwise direction, as shown in Fig. 2.

A gripper operating cam 83 is mounted on cam shaft 55 between the left-hand bearing plate 56 and intermediate bearing plate 57. It is located adjacent left-hand die head operating cam 58, as shown in Fig. 5. An actuating lever 84 is pivotally mounted at one end on intermediate bearing plate 57, as shown in Fig. 3, and has the opposite end secured by pivot pin 85 to an intermediate portion of link 78. A cam follower roller 86 is rotatably mounted on an intermediate portion of actuating lever 84 below cam shaft 55 and in aligned relation for engagement with the periphery of gripper operating cam 83. Gripper operating cam 83 has a projecting portion of greater radius at 87 for moving actuating lever 84 in a clockwise direction on its pivotal mounting, as shown in Fig. 3, and for also moving movable gripping members 70 into full open position. Cam shaft 55 rotates in a counter-clockwise direction, as shown in Fig. 3, from which it will be clear that as the cam shaft rotates, the inclined portion at the bottom of projection 87 of gripper operating cam 83 will allow the cam follower roller 86 to move inwardly toward shaft 55 so that link 78 will transmit the motion of springs 81 to move movable gripping members 70 toward the closed position in cooperation with stationary gripping members 71.

Stationary gripping members 71 have the rear ends formed with bearing projections 90 mounted on gripper operating shaft 73 in the bifurcated projections 72 of the movable gripping members. The front end of each stationary gripping member 71 has a projection 91 formed to slidably engage gib 10 on the front edge of bed plate 5. A clamp 92 is secured by a bolt to the outer end of projection 91 with the lower end formed with a rearwardly extending lug engaging the underside of gib 10, as shown in Fig. 3. The free end of the projection of clamp 92 is bevelled so that when the bolt securing it to projection 91 is tightened the clamp will grip gib 10 between the rearwardly extending projection on

the lower end thereof and projection 91 to tightly secure a forwardly extending portion of a stationary gripping member 71 in adjusted position on bed plate 5.

Each of the gripping members 70 and 71 of each pair are of arcuate form, movable gripping members 70 extending through an arc slightly greater than 180 degrees while stationary gripping members 71 have an arcuate form of less than 180 degrees in complementary relation to the movable gripping members. Each of the gripping members 70 and 71 is formed with an arcuate seating portion 93 for detachably mounting and positioning a cylinder gripping insert on each of the gripping members. Inserts 94 are mounted in both the movable and stationary gripping members and are formed with a true arcuate inner edge so that when the movable gripping member is in closed position relative to the stationary gripping member of a pair, the insert carried by these members will form a true circle for holding a cylinder in true cylindrical shape. The inserts are removably mounted in the pair of gripping arms so that one set of inserts may be exchanged for another for equipping the gripping members to receive and hold different sized cylinders.

By having the adjustable clamps at the front portion of the stationary gripping members and the movable gripping members adjustably mounted on gripper operating shaft 73 it will be apparent that each pair of gripping members may be adjusted for gripping a cylinder near the ends thereof adjacent the beading dies when they are in the full closed beading position. The gripping members may also be adjusted for different positions of adjustment of the beading heads on bed plate 5 to maintain the desired adjusted position of the gripping members for the varying lengths of cylinders that the die heads are adjusted to bead.

As gripper operating cam 83 revolves in a counterclockwise direction from the position shown in Fig. 3 to that shown in Fig. 6, the movable gripping arms will move from the full open to the partially closed position slightly in advance of full closed position where a cylinder fed into the stationary gripping members will be engaged and gripped by the cooperation of the movable and stationary gripping members for shaping into substantially cylindrical relation. The gripping members will hold the cylinder with light frictional engagement so that during initial movement of the die heads toward each other they will engage one end of the cylinder fed into the gripping members and move it longitudinally or axially through the gripping members into a centered position between the beading dies.

Gripper operating cam 83 has a shoulder 95 thereon arranged to allow cam follower roller 86 to move inwardly toward cam shaft 55 an additional amount in further rotation of cam shaft 55 from the position shown in Fig. 6 so that movable gripping members 70 of each pair will move into the full closed position in relation to stationary gripping members 71. It will be understood from the foregoing description that the gripping members are moved into and held in closed position by tension springs 81 operative on link 78.

Two pairs of gripping members are shown in the drawings, one pair associated with each beading die and die head in order to grip opposite ends of a cylinder being beaded adjacent

11

the portion formed into the bead. A pair of guide members 97 are secured to the outer ends of stationary gripping members 71 and project forwardly therefrom in inclined relation, as shown in Fig. 3. Guide members 97 are of angular form in cross-section to provide horizontal and vertical flanges and are oppositely formed to each other so that the vertical flanges are on the outer edges of the horizontal flanges. This provides for receiving and guiding opposite ends of sheet material cylinders so they may be placed on the horizontal flanges of guide members 97. These cylinders will roll inwardly and rearwardly down the inclined horizontal flanges into gripping inserts 94 carried by the stationary gripping members 71.

Control switches 100 are mounted in a front wall portion of base 1 connecting pedestals 2 below the central portion of bed plate 5 for manual operation to control the machine operation in a desired manner as hereinafter described in connection with the circuit diagram. The switch box 101 is formed with a hinged cover in the right-hand pedestal opening through the right-hand side thereof at the end of the base and is provided with a plurality of switches 102 and indicator lamps 103 for controlling and showing the condition of operation of certain electrically operated parts of the machine as described hereinafter in connection with the wiring diagram.

In the wiring diagram, Fig. 13, the circuits for operating the several motors, the heaters for forming the beads and the controls therefor are shown diagrammatically and illustrate one method of obtaining electrical operation and control of the machine. Current is obtained from a suitable source of supply through wires 104 and 105. Wire 104 has a conventional circuit breaker 106 connected therein. Wire 104 is then connected through several branches with one terminal of each motor 50, one terminal of each indicator lamp 103, one terminal of each heating element 29, one terminal of each thermostat control switch 38 and a terminal of control relay 107. One of the indicator lamps 103, indicated in Fig. 13, at 103, has the opposite terminal connected with current supply wire 105 so that whenever the circuit to the source of supply through wires 104 and 105 is closed by closing circuit breaker 106, indicator lamp 103 will be illuminated to show that the circuit to the machine is closed.

Two of the switches indicated at 102 and numbered 109 in Fig. 13 are included in a circuit connecting each motor 50 with current supply wire 105, so that whenever switches 109 or either of them are moved into closed position, the motor 50 controlled thereby will be included in the circuit with the source of power for normal operation to rotate corresponding beading dies.

The other terminal of each thermostat control switch 38 is connected by wire 110 through a pair of switches 111, one for each thermostat control circuit, for manually controlling the circuit to the thermostat control and heating element 29. The circuits through wires 110 and switches 111 extend through a pair of control relays 112, one for each heating element circuit being connected to one terminal of the coil winding of one of the relays. The opposite terminal of the coil winding of each relay is connected to wire 113 forming a return circuit connected with current supply wire 105. This completes the circuit from wire 104 through each thermostat control 38, switch 111, coil winding of each relay 112 to wire 105. The current from wire 104 passes through each

12

heating element 29 and then through a pair of wires, one for each heating element, indicated at 114, to one terminal of the relay armature for the relay 112 shown above the relay in Fig. 13 and having corresponding connections with the corresponding control switch 111 and thermostat control 38. The contacts engaged by the respective armatures of relay 112 are connected together and to wire 113 to complete the circuit to current supply wire 105. Indicator lights 115 contained in the group of indicator lights 103 are connected between wire 104 and each wire 114 to indicate when the corresponding heater element 29 is in circuit with current supply wires 104 and 105 and operating to heat the beading dies.

Switches 111 manually control each heating element 29 so that when they are manually closed the current through heating element 29 will then be automatically controlled by the operation of relays 112 under control of thermostat control switches 38. It should thus be understood that heating elements 29 will be electrically heated automatically to the temperature for which the thermostat controls 38 are set. Whenever the temperature of one of heating elements 29 reaches the maximum for which the respective thermostat control element 38 is set, the thermostat control element will then operate to open the circuit through the coil of the respective relay 112 thereby allowing the armature for the respective relay to move to open position opening the circuit through heater element 29. As soon as the circuit closes at thermostat control 38 the coil of relay 112 is again energized to close the circuit to heating element 29 and secure automatic heating to the desired maximum temperature. Each indicator light 115 of the group of lights 103 indicates the period during which the circuit through each heating element 29 is closed to maintain heating thereof to the maximum temperature to which the thermostat controls are set for each element in a manner that should be well understood to one skilled in the art.

The control switches 100 preferably comprise three conventional switches including a starting switch 116, a stop switch 117 and a jog switch 118, all of double pole single throw form. Each of these switches has the switch blade normally actuated to close one of the pair of contacts and each switch is adapted to manual operation to move the switch blade to disengage the normally closed pair of contacts and engage the opposite pair of normally open contacts. Fig. 13 shows the normal position of the several switches.

A branch circuit from wire 104 is connected to one of the normally open contacts of jog switch 118 and one of the normally closed contacts of stop switch 117 by wire 119. The wire 120 connects the other normally closed contact to stop switch 117 with one of the normally closed contacts of jog switch 118. Wire 121 connects the other normally closed contact of jog switch 118 with one of the normally open contacts of start switch 116. The normally closed contacts of start switch 116 have no electrical connections and the normally open contacts of stop switch 117 have no electrical connections. The other open contact of start switch 116 is connected by wire 122 with the other normally open contact of jog switch 118 from which the wire connection extends to coil winding 123 of relay 107 having the opposite end connected by wire 124 to current supply wire 105. This completes a control circuit through the several switches 100 so that by manually depressing

start switch 116, the switch blade will close the normally open contacts and thereby close the circuit from wire 121 to wire 122 for connecting coil winding 123 of relay 107 in circuit with current supply wires 104 and 105 to energize coil winding 123 of relay 107. This will take place only while stop switch 117 and jog switch 118 are in the normal position. When relay coil 123 is energized it will move relay armature 125 to engage the stationary contacts of the relay and close the circuits controlled by the relay. This relay has three pairs of contacts to close three different circuits. When the relay is closed one set of contacts controlled by armature 125 closes a circuit to wire 126 connected with one of the normally closed contacts of jog switch 118 which is the same contact to which wire 121 is connected. This provides a stick circuit for relay 123 so that current from supply wire 104 through branch wire 119 and wire 120 passes through both stop switch 117 and jog switch 118 to wire 126, through one set of contacts in the closed position of relay armature 125 and wire 127 connected with wire 122 and one terminal of coil winding 123. The current then passes through the coil winding 123 to wire 124 and to current supply wire 105 completing the circuit to maintain coil 123 energized and the armature contacts closed so long as the stop and jog switches 117 and 118 respectively, remain in their normal position.

When relay 107 has armature 125 in closed position current from wire 104 passes through wire 128 to another set of relay contacts and then through wire 129 to one terminal of electric motor 67. The other terminal of electric motor 67 is connected by wire 130 through a suitable fuse 131 to the third set of contacts of relay 107 closed by armature 125 when the circuit is connected to wire 124 and current supply wire 105 so that motor 67 is energized to operate cam shaft 55.

It will be seen that by operating start switch 116 relay 107 is energized to close the circuit to motor 67 whereupon this operation will continue until the stop switch 117 is manually operated to open the circuit that closes the normally closed contacts thereby de-energizing coil winding 123. Coil winding 123 will also be de-energized momentarily by the manual operation of jog switch 118. However, the operation of jog switch 118 is for the purpose of closing the normally opened contacts which will close the circuit through wire 122 from wire 119 to coil winding 123 to secure energization of relay 107 for connecting motor 67 with the current supply to secure its operation. The normal purpose of jog switch 118 is to secure operation of motor 67 only so long as the jog switch is manually operated to close the normally open contacts. Start switch 116 is normally operated to secure the starting of the machine for continuous operation until manual operation of stop switch 117.

In operation the start switch is closed to start motor 67 after switches 102 are closed including both of the switches 109 and 111. When heating elements 29 have heated the forming dies to the desired maximum temperature, it is usual to then operate start switch 116 to start motor 67. By feeding plastic cylinders to guide members 97, they will roll into the gripping members as soon as the movable gripping members are moved by the operation of motor 67 to open position. These gripping members will then move to closed position for gripping a cylinder in the manner hereinbefore described so that it is centered between the beading dies, heated and beads formed in the

manner described. Motor 67 then operates upon completion of the beads on opposite ends of each cylinder during simultaneous operation of the beading dies in forming these beads, to move the movable gripping members to open position which will carry the beaded cylinder upwardly therewith. The machine operator will in the meantime have placed a new cylinder on guide members 97 so that as soon as the movable gripping members are in the open position this new cylinder will have moved into the stationary gripping members. The operator manually removes the completed cylinder from the movable gripping members in the open position before their movement is again started toward the closed position for a subsequent beading operation on the new cylinder. Through the operation of start switch 116 motor 67 is energized for continuous operation to secure continuous operation of the beading machine so that the operator merely has to feed new cylinders into the machine by placing them upon guide members 97 and remove the completed cylinders from the movable gripping members in open position. The speed of the operation of the gripping members, forming dies, etc., can be controlled by the variable speed mechanism hereinabove described to suit the speed at which an operator may feed cylinders through the machine and remove completed cylinders therefrom.

The invention claimed is:

1. A machine for beading cylinders of flexible sheet material comprising a pair of circular beading dies, means slidably mounting said dies in opposed coaxial relation, cylinder gripping means having a pair of gripping members with one relatively movable to the other between open and closed positions, said gripping members having portions cooperating to engage and hold a flexible cylinder in true cylindrical shape, means mounting said cylinder gripping means between said beading dies for accurately holding a cylinder in aligned coaxial relation between said beading dies, means for moving said beading dies on said first-mentioned means from a separated position toward each other to first engage and move a cylinder positioned therebetween coaxially into centered relation on said gripping members, means moving said movable gripping member toward the other into partial gripping relation for supporting a cylinder therein during the centering operation of the die moving means and means for moving said dies from the cylinder centering position toward each other to form beads on opposite ends of the cylinder after said movable gripping member is moved thereby and held by said beading die moving means in closed position firmly gripping a cylinder therein, said last-mentioned means moving said beading dies apart into separated relation to a beaded cylinder and moving said movable gripping member into open position for ejection of a beaded cylinder at the end of the beading operation.

2. In a cylinder beading machine, the combination of a pair of opposed beading dies, die mounting means mounting said dies for rotation relative to each other and slidable movement in horizontal coaxial relation toward and from each other, means for rotating said dies in opposite directions, a cylinder gripper formed of stationary and movable cooperative gripper members, the movable gripper member being formed to extend more than half-way around a cylinder to grip and hold said cylinder and cooperating in closed position against the sta-

tionary gripper member to hold a flexible sheet material cylinder in true cylindrical shape and axially aligned relation to said beading dies, means for operating said movable gripper member from open to a cylinder holding position in advance of the closed position and subsequently into closed position for holding a cylinder against rotation during beading thereof and then back to open position at the end of the beading operation, and means for moving said beading dies toward each other to engage and center a cylinder therebetween while said gripper members are in said holding position, maintaining contact with said cylinder ends in the centering position, moving said dies toward each other an additional amount to simultaneously form beads on opposite ends of said cylinder after said gripper members are moved to full closed position and then moving said dies apart to disengage opposite ends of a beaded cylinder while said movable gripper member moves said cylinder outwardly for ejecting it from between said dies.

3. A machine for beading cylinders as claimed in claim 2, wherein a bed plate has said die mounting means slidable thereon and formed of die heads, said means for moving said beading dies has a cam mechanism comprising a shaft rotatably mounted on said bed plate in longitudinally extending relation parallel to the axis of said beading dies, a cam member mounted on said shaft adjacent of said die heads, a cam follower on each die head engaging the adjacent cam member, each of said cam members having peripheral portions formed in opposed relation for moving said die heads toward and from each other on said bed plate in centering and beading opposite ends of a cylinder, a gripper operating cam on said shaft engaging a follower for operating said movable gripper member in timed relation to the operation of said die heads, and power operated means for rotating said shaft.

4. A machine for beading cylinders as claimed in claim 2, wherein a bed plate has said die mounting means formed of a pair of die heads slidable thereon and said means for moving said beading dies has a shaft rotatably mounted in spaced parallel relation to the axis of said beading dies on said bed plate, a pair of cam members mounted on said shaft adjacent said die heads and having peripheral portions formed with camming portions arranged in opposed relation for engaging cam followers on said die heads operating them in opposite directions in centering and beading a cylinder, an adjustable cam element on each cam member for adjusting the bead forming portion of said cam members to vary the amount of material formed into the beads on opposite ends of a cylinder, and a gripper operating cam engaging and operating a follower carried by said movable gripper member.

5. A machine for beading cylinders as claimed in claim 2, wherein a bed plate has said die mounting means formed of a pair of die heads slidable thereon and said means for moving said beading dies has a cam mechanism in which a cam shaft is rotatably mounted in spaced parallel relation on said bed plate relative to the axis of said beading dies, said cam mechanism having a pair of cam members on said shaft in spaced relation opposite said die heads, each cam member engaging a cam follower on the adjacent die head, a gripper operating shaft

rotatably mounted on said bed plate in spaced parallel relation to the axis of said beading dies and said cam shaft, said gripper members being mounted on said gripper shaft, and a gripper operating cam on said cam shaft engaging and operating a cam follower carried by said gripper operating shaft.

6. A machine for beading cylinders as claimed in claim 2, wherein a bed plate has said die mounting means formed of a pair of die heads slidable thereon and said means for moving said beading dies has a cam mechanism for moving said beading dies, said die mounting means having one of said die heads adjustably mounted on a slide member slidably mounted on said bed plate, said die head being adjustable for beading cylinders of different lengths and said slide member having a connection for operation by said cam mechanism for operating said die head in each adjusted position thereon.

7. A machine for beading cylinders as claimed in claim 2, wherein a bed plate has said die mounting means formed of a pair of die heads slidable thereon and said means for moving said beading dies has a cam mechanism in which a cam shaft is rotatably mounted in spaced parallel relation on said bed plate relative to the axis of said beading dies, said cam mechanism having a pair of cam members mounted in spaced relation on said cam shaft each adjacent one of said die heads, a slide member slidably mounted on said bed plate mounting one of said die heads for adjustment toward and from the other die head for beading cylinders of different length, cam actuated means connected to said slide member and the other die head and engaging said pair of cam members for moving said die heads toward and from each other in cylinder beading operations, a gripper operating shaft rotatably mounted on said bed plate in spaced parallel relation to said cam shaft and the axis of said beading dies, said gripper members having one end mounted on said gripper operating shaft with a pair of spaced movable gripper members adjustably attached to the shaft for movement therewith, and a gripper operating cam on said cam shaft engaging a follower on said gripper operating shaft operating said shaft to move said movable gripper members in said timed relation to the operation of said die heads.

8. A machine for beading cylinders comprising a horizontally arranged bed plate, a pair of die heads slidable mounted in opposed relation at opposite ends on said bed plate, opposed beading dies rotatably mounted on said die heads, means for rotating said beading dies in opposite directions, a pair of gripping members mounted on said bed plate between said die heads with a movable gripping member operable between open, partially closed and closed positions for slidably holding a cylinder, said movable gripping member being formed to encircle more than half of a cylinder, and cam mechanism for moving said die heads and movable gripping member in timed relation to engage said beading dies with opposite ends of a cylinder slidably held by said gripping members in partially closed position for centering said cylinder, then moving said gripping members to closed position and said die heads toward each other for forming beads on opposite ends of said cylinder and finally disengaging said die heads from said cylinder and moving said gripping members to open position, said movable gripping member gripping a beaded cylinder sufficiently for lift-

ing it away from said other gripping member in ejecting finished cylinders from said machine.

9. A machine for beading cylinders comprising a horizontally arranged bed plate, a pair of die heads slidably mounted in opposed relation at opposite ends on said bed plate, opposed beading dies rotatably mounted on said die heads, means for rotating said beading dies in opposite directions, a pair of gripping members mounted on said bed plate between said die heads with a movable gripping member operable between open, partially closed and closed positions for slidably holding a cylinder, cam mechanism for moving said die heads and movable gripping member in timed relation to engage said beading dies with opposite ends of a cylinder slidably held by said gripping members in partially closed position for centering said cylinder, then moving said gripping members to closed position and said die heads toward each other for forming beads on opposite ends of said cylinder and finally disengaging said die heads from said cylinder and moving said gripping members to open position, said movable gripping member gripping a beaded cylinder sufficiently to lift it away from the other gripping member and move it outwardly from between said beading dies for ejection from said machine, and means for feeding cylinders into said gripping members in open position.

10. A machine for beading cylinders comprising a bed plate having the longitudinal portions extending in horizontal relation, a pair of die heads slidably mounted on said bed plate for movement toward and from each other, beading dies mounted in coaxial opposed relation on the inner ends of said die heads, means mounted on said bed plate for reciprocating said die heads back and forth in beading operations on opposite ends of sheet material cylinders, positioned coaxially between said beading dies, and means for feeding sheet material cylinders into said coaxial position between said beading dies having gripping members for encircling a cylinder inwardly from opposite extremities formed with cylindrical portions engaging and holding a cylinder in true cylindrical shape, said means having said gripping members operable to hold a cylinder in coaxial relation between said beading dies during the movement of said dies toward each other for beading opposite ends of said cylinder and said means being operable to move a beaded cylinder outwardly from between said beading dies to partially eject it from said machine.

11. A machine for beading cylinders of flexible sheet material comprising a pair of circular beading dies slidably mounted in opposed coaxial relation, cylinder gripping means formed of a pair of gripping members with one member movable relative to the other between open and closed positions, said gripping members cooperating to engage and hold a flexible cylinder in true cylindrical shape and aligned in coaxial relation between said gripping means and beading dies, means for moving said beading dies from a separated position inward toward each other to first engage and move the cylinder into centered relation to said gripping members, means for moving said movable gripping member from open position to partially closed position for supporting a cylinder therein during the centering operation when the dies lightly engage both ends of the cylinder, means for moving said slidably mounted dies from cylinder centering po-

sition toward each other to form beads on opposite ends of the cylinder after said movable gripping member is closed firmly gripping the cylinder to hold it against rotation, means for moving said beading dies apart into separated relation to the beaded cylinder, and means for moving said movable gripping member into open position for ejection or removal of the beaded cylinder at the end of the operating cycle.

12. In a cylinder beading machine, the combination of a pair of opposed beading dies mounted for rotation relative to each other and slidably mounted in horizontal coaxial relation for movement toward and from each other, means for rotating said dies in opposite directions, a cylinder gripping means formed of stationary and movable cooperative gripping members, the movable gripping member being formed to extend more than half-way around a cylinder to grip said cylinder to a greater degree than the stationary gripping member resulting in the cylinder being lifted out from between the dies on the upward motion of the movable member, means for operating said movable gripper member to a partially open position in advance of the closed position for centering the cylinder between the movable beading dies prior to movement into closed position when holding a cylinder against rotation during beading thereof, and means for moving said beading dies toward each other to engage and center a cylinder between them while said gripper members are in partially closed position, maintaining contact with said cylinder ends in the centering position to preheat the material prior to the beading operation, then moving said dies toward each other an additional amount to simultaneously form beads on opposite ends of the cylinder and then moving said dies apart to disengage opposite ends of the cylinder after which said movable gripper member moves said cylinder outward to eject it from between said dies.

13. A method of beading the ends of plastic sheet material cylinders consisting in feeding a cylinder into coaxial relation between a pair of heated coaxial beading dies, gripping and tightly holding said cylinder in cylindrical shape, moving said beading dies toward each other to engage and center said cylinder therebetween while engaging the terminal portions, tightly gripping and positioning said cylinder in coaxial true cylindrical relation between said beading dies while heating said terminal portions, moving said dies toward each other to simultaneously form opposite heated terminal portions into beads, moving said beading dies apart to disengage the beaded cylinder, and ejecting the beaded cylinder.

RALPH F. TABER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
576,980	Grimm	Feb. 9, 1897
942,980	Dill et al.	Dec. 14, 1909
2,107,011	Moorshead et al.	Feb. 1, 1938
2,274,827	Emmerich	Mar. 3, 1942
2,532,844	Hulbert, Sr., et al.	Dec. 5, 1950

FOREIGN PATENTS

Number	Country	Date
511,844	Great Britain	Aug. 25, 1939