INVENTORS.

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PICTURE
This invention relates to machines for securing end members to tubes and particularly to such machines wherein the tube end is cramped to secure the end member in place.

While the present invention is capable of use in securing end members to tubes of various types it is particularly designed and is hereinafter described as used in securing end members to tubes formed of paper or fibrous material. Paper tubes which are closed at one end are frequently used in forming packages to receive rolls of floor coverings or the like. When so used two tubes are slipped over opposite ends of the roll and are connected at the center of the roll by tape or other suitable means.

The end securing members of such tubes have heretofore been applied to the tube and stapled into position which is both a costly method and requires a complicated machine. A machine for such an operation is shown in United States Patent 2,324,572 issued July 20, 1943. A tube having its end member secured by staples has the additional disadvantage that it does not have a pleasing appearance. It has been proposed to crimp the end securing members of paper tubes into position but the machines for performing this operation are complex requiring a large number of separate operations and also they are not readily adaptable to receive tubes of varying lengths and diameters.

A general object of the invention is to provide a machine which will insert an end closure member into a tube and crimp the end of the tube to hold that member in place. Another object of the invention is to provide such a machine wherein the operations are carried out simultaneously. Another object is to provide such a machine which is simple in construction and which is coordinated to perform the operations accurately, quickly and in time relationship so that the tubes are fed into the machine at one side thereof and the finished tubes are delivered from the other side in rapid succession. A further object is the provision of such a machine whereby all the operations on the end of the tube are carried out at one point while the tube is in a stationary position. A still further object is to provide such a machine which will occupy a minimum of floor space.

In accordance with the invention, a machine is provided which inserts an end closing member into a tube and simultaneously crimps the tube thereby holding the end member firmly in place. The end closure member is of the type having a hole in its center and preferably a lip about its periphery extending outwardly. The machine has a crimping head with a carrier means attached thereto, for extending into the hole in the end closure member, which crimps the end of the tube over the end member. Means are provided for securely holding the tube adjacent to the crimping head and for feeding the end closure member into juxtaposition with the end of the tube. The crimping head is rotated while rotating it is reciprocated so that in one direction the carrier means attached to the head extends into the hole of the end closure member, and drives that member into the end of the tube while the end of the tube is simultaneously cramped and in the opposite direction withdraws the carrier means from the tube and the end closure member.

A feature of the invention resides in the method of coordinating the operations to which the tubes are subjected whereby they are carried out in the desired order and in timed relation and at relatively high speed.

Another feature resides in the ability of the machine to be readily converted to handle tubes of different lengths and different diameters.

Another feature resides in the construction of the machine wherein the inserting of the end member and the crimping takes place at one position and in one simple operation.

Another feature is the ability of the machine to feed an end closure member and crimp the tube over that member without the necessity of having any component pressing against the opposite side of the end member to hold it in position.

These and other features of the invention and the advantages thereof will be better understood from the following detailed description when it is read in conjunction with the several figures of the drawings in which:

Fig. 1 shows a perspective view of one embodiment of the machine of the invention with a number of tubes being fed into and coming out of the machine, the crimping head driving mechanism, end closure member supply and a cam shaft and drive for operating the various mechanisms of the machine.

Fig. 2 is a fragmentary front elevation view of a waxing apparatus and an upper tube stop.

Fig. 3 is a fragmentary front elevation view showing clamp for holding the tube and mechanism for operating the clamp.

Fig. 4 is a fragmentary front elevation view showing stops for feeding the tubes and mechanism for operating the stops.

Fig. 5 is a front elevation view showing a mechanism for applying motion to the tube being fed into the machine.

Figs. 6, 7 and 8 are elevation views of the mechanism for operating the end plate.

Figs. 9, 10 and 11 are sectional views showing the crimping head and the steps in the crimping operation.

Fig. 12 is a fragmentary sectional view of a modification of the crimping head.

Fig. 13 is an elevation view showing the face of the crimping head.

Fig. 14 is a fragmentary front elevation view of part of the end closure member feeding mechanism.

Fig. 15 is a fragmentary top elevation view of part of the end closure member feeding mechanism and crimping head assembly.

Fig. 16 is a side elevation view of the mechanism for operating the stops for the end closure members.

Fig. 17 is a sectional view of the mechanism for reciprocating the crimping head.

The machine of the invention is connected with conventional tube forming apparatus in which a continuous length of spirally wrapped paper tubing is fed to a cutting device to sever the tube into individual tubes of desired length and then fed into the machine.

In the embodiment in Fig. 1, the tubes from a source such as a tube forming machine are dropped on to an inclined feed table 11 which holds a number of tubes indicated at 12 in readiness to be passed into crimping position indicated generally at 13. End closure members 41 are fed into the machine by a rack 42 which extends vertically above the crimping position and feeds a single end closure member 43 to the crimping position. A crimping head 44 and a carrier 51 for the end closure
member is located adjacent the crimping position. The crimping head 44 is rotated by motor 46 through a series of pulleys 47, 48 and reciprocated in and out of the tube in crimping position. An air cylinder 49 drives pinion gear 90, shown in Fig. 17, which moves rack 91 on a spindle thereby supplying the reciprocating motion to the crimping head 44. Air cylinder 49 is actuated by cam 81 on cam shaft 50 through a solenoid. The opposite side of the motor 46 drives the cam shaft 50 through a gear box 53. The cam shaft 50 has along its length four cams 27, 81, 82, 83 which operate the various mechanisms of the machine. Cam 27 operates the movable jaws of the clamps. Cam 81 actuates the air cylinder 49. Cam 82 operates the end plate and cam 83 tube stops 23, 32.

At the start of the crimping operation the crimping head 44 moves forward and picks up the end closure member 43 on a tapered shaft 51 axled to the crimping head by passing through the hole in the end closure member and driving it into the end of the tube in crimping position. The end of the tube is cramped over the end closure member 43 by the crimping head 44. The crimping head and tapered shaft are then removed from the end of the tube and the cramped tube dropped onto an inclined table 52 which carries the cramped tube out of the machine.

The tubes on the feed table 11 have an agitating motion applied to their ends by means of a reciprocating plate 14 shown in Fig. 3. This motion prevents the tubes 12 from jamming or sticking on the inclined table 14 thereby giving a uniform feed of tubes. The plate 14 is reciprocated by the motion of a rocking arm 15 which is moved through pivot arm 16 and shaft 17 by an arm 18 axled to rod 19. The plate 14 is held in position by a second rocker arm 20 which pivots on pin 21 and follows the motion of the first rocker arm 15.

The first tube 22 falls into crimping position 13 and rests on a movable stop 23. The machine can be equipped with one or more such stops 23 depending on the length of tube and the support necessary for the tube 22. When the tube 22 rests on stop 23 one side 24 of a clamp member moves into position against the tube 22 and presses it against the opposite side 25 of the clamp thereby holding the tube firmly in position. It is preferred to have two such clamps to grip the tube along its length although additional clamps can be used. The side 24 of the clamp pressing against the tube is operated by a cam follower 26 off of arm 83 located on cam shaft 50 which is driven by motor 46. A rocker shaft 28 is moved by the cam follower 26 and is connected to the side 24 of the clamp through a series of connecting members 29, 30, 31.

As the tube has an end closure member inserted and secured by crimping an upper stop 32 moves between the cramped tube and the next tube in line thereby preventing the flow of tubes. The upper stop 32 is attached to a slide member 33 which moves in a groove. The slide member 33 is attached by a shaft 34 to one end 35 of a member 36 pivoted at its midpoint on rod 19. Rod 19 through pivot arm 18 also operates the mechanism for applying motion to the tubes 12. The opposite end 37 of the pivot member 36 is connected to a shaft 38 to a slide 39 which is axled to a bottom stop 23. In operation the top stop 32 is moved to allow a tuba to fall into crimping position and to rest on the bottom stop 23. After the tube is cramped the top stop 32 is inserted to hold the next tube thereby preventing the flow of tubes and allow the bottom stop 33 to be removed so that the cramped tube drops to the inclined table 52 which carries the cramped tube out of the machine. Both the top and bottom stops are moved by the swinging motion of the pivoted member 35 which is moved by the rotation of rod 19. Rod 19 is rotated by the action of cam 83 through linkages 55, 56, 57 on rocker arm 58.

It is desirable in a tube crimping operation to have a lubricant such as wax on the outer surface of the tube near the end to be cramped. This lubrication of the end of the tube greatly facilitates the bending of the tube into its cramped position. Wax can be applied by the wax applicator shown in Fig. 2. A head 101, of resilient or soft material is axled to a rocker arm 102 which is pivoted by the motion of rod 103. When the rocker arm 102 moves downward the head 101 dips into an open trough containing liquid wax 105 thereby picking up wax. The rocker arm 102 then swings upward to contact a tube 106 immediately above and applies a small quantity of wax on the outer surface of the tube which is picked up by the motion of the rocker arm 102 controlled by a contact arm 107 which is axled to rod 103. The forward motion of the top slide 33 when top stop 32 moves forward to interrupt the flow of tubes causes the head 101 on the wax applicator to move out of the wax 105 and press against the tube 106 thereby applying wax to the tube. When the stop 32 is removed the top slide 33 moves back and the weight of the rocker arm 102 causes the head 101 to swing back into the wax 105. A spring 108 can be provided to assist in returning the contact arm 107 and associated rocker arm to their normal position with the head 101 in the wax 105.

The crimping head 44 comprises a disc 60 having a peripheral rabett 61 adjacent its outer edge. The rabett has two straight angularly disposed plane faces 62, 63 and a semi-circular groove 64 connecting the faces. A tapered shaft 51 is attached to the center of the disc 60 and extends perpendicularly thereto. This shaft is tapered so that it can readily be inserted into the hole in the end closure members and will allow that member to just touch the crimping disc 60. The crimping head 44 is equipped on the opposite side of the disc with a shaft 68 for fitting into a conventional drill press 69. In this manner crimping heads of various sizes can be readily inserted in the machine.

The crimping head is preferably equipped with rollers 67 on the face of the disc 60 to aid in completing the bending of the tube and thereby forms a neat appearing crimp. The roller is positioned so that it presses against the outer edge of the tube which is bent inside the tube. Any desirable number of rollers can be placed on the disc. In the second embodiment of a crimping head, rollers 65, are placed in the peripheral rabett 61 with a portion of its surface extending above the bottom of the groove 64 at an angle to the face of the disc 60. In this manner the bending of the tube in the crimping operation is facilitated by the action of the roller.

In operation the end closure member is fed adjacent the tube in crimping position and the rotating crimping head 44 is moved forward to pick up the end closure member and drive it into the tube. The crimping head 44 is driven sufficiently far past the end of the tube to allow the tube to be bent and wrapped as shown at 70 around the lip 71 on the end closure member.

When the tube to be crimped is in crimping position a plate 120 is pressed against the opposite end of the tube to align the tube longitudinally in the crimping position. The plate 120 is fixed to a slide member 121 which reciprocates in a groove 122. The plate is operated from a cam 82 on the cam shaft 50. A cam follower 123 moves shaft 124 through a member 125 pivoted at its midpoint. The shaft 124 in turn moves a rocker shaft 126 which rotates rod 127. The rod 127 moves linkage 128 which is axled to the slide member 121. It is preferred to construct the machine with a cam arm 129 so that the bracket 129 for affixing the plate 120 to the slide member 121 can be placed at any position along the slide plate depending on the length of the tube to be cramped.

The end closure member is fed into crimping position by the action of three cooperating members which are
controlled by the reciprocating motion of the crimping head. The reciprocating motion of the crimping head 44, as mentioned above, is controlled by a cam 51 on the camshaft 50 which in turn is moulded actuated as in cylinder 49. Affixed to the top of the crimping head unit 149 are two straight parallel cams 141, 142 with associated cam followers 143, 144 through which connecting links 145, 146 rotate parallel rods 147, 148. These rods 147, 148 are connected to two clam shaped members 149, 150 which hold the end closure member 43 in crimping position.

At the start of the crimping operation an end closure member 43 is held by the two clam shaped members 149, 150. The remaining end closure members 155 rest on two parallel upper stop members 153, 154. As the crimping head 44 moves forward the two clam shaped members 149, 150 pivot apart by the rotation of the rods 147, 148 caused by the cam followers 143, 144 riding up on the cams. The clam shaped members release the end closure member 43 as the carrier means 51 attached to the crimping head passes through the hole 151 in the end closure member. The crimping head drives the end closure member into the tube and crimps the end of the tube out of that member in the tube. As the crimping head completes its forward motion the upper stops 153, 154 are removed and the end closure member allowed to fall onto a lower stop 152 which has been inserted in their path. After completing the crimping operation the crimping head moves in the opposite direction, the tubes and the cam followers 143, 144 cause the clam shaped members 149, 150 to close in position to receive the next end closure member 155. Through the same motion of the crimping head 44 the upper stops 153, 154 are inserted to stop the flow of end closure members and the lower stop 152 is withdrawn to allow the next following end closure member 155 to drop into the clam shaped members 149, 150.

The upper and lower stops are controlled by the pivoting rocker arm 156 which is moved by the rotation of one of the rods 148 to which it is attached. The 145ward motion of the crimping head 44 causes rocker arm 156 through connecting linkages 157 to move arm 158 and parallel follow arm 159 which are pivoted at their midpoints. Connected to one end of the arms 159, 158 is the lower stop 152 which is inserted to stop the flow of end closure members. When the cam crimping head moves in the opposite direction the upper stops 153, 154 are pivoted at the opposite ends of the arms 158, 159 move in to interrupt the flow of end closure members and the lower stop 152 is removed. In this manner the motion of the crimping head controls the feeding of end closure members in turn to the crimping position. It is convenient to use fingers connected to electrical switches which will interrupt the operation of the machine in the event the tube or end closure member supply is exhausted. Such controls can readily be inserted in the supply means. As stated above the machine is particularly suited for tubes and end closure members of paper or other fibrous materials. The end closure member is preferably a tight fit in the tube and made of stiff paperboard of from 2/16 to 1/8 in. in thickness. The hole in the end member can be of any size although the strength of the end closure member is affected by the size. A typical hole size is from 1/2 to 7/16 in.

The methods of the invention can be carried out on various types of mechanism and the particular forms of end closure members illustrated are generally typical of those which can be produced with the machine herein shown and described. It is intended that the type and arrangement of the parts and the methods described are capable of many changes and modifications without departing from the spirit and scope of the invention. It should, therefore, be understood that the particular embodiments of the invention herein described and shown in the drawings are intended to be illustrations of the invention and any departure from the above description which conforms to the present invention is intended to be included within the scope of the claims.

What is claimed is:

1. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face into a tube and simultaneously crimping the tube over the lip thereby firmly attaching the tube and the end closure member together which comprises a crimping head comprising a disc having a peripheral rabbot, the rabbot having two straight angularly disposed plane faces and a semi-circular groove connecting the faces, carrier means for the end closure member comprising a tapered shaft attached to the center of the crimping head disc and extending perpendicularly thereto, means for continuously supplying tubes, means for feeding the tubes in turn to a position adjacent to the crimping head comprising two oppositely reciprocating members, one of the reciprocating members being located above the tube in crimping position and below the next following tube and operating to prevent movement of all other tubes when a crimped tube is being removed from the crimping position and the other reciprocating member being located below the tube being cramped to hold the tube in crimping position, a movable plate to press against the opposite end of the tube in crimping position to align the tube in crimping position, a series of gripping clamps for holding the tube in crimping position, one side of each clamp being fixed and the other side movable to push the tube against the fixed side, means for continuously supplying end closure members, means for feeding the end closure members in turn into juxtaposition with the end of the tube comprising two oppositely reciprocating members, one reciprocating member being located between the end closure member in crimping position and the next following end closure member and operating to prevent movement of the next following end closure member when the end member is being cramped in the tube and the other reciprocating member being above the next following end closure member and operating to prevent movement of all other end closure members when the next following end closure member is moving into the crimping position, means for holding the end closure member in the juxtaposition comprising two clam shaped members, the clam shaped members being pivotally mounted to swing to engage thereby gripping each side of the end closure member and holding it in crimping position a distance apart when the carrier means extends into the hole in that member, means for rotating the crimping head and means for producing a reciprocating motion of the rotating crimping head comprising a cam member having two straight angularly disposed plane faces and a semi-circular groove connecting the faces, carrier means for the end closure member, comprising a tapered shaft attached to the center of the crimping head disc and extending perpendicularly thereto, means for continuously supplying tubes, means for applying a separating force to one edge of each tube to insert a uniform fit of the tube without jamming, means for feeding the tubes in turn to a position adjacent to the crimping head comprising two oppositely reciprocating members, one of the reciprocating members being located above the tube in crimping posi-
tion and below the next following tube and operating to prevent movement of all other tubes when a crimped tube is being removed from the crimping position and the other reciprocating member being located below the tube being crimped to hold the tube in crimping position, a molded plate to press against the opposite end of the tube in crimping position to align the tube in crimping position, means for applying wax on the side of each successive tube prior to crimping and adjacent to the end to be crimped, a series of gripping clamps for holding the tube in the crimping position, one side of each clamp being parallel and the other side movable to push the tube against the fixed side, means for continuously supplying end closure members consisting of a rack with internal clearance to allow only one such member at a time to be supplied, means for feeding the end closure members in turn into juxtaposition with the end of the tube comprising two oppositely reciprocating members, one of the reciprocating members being located between the end closure member in crimping position and the next following end closure member and operating to prevent movement of the next following end closure member when the crimped member is being crimped in the tube and the other reciprocating member being above the next following end closure member and operating to prevent movement of all other end closure members when the next following end closure member is moving into the crimping position, means for holding the end closure member in the juxtaposition comprising two clam shaped members, the clam shaped members being pivotally mounted to swing together thereby gripping each side of the end closure member and holding it in crimping position and to swing apart when the carrier means extends into the hole in that member, means for rotating the crimping head and means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive the end member into the tube while simultaneously crimping the end of the tube, over the lip of said end closure member and in the opposite direction causes the carrier means to be withdrawn from the tube and the end closure member.

3. The machine of claim 2 wherein the means for continuously supplying tubes, the means for feeding the agitating force, the means for feeding tubes, means for moving the reciprocating plate, means for applying wax, means for reciprocating the movable side of the gripping clamps, and means for reciprocating the rotating crimping head all operated from cams affixed to a common rotating shaft.

4. The machine of claim 2 wherein the means for feeding the end members is operated by the reciprocating motion of the crimping head.

5. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face into a tube and simultaneously crimping the tube over the lip thereby firmly securing the end closure member in the tube, which comprises a crimping head, carrier means attached to the crimping head for the end closure member comprising a tapered shaft attached to the center of the crimping head and extended perpendicular thereto, means for holding the tube adjacent to the crimping head, means for feeding the end closure member into juxtaposition with an end of the tube, means for holding the end closure member in the juxtaposition, means for rotating the crimping head means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive that member into the end of the tube while simultaneously crimping the end of the tube over said outwardly extending lip and in the opposite direction causes the carrier means to be withdrawn from the tube and the end closure member and means for releasing the end closure member from the holding means when the carrier means enters into the hole in the end closure member.

6. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face into a tube and simultaneously crimping the tube over the lip thereby firmly securing the end closure member in the tube, which comprises a crimping head, carrier means attached to the crimping head for the end closure member comprising a tapered shaft attached to the center of the crimping head and extended perpendicular thereto, means for continuously supplying tubes, means for feeding the tubes in turn to a position adjacent to the crimping head, means for continuously supplying end members, means for holding the tube in such a position, means for feeding a single end closure member into juxtaposition with an end of the tube, means for holding the end closure member in the juxtaposition, means for rotating the crimping head, means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive that member into the end of the tube while simultaneously crimping the end of the tube, in the opposite direction causing the carrier means to be withdrawn from the tube and the end closure member from the holding means when the carrier means enters into the hole in the end closure member.

7. The machine of claim 6 wherein the crimping head comprises a disc having a peripheral rabbot, the rabbit having two straight angularly disposed plane faces and a semi-circular groove connecting the faces.

8. The machine of claim 7 wherein cylindrical pins to aid in the crimping of the tube are equally spaced in the peripheral rabbit so that a portion of their surfaces extends above the semi-circular groove and their axes extend away from the axis of the disc at an acute angle to the disc.

9. The machine of claim 7 wherein the carrier means comprises a tapered shaft attached to the center of the disc and extending perpendicular thereto along its axis, the smaller diameter of the shaft being smaller than the diameter of the hole in the end closure member and the largest means for the shaft being approximately the diameter of the hole.

10. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face into a tube and simultaneously crimping the tube over the lip thereby firmly securing the end closure member in the tube, which comprises a crimping head, carrier means attached to the crimping head for the end closure member comprising a tapered shaft attached to the center of the crimping head and extended perpendicular thereto, means for feeding tubes in turn to a position adjacent to the crimping head, a movable plate for pressing against the opposite end of the tube to align the tube in crimping position, a series of gripping clamps for holding the tube in the crimping position, means for feeding the end closure member into juxtaposition with an end of the tube, means for holding the end closure member in the juxtaposition, means for rotating the crimping head, means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive that member into the end of the tube while simultaneously crimping the end of the tube, means for releasing the end closure member from the holding means when the carrier means enters into the hole in the end closure member.

11. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face
into a tube and simultaneously crimping the tube over the lip thereby firmly securing the end closure member in the tube, which comprises a crimping head, carrier means attached to the crimping head for the end closure member comprising a tapered shaft attached to the center of the crimping head and extended perpendicularly thereto, means for holding the tube adjacent to the crimping head, means for continuously supplying end members, means for feeding the end members in turn into juxtaposition with an end of the tube, means for holding the end closure member in the juxtaposition, means for rotating the crimping head, means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive that member into the end of the tube while simultaneously crimping the end of the tube, and in the opposite direction causes the carrier means to be withdrawn from the tube and the end closure member and means for releasing the end closure member from the holding means when the carrier means enters into the hole in the end closure member.

13. A machine for inserting an end closure member having an outwardly extending lip and a hole in its face into a tube and simultaneously crimping the tube over the lip thereby firmly securing the end closure member in the tube, which comprises a crimping head comprising a disc having a peripheral rabbet, the rabbet having two straight angularly disposed plane faces and a semicircular groove connecting the faces, carrier means for the end closure member comprising a tapered shaft attached to the center of the crimping head disc and extending perpendicularly thereto, means for continuously supplying tubes, means for feeding the tubes in turn to a position adjacent to the crimping head comprising two oppositely reciprocating members, one of the reciprocating members being located above the tube in crimping position and below the next following tube and operating to prevent movement of all other tubes when a crimped tube is being removed from the crimping position and the other reciprocating member being located below the tube being crimped to hold the tube in crimping position, a movable plate to press against the opposite end of the tube in crimping position to align the tube in crimping position, a series of gripping clamps for holding the tube in the crimping position, means for continuously supplying end closure members, means for feeding the end closure members, in turn into juxtaposition with the end of the tube, means for holding the end closure member in the juxtaposition, means for rotating the crimping head, means for producing a reciprocating motion of the rotating crimping head when said end closure member is in position which in one direction causes the carrier means attached to the head to enter into the hole in the end closure member and to drive the end member into the tube while simultaneously crimping the end of the tube, and in the opposite direction causes the carrier means to be withdrawn from the tube and the end closure member and means for releasing the end closure member from the holding means when the carrier means enters into the hole in the end closure member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,916,975

December 15, 1959

Joseph F. Casior et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 38, for "acute" read — acute —.

Signed and sealed this 24th day of May 1960.

(SEAL)

Attest:

KARL E. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents