The invention pertains to a procedure of manufacturing packaging containers which are deep-drawn of thermoplastic foil and which are reinforced by cardboard or a similar material. Furthermore, the invention pertains to a device for carrying out the procedure and also to a packaging container manufactured according to this procedure.

It is known practice to provide deep-drawn packaging containers of thermoplastic foil with a handle or a reinforcement of some stiff material like cardboard, in order to render them more resistant and to facilitate their handling, but especially to create an adequate surface on which to print data pertaining to contents, instructions for use, advertising texts, etc. If the container consists merely of thermoplastic foil, such a surface presents itself only on the top foil covering the container.

To manufacture such deep-drawn containers with cardboard reinforcements, it has until now been common practice to deep-draw the containers and to fill and seal them. Then, one by one or in groups they were glued to a precut cardboard. Another practice is to glue the containers to the cardboard in such a fashion that they penetrate through openings punched into the cardboard. Gluing the finished containers to the cardboard can only be done one by one and not in a continuous manner. Furthermore, it involves manual labor and is therefore impractical and expensive.

In order to eliminate these drawbacks, the invention proposes a procedure according to which a continuous length of thermoplastic foil, together with a continuous length of cardboard or a similar material, is fed into a deep-drawing device in which it is fused with the cardboard length through hot sealing.

After the deep-drawing process, the lengths, having been fused, are led through a mechanism for filling the containers, through another one for sealing them and through a cutter which separates individual containers or container groups from each other, a transport mechanism for the lengths having been placed directly before the cutter.

Suitably, openings are punched into the cardboard length just before fusing it with the thermoplastic foil. This procedure provides for making the containers and fusing them with the cardboard reinforcement in a single manufacturing process, thus eliminating the impractical and time consuming gluing of the containers to the cardboard. Even though the following text always makes mention of a "band of cardboard and the like," it is understood that any other similarly stiff material may be used for reinforcing the deep-drawn containers, and that according to the invention the procedure may be carried out by using a length of other material instead of cardboard.

In carrying out the procedure according to the invention, there are two basic possibilities: one is to join the cardboard length with that side of the thermoplastic foil which is not facing the container. This means that with the container opening facing upward, the cardboard reinforcement is fused with the thermoplastic foil from above. The other possibility is to draw the thermoplastic foil through the openings in the cardboard length. This means that the cardboard reinforcement is applied to the side of the thermoplastic foil which is facing the containers, i.e., the bottom side. The latter method has the considerable advantage that, when deep-drawing the containers, the rim of the cardboard openings serves at the same time as the upper rim of the deep-drawing form, making it possible to deep-draw different shapes of containers by using the same deep-drawing form, depending only on the shapes of the openings cut into the cardboard length. Another possibility is to deep-draw the thermoplastic foil through cardboard openings which are narrower than the deep-drawing form itself, thus creating containers with a narrow opening. By using appropriate pressure, such containers may be filled with items like pills, screws, etc., items which are slightly larger than the opening in the container and which are thus kept inside the container. Covering or sealing the container is then unnecessary.

It is advisable, when proceeding in accordance with the invention, to use a length of cardboard and the like which has been treated with a material suitable for hot-sealing. The materials used for this purpose, notably thermoplastic plastics, are known. It is, however, possible to use an untreated cardboard, inasmuch as a sufficiently preheated thermoplastic foil will stick even to cardboard and the like which has not been treated in the aforementioned manner.

Another basic advantage of the procedure according to the invention lies in the fact that the comparatively sturdy cardboard length serves at the same time as a means of transporting the thermoplastic foil as well as the containers drawn from it, through the deep-drawing device. The thermoplastic foil as well as the containers drawn from it, are connected with the cardboard length and can be pulled through the device with it. Special accompanying transporting devices, such as forms for the containers, etc., are therefore not necessary. This makes it possible to use in a simple manner even thin thermoplastic foils, especially vacuum-tight polyester or polyolefin foils which normally cannot be shaped into self-supporting packages and which are not sturdy enough to run through a deep-drawing device without some kind of support.

The deep-drawn containers may be closed in the usual manner by being sealed with a covering foil. The latter may consist of a thermoplastic foil, paper, plastic covered metal like aluminum, etc. For certain purposes it may prove advantageous, according to the invention, to seal onto the container openings, which may be open or foil covered, a length of cardboard or the like. Thus the container openings are more effectively protected, the packages receive an additional support, and an extra printing surface is created. Instead of superimposing a second length of cardboard or the like, the invention provides for proceeding as follows: if the length of cardboard or the like, which is fed through the equipment jointly with the thermoplastic foil, is wider than the length of thermoplastic foil, cuttings from the overlapping sides of the card-
board length may be folded and sealed onto the container openings.

The cardboard material covering the container openings may be provided with openings especially for punching the contents through the containers, thus creating the known push-through packages for pills, etc. which previously had to be made by hand.

A preferred method of applying the invention is to cut the openings in the cardboard length being fed through the device together with the thermoplastic foil in such a fashion that in the deep-drawing process parts of the cardboard length are drawn into the deep-drawing form and then hot-sealed onto the sides and/or the bottom of the container.

This simple method provides for containers not only the rim but also the sides (whether vertical or slanted) and possibly the bottom reinforced by cardboard and the like. This renders the containers especially resistant to pressure from the top. Another advantage is that the sides of a container may serve as a printing surface.

Suitably, these cardboard cuttings which are drawn into the deep-drawing form, should be overlapping parts connected with the openings in the cardboard length. In the process of deep-drawing, they are bent downward and sealed to the sides of the container. Another possibility would be to punch a clean-cut opening into the cardboard length and to fuse the cardboard clipping with the bottom of the container.

Any one of the known methods may be applied in the deep-drawing of the thermoplastic foil. It is most advantageous, according to the invention, to heat the thermoplastic foil to the softening point by bringing it in contact with a heating plate. It is then pressed into a deep-drawing form (together with parts of the cardboard length if so desired). It is advisable to apply only moderate pressure when pressing the thermoplastic foil against the heating plate, but to use higher pressure when pressing or drawing it into the deep-drawing form.

One contrivance for carrying out the procedure according to the invention is characterized by devices for feeding a continuous length of thermoplastic foil, jointly with a continuous length of cardboard and the like provided with openings, into a deep-drawing device with at least one deep-drawing form. Suitably, the following equipment is set up in assembly line fashion, along the course taken by the cardboard length: a cutting device for punching the openings into the cardboard length, a deep-drawing device, a device for filling the deep-drawn containers, one for closing the containers by sealing them with a covering foil and/or with parts of the cardboard length, and another cutting device for separating the containers. The feeding devices may be set up in such a manner that the thermoplastic foil runs between the cardboard length and the deep-drawing form or, in a reversed manner, that the cardboard length runs between the thermoplastic foil and the deep-drawing form, so that the thermoplastic foil is deep-drawn through the openings in the cardboard length.

The invention pertains furthermore to a packaging container of deep-drawn thermoplastic foil with reinforcements of cardboard and the like. This container is characterized by a rim protruding over and surrounding the container opening. Connected with the rim is a cardboard reinforcement surrounding the container on the side facing it. In another version of the container, according to the invention, the cardboard reinforcement is connected with the protruding rim on the side not facing the container opening. Preferably, in such a container, the inner rim of the cardboard reinforcement is connected with flaps that are bent downward and fused with the sides and possibly with the bottom of the container. If the cardboard reinforcement is on the lower side of the surrounding rim, the flaps are on the outside of the container walls, so that the contents of the container touch only the thermoplastic foil and not the cardboard reinforcement. If, however, the cardboard reinforcement is on the upper side of the surrounding rim, the flaps are inside of the container wall which is thus protected from the exterior by the thermoplastic foil. Suitably, the flaps fused with the container walls are of such dimensions as to form support panels that reach to the bottom of the container.

Still another version of the container provides for cardboard reinforcements connected sideways with the surrounding rim so that they may be folded onto the openings and/or the bottom side of the container, where they may be fastened by sealing or pinning. Hereunder and by means of the enclosed drawings are described in detail procedures for carrying out the invention which are to be understood as not restricting examples.

FIG. 1 shows the pattern of an example of a mechanism for carrying out the procedure according to the invention.

FIG. 2 shows in a similar representation as FIG. 1 a mechanism for a modified form of carrying out the procedure.

FIG. 3 is a schematic representation in cut-away view explaining the procedure according to FIG. 2.

FIG. 4 shows a top view explaining the procedure in a different form of execution.

FIG. 5 shows a top view of the cardboard length, provided with openings, as fed into the deep-drawing device.

FIG. 6 shows a cut-away view of one version of the deep-drawing device during the process of deep-drawing.

FIG. 7 shows, in perspective representation, a container manufactured according to a first procedure according to the invention.

FIG. 8 shows a transverse cut through approximately the center of the container shown under FIG. 7.

FIG. 9 shows, in perspective representation, a container manufactured according to a second procedure according to the invention.

FIG. 10 shows, in perspective representation, a circular container.

FIG. 11 and FIG. 12 show another container according to the invention, open and closed.

FIG. 13 shows another container manufactured according to the invention.

FIG. 14 and FIG. 15 show a double container manufactured according to the second procedure according to the invention.

FIG. 16 shows another version of a container.

FIG. 17 and FIG. 18 show the folding of a package manufactured according to FIG. 4.

FIG. 19 and FIG. 20 show the folding of a similar package as in FIG. 17 and FIG. 18.

In the mechanism according to FIG. 1, a cardboard length 1 is taken from a roll 2 and fed into a cutting device 3 which punches openings 4 into the cardboard length 1, leaving flaps 5 attached to the edges of the openings 4. In the same cutting device, side flaps 10 may be created through incisions 9 on the side. It is of course possible to use, instead of cardboard, a length of another stiff material like stiff paper or even a stiff plastic foil.

From cutting device 3 the cardboard length 1 is taken to deep-drawing station 11. This deep-drawing station receives a deep-draw foil 12 from a roll 13. In the following text the term deep-draw foil designates a foil of thermoplastic plastic which can be heat-softened and then molded when in soft condition. Such foils are for instance polyvinylchloride, saran, polyster, polyethylene, etc. The deep-draw foil is heated by means of a heating device 11' which is placed directly before the deep-drawing station and is then, within the deep-drawing station 11, drawn into the deep-drawing form or forms and at the same time sealed to the cardboard length above it. In the diagram the deep-draw foil is narrower than the cardboard.
5 length, so that the side flaps 10 are not fused with the deep-draw foil.

From the deep-drawing station 11, the container length 14 is taken from the deep-draw foil 12 with the cardboard length) is fed into a filling station 15 where the containers may be filled in the usual manner. Sealing the container can be done advantageously by folding the side flaps 10 (by means of a metal arm not shown in the drawing) onto the container opening to which they are point-welded by means of welding device 18. It is of course possible instead (or in addition) to seal the container openings in the usual manner with a covering foil.

Finally the containers are separated in cutting station 21. It is of course possible to do the cutting in such a fashion as to create container units consisting of several containers. Conveyor devices 26, placed directly before the cutting station, keep the entire container length moving through the various stations by holding on to the cardboard. This makes it possible to use even a thin thermoplastic foil which normally would not be resistant enough to be moved through the entire mechanism in this manner.

The heating device which is placed before the deep-drawing station may be a contact heater, an infra-red heater, etc. The deep-draw foil can also be heated in the deep-drawing station itself.

As an additional station, it would be possible to place behind the filling station a device (not shown) for evacuating the containers and (if desired) gas spraying them with an inert protective gas. This, however, would require the containers to be sealed with a covering foil.

FIG. 5 shows in greater detail the shape of the cardboard length after cutting. Each opening 4 is surrounded by flags 5, 6, 7, 8, which in the process of deep-drawing are bent and (according to this particular procedure) fused with the inside of the container walls. These flags 5, 6, 7, 8 may of course be of different shapes. They may be longer for covering the bottom of the container. There may also be fewer or no flags at all. Furthermore, there may be side flaps 10 which are formed by incisions 9. Suitable, these incisions have a certain width so that later, when the containers are separated in cutting station 21, the cuts are congruous with the former 9. The side flaps 10 may be provided with openings 19 through which the contents of the container are visible, especially when the container is covered with a plastic foil underneath the cardboard 10.

FIG. 2 shows a modified procedure in which corresponding parts are numbered as in FIG. 1.

The main difference compared to the procedure under FIG. 1 lies in the fact that the thermoplastic foil 12 has been fused with the cardboard length from above instead from underneath. For this reason the thermoplastic foil 12 (in deep-drawing station 11) is drawn through the openings 4 in the cardboard length, in order to form the containers 14. If also in this case (not shown) side flaps are left in the openings 4 (like flags 5, 6, 7, 8 under FIG. 4) which will cover the outside walls of the container 14.

Another difference lies in the fact that the deep-draw foil is heated inside the deep-drawing station 14 and not in a separate heating station. After the deep-drawing process the containers are filled (as under FIG. 1) in the filling station 15. Furthermore, the procedure under FIG. 2, differing from FIG. 1, provides for the containers to be sealed with a foil 17 prior to being covered with the side flaps 10. The foil is placed and sealed onto the containers in a sealing station 16. This foil may be one of treated metal, paper or thermoplastic foil.

The procedure according to FIG. 2 is represented again in flow in the diagram of FIG. 5. It can be seen that the thermoplastic foil 12, fused with the upper side of cardboard length 1, which may have been provided with openings 4, is fed into the deep-drawing station 11. An example for the equipment of the deep-draw station will be described later. The containers are then filled in the filling station 15, for instance with solid items such as pills, or with a contents in liquid or powder form. The covering foil 17 is then taken from a roll and sealed onto the container openings in the sealing station 16. In a cutting station 21 the containers are separated individually or in groups.

FIG. 4 shows schematically and from above one grouping pattern centering in a cardboard length 1 cut symmetrically to a center line. Starting from the center line, the length consists of a part 110 provided with openings, another part (divided by folding line 113) 111 provided with openings and another part 112 not provided with openings, which may be wider than shown in the diagram. The other side of the center line provides for corresponding parts 110’, 111’ and 112’ of the cardboard length.

The direction of transportation is from right to left. In the deep-drawing station 11 the thermoplastic foil 12 is drawn through the openings of the center parts 110 and 110’ of the cardboard length, as shown under FIG. 3. The deep-draw foil is just wide enough to cover the openings of the center parts 110 and 110’ of the cardboard length. In the filling station 15 the containers are filled and in the sealing station 16 they are sealed with a covering foil 17. Then, by means of the cutting device 114, the finished container length is cut along the center line and individual container groups are separated. Now, with the help of folding arms 115, 116, the different parts 110, 111, and 112 of the cardboard length may be folded so that the openings of part 111 cover the openings of part 110. In this manner a push-through package is created which will be described later. Part 112 serves as a protection for the container bottoms. The sealing station 117 separates to join parts 110 and 111 of the cardboard length.

The other side of the cardboard cut lengthwise is treated in the same way. The corresponding details are not shown. An especially advantageous version of the deep-drawing station is shown under FIG. 6.

A heating plate 22 with heating devices like 23 is suggested for heating the foil. This heating plate is provided with airholes 24 and 25 and may be ridged on the bottom for easier removal of the foil. The heating plate works in conjunction with a cooling device 26 which is also provided with airholes 27, 28. The holes 24, 25 are connected with a pressure or vacuum duct 29, holes 27, 28 are connected with a pressure or vacuum duct 30.

The cardboard length 1 with its flaps 6 and 8 is fed into the device together with the deep-draw foil 12. The form is closed tight by means of valves 31, 32. Compressed air which is led through duct 30 and openings 27 and 28 exerts a pressure of, for instance 0.2 atu, on the foil 12 thus pressing it against the heating plate 22. In this manner, it will be heated to the softening point. The flags 6 and 8, still projecting horizontally from the cardboard length 1, are not pressed against the heating plate. In case they are covered with a hot-sealing film, this film is only moderately heated and the flags are not yet pressed against the deep-draw foil 12, the necessary pressure not yet being applied.

Then the air from duct 30 is withdrawn and at the same time air is injected into duct 39, thus exerting a pressure of, for instance, 6 atu, above the openings 24 and 25 on the deep-draw foil 12 which is thereby pressed into form 26 together with flaps 6 and 8 in the position indicated by the lined area.

After flaps 6 and 8 have settled on the walls of form 26, the foil which is still hot is pressed to the flat surface of the flags (which has previously been prepared for hot-sealing), so that the flaps and the foil are fused.

The valves 31, 32 are bled in the same way, a connecting link between the cardboard length and that part of the deep-draw foil 12 which has not been deep-drawn.

After opening the form the thus created container length 14 can be moved ahead and a new section of the
cardboard length 1 can be fed in together with a corresponding section of the deep-draw foil 12. FIGS. 7 and 8 show an example of a container manufacturing procedure according to the invention. In this case, the cardboard length is on top of the deep-draw foil. This means that FIG. 7 shows a top view of the rim 125 formed by the cardboard reinforcement surrounding the container. On its lower side (not visible) is the rim of thermoplastic foil surrounding the container. The bottom 122 as well as the shorter sides 123 and 124 of the container consist of thermoplastic foil which is not reinforced. This foil covers also the outside walls of the longer sides. The longer sides, however, are reinforced on the insides by flaps 126 and 127 of the cardboard length. FIG. 3 shows clearly in a cut approximately through the middle of the container, the position of the thermoplastic foil 12 which is reinforced at the rim and on the walls of the longer sides by parts 125, 126 and 127. The package may be sealed with a covering foil or cardboard 128.

FIGS. 9 to 20 show containers manufactured according to the second procedure according to the invention. Here the thermoplastic foil is deep-drawn through openings in the cardboard length. In the case of FIG. 9 (container is shown from below) the opening in the cardboard length 1 through which the container has been deep-drawn was made by a cross cut forming triangular flaps 33, 34, 35 and 36 which in the process of deep-drawing the foil 12 are folded into the deep-drawing form where they are fused with the side walls and the bottom of the container. The side flap of the cardboard length 1 which has been folded onto the container opening is marked by a 10.

Under FIG. 10 showing a container from below, a circular or rather polygonal opening has been cut. Here the trapezoidal flaps, e.g. 37 and 38, cover the sidewalls of the polygon. They are cut to the height of the container so that the bottom of the container formed by deep-drawing of the foil 12 remains uncovered.

The corresponding flaps may of course be of various shapes like circular segments 39 and 40 (see diagram 11). Here, by the way, the cardboard length 1 is elongated on one side and provided with a slot 41. On the other side it is provided with two folds over a joint 42 showing a flap 43 with a tongue 44 which can be bent and inserted into slot 41. Thus a sack-like package is created as shown in diagram 12, enveloping the package (provided with reinforcements 39, 40) by cardboard length 1 and flap 43. Diagram 12 shows the package from an angle differing by 180° from that in diagram 11.

A similar package is shown in diagram 13. Here both sides of the cardboard length 1 are provided with joints 45, 46 with two folds each to which flaps 47, 48 are attached. Flap 47 has a tongue 49 and flap 48 a slot 50 into which tongue 49 may be inserted, thus forming a box-like container covering the deep-drawn package. The sides of this box-like container are open. In order to create a completely closed box-like outer package, the cardboard length 1 should be provided with folding tongues. All these different kinds of foldings may be carried out prior to entering station 18 of diagram FIG. 2.

As already mentioned, the cutter 21 may separate groups of containers. By cutting off for instance two packages each, one obtains two triangular packages 52, 53 in a rectangular carrying case 54 (diagram FIG. 14). By folding this carrying case over fold 55, putting packages 52, 53 on top of each other, one obtains the package shown in diagram FIG. 15 which may for instance serve to sell together two lots of merchandise requiring individual packaging. In this case, reinforcing flaps 56 are created by cutting 54 into the openings 4 into the center, forming very narrow trapezoids.

Finally one may also proceed according to diagram 16, not leaving any flaps on the sides of the openings 4 but to cut the openings, all or in part, in such a fashion as to leave only very narrow connecting strips. Later, in deep-drawing station 11, the applied pressure will sever the connection between part 57 and the cardboard length 1. This part will then fall into the form where it is fused with the hot deep-draw foil 12, thus creating the package shown in diagram FIG. 16 where the bottom of the container is reinforced by part 57.

The application of the procedure according to the invention is of course not limited to deep-drawn packages of rectangular or trapezoidal shapes. It is also possible to create deep-drawn reinforced packages which are triangular. Such packages may be pyramidal or prismatic, and especially in the latter, the triangular sides may be provided with triangular reinforcements. This is of special interest if several prismatic packages are to be combined to a package of polygonal shape. Semicircular packages may be reinforced in the same fashion.

Diagrams 17 and 18 show the folding of a container created according to the procedure demonstrated in diagram 4. The thermoplastic foil is connected with part 110 of the cardboard length through the openings of which it had been deep-drawn to create packages which may contain pills for example. The container openings are sealed with a covering foil which may be applied in means of folding arm 115 of diagram FIG. 4 this foil is then folded onto part 111 which has been provided with openings. Part 112 of the cardboard length (without openings) is then folded onto the bottom of the container as a protection (diagram FIG. 18). The pills may be extracted through the openings in part 111 by pressing the bottom of the container. The rims around the openings prevent excessive tearing of the covering foil 17 which would in turn tear open neighboring containers.

Diagrams 19 and 20 show a similar model. Here, in two sections of the cardboard length, two groups of containers have been manufactured by deep-drawing the thermoplastic foil through the openings in the cardboard length (in diagram 19 the thermoplastic foil is underneath the cardboard length). In this case, the cardboard is folded in such a manner that the bottoms of the containers touch. The sides of the package are covered by side flaps 217, 218. Finally, in order to protect the container openings covered only by a thin foil, parts 219 and 220 of the cardboard length are folded around the container. To close the package, a tongue 215 may be inserted into a slot 216 cut into the cardboard length.

The procedure according to the invention is of course not limited to manufacturing only the types of containers shown. Even the kind of equipment and the manner of arranging it may be changed without deviating from the framework of the invention. Other stations may be included in the procedure, for instance for evacuating the containers or for filling the containers with an inactive protective gas. In the manufacturing process, the lengths of foil may move in a vertical or slanted fashion instead of horizontally, as well as upward or downward.

I claim:
1. In a method for manufacturing deep-drawn, thermoplastic foil packaging containers provided with a relatively rigid reinforcement, the improvement comprising
(a) feeding a continuous length of thermoplastic foil and a continuous length of reinforcement in overlapping relationship into a deep-drawing device,
(b) deep-drawing the thermoplastic foil, and
(c) simultaneously fusing the thermoplastic foil to the reinforcement by heat sealing so forming a container.
2. A method as in claim 1, including,
(a) filling the formed containers,
(b) closing the formed containers, and
(c) separating the formed containers from one another.
3. A method as in claim 1, including,
(a) cutting openings in the reinforcement before fusing the thermoplastic foil to the reinforcement.
4. A method as in claim 1, wherein the thermoplastic foil is fused on the side of the reinforcement which becomes the inside of the container.

5. A method as in claim 3, wherein the thermoplastic foil is deep-drawn through the openings in the reinforcement.

6. A method as in claim 2, wherein the formed containers are closed by,
(a) sealing with a thermoplastic foil, and
(b) covering with a reinforcement.

7. A method as in claim 1, wherein the reinforcement is wider than the thermoplastic foil such that flaps of reinforcement can be formed on the container for closing the container.

8. A method as in claim 7, including,
(a) forming openings in the flaps,
(b) folding the flaps through the openings, and
(c) fusing the flaps onto the thermoplastic foil by heat sealing.

9. A method as in claim 3, including,
(a) forming flaps of reinforcement around said openings,
(b) preheating the thermoplastic foil before deep-drawing the thermoplastic foil and the reinforcement.

10. A method as in claim 10, including,
(a) pressing the thermoplastic foil under low pressure against a heating plate to preheat the thermoplastic foil, and
(b) pressing the thermoplastic foil under a relatively higher pressure into a deep-drawing mold.

11. A method as in claim 10, including,
(a) pressing the thermoplastic foil under low pressure against a heating plate to preheat the thermoplastic foil, and
(b) pressing the thermoplastic foil under a relatively higher pressure into a deep-drawing mold.

12. An apparatus for manufacturing deep-drawn thermoplastic foil packaging containers provided with a relatively rigid reinforcement comprising,
(a) a deep-drawing device,
(b) means to feed thermoplastic foil into the deep-drawing device,
(c) means to simultaneously feed reinforcement into the deep-drawing device, and
(d) means for fusing the thermoplastic foil to the reinforcement.

13. Apparatus as in claim 12, including,
(a) means for filling the containers,
(b) means for closing and sealing the containers, and
(c) means for separating the containers from one another.

14. Apparatus as in claim 12, wherein the thermoplastic foil is arranged to be fed between the deep-drawing device and the reinforcement.

15. Apparatus as in claim 12, wherein the reinforcement is arranged to be fed between the deep-drawing device and the thermoplastic foil.

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U.S. Cl. X.R., 53-184; 156—224, 509