June 10, 1930. H. B. SMITH 1,762,703

BOX AND METHOD OF MAKING SAME

Original Filed Jan. 12, 1923 5 Sheets-Sheet 1

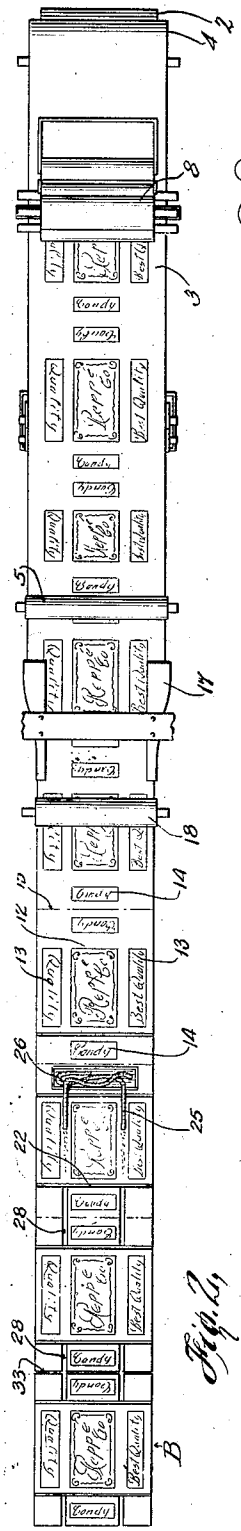


Fig. 2.

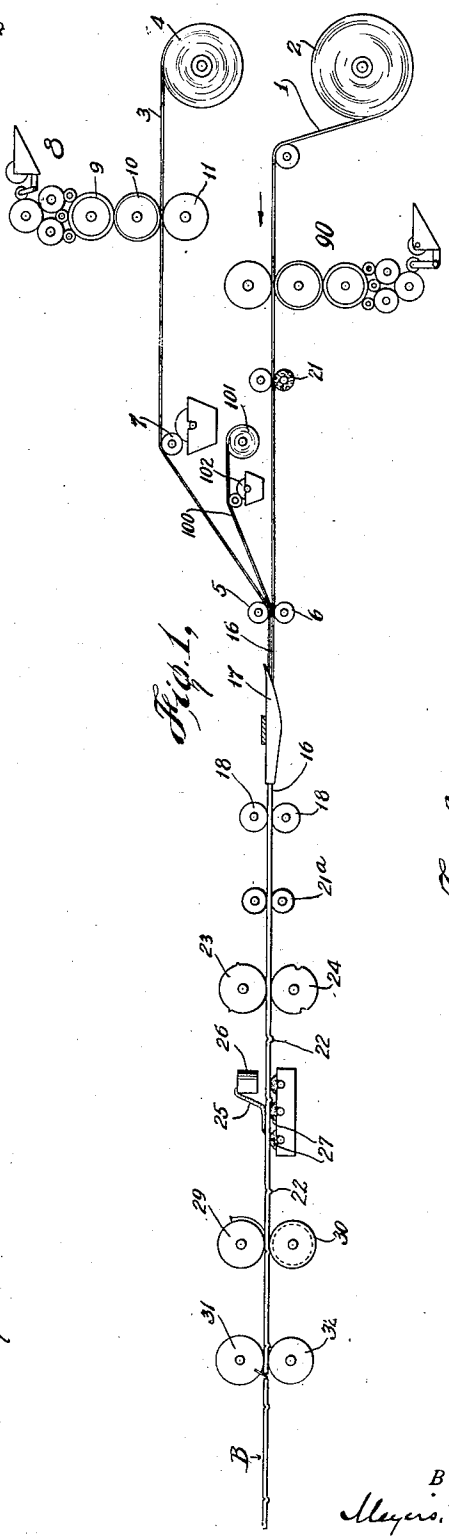


Fig. 1.

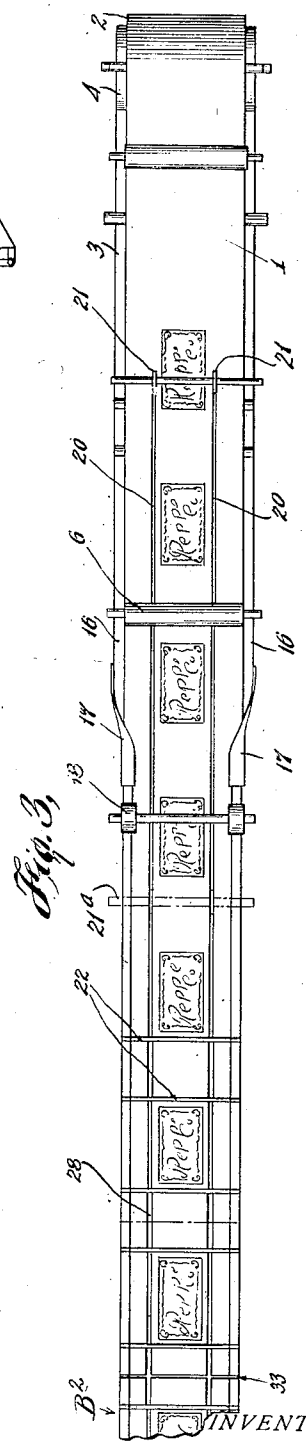


Fig. 3.

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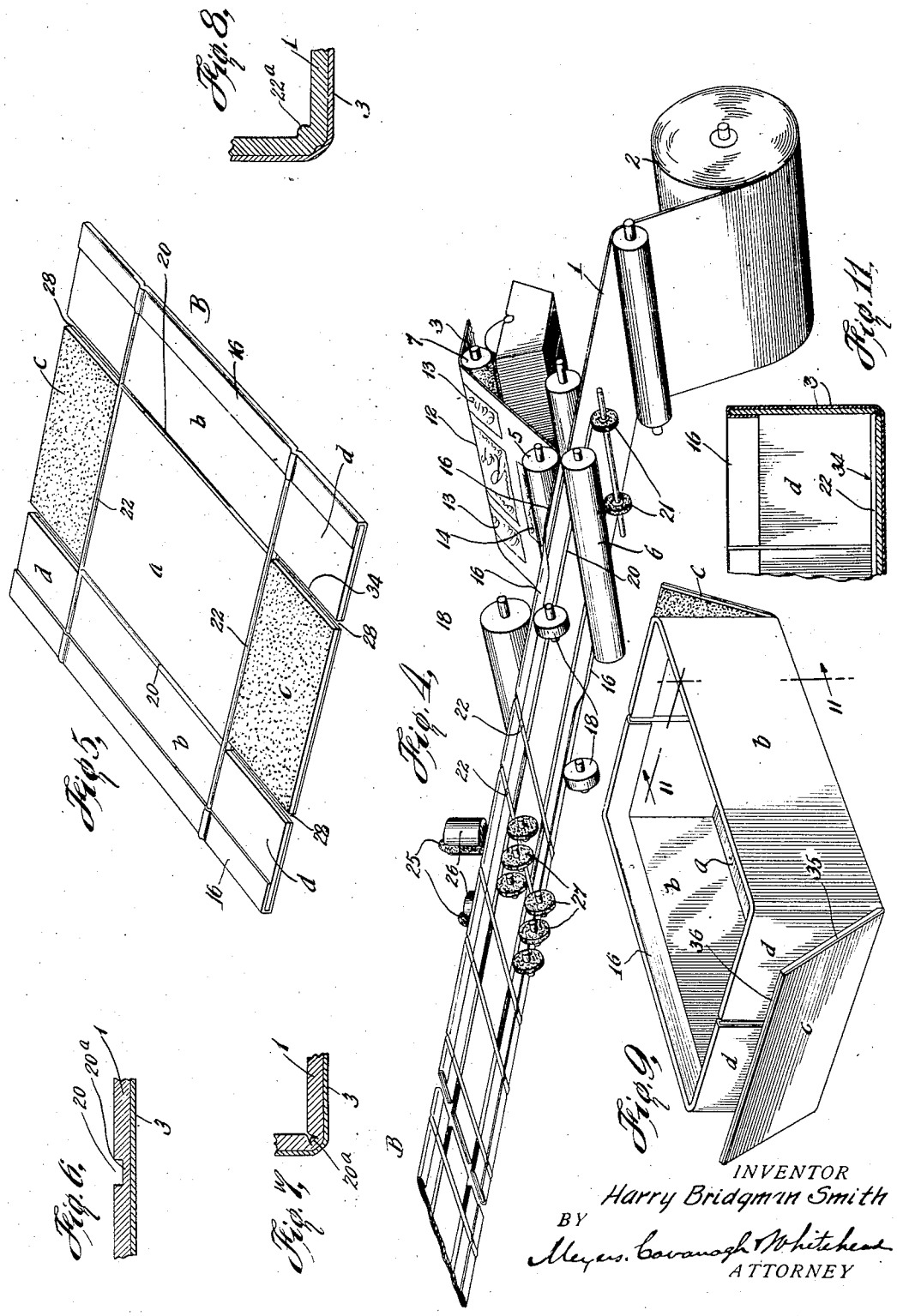
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BOX AND METHOD OF MAKING SAME

Original Filed Jan. 12, 1923 5 Sheets-Sheet 2



June 10, 1930. H. B. SMITH 1,762,703

BOX AND METHOD OF MAKING SAME

Original Filed Jan. 12, 1923 5 Sheets-Sheet 3

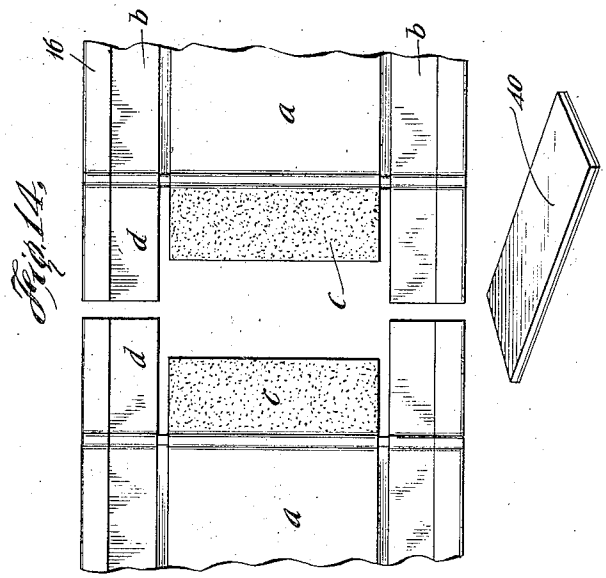


Fig. 11.

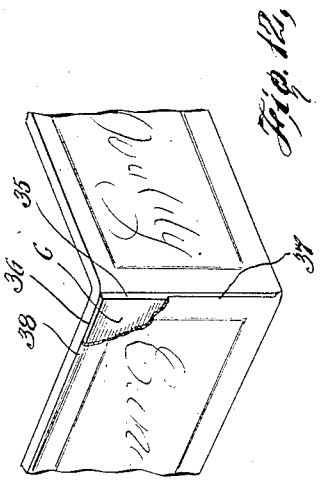


Fig. 12.

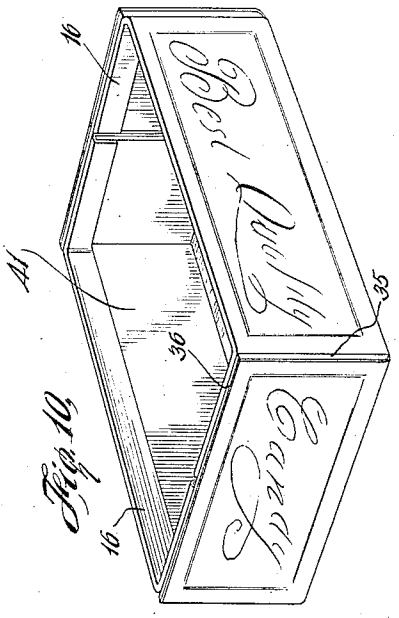


Fig. 10.

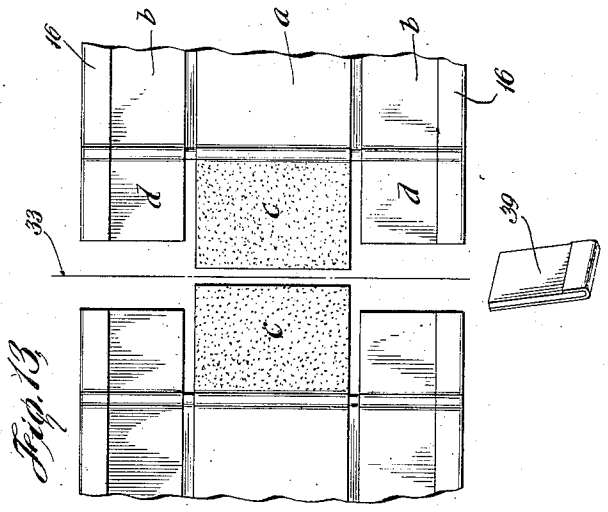


Fig. 13.

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June 10, 1930. H. B. SMITH 1,762,703

BOX AND METHOD OF MAKING SAME

Original Filed Jan. 12, 1923 5 Sheets-Sheet 4

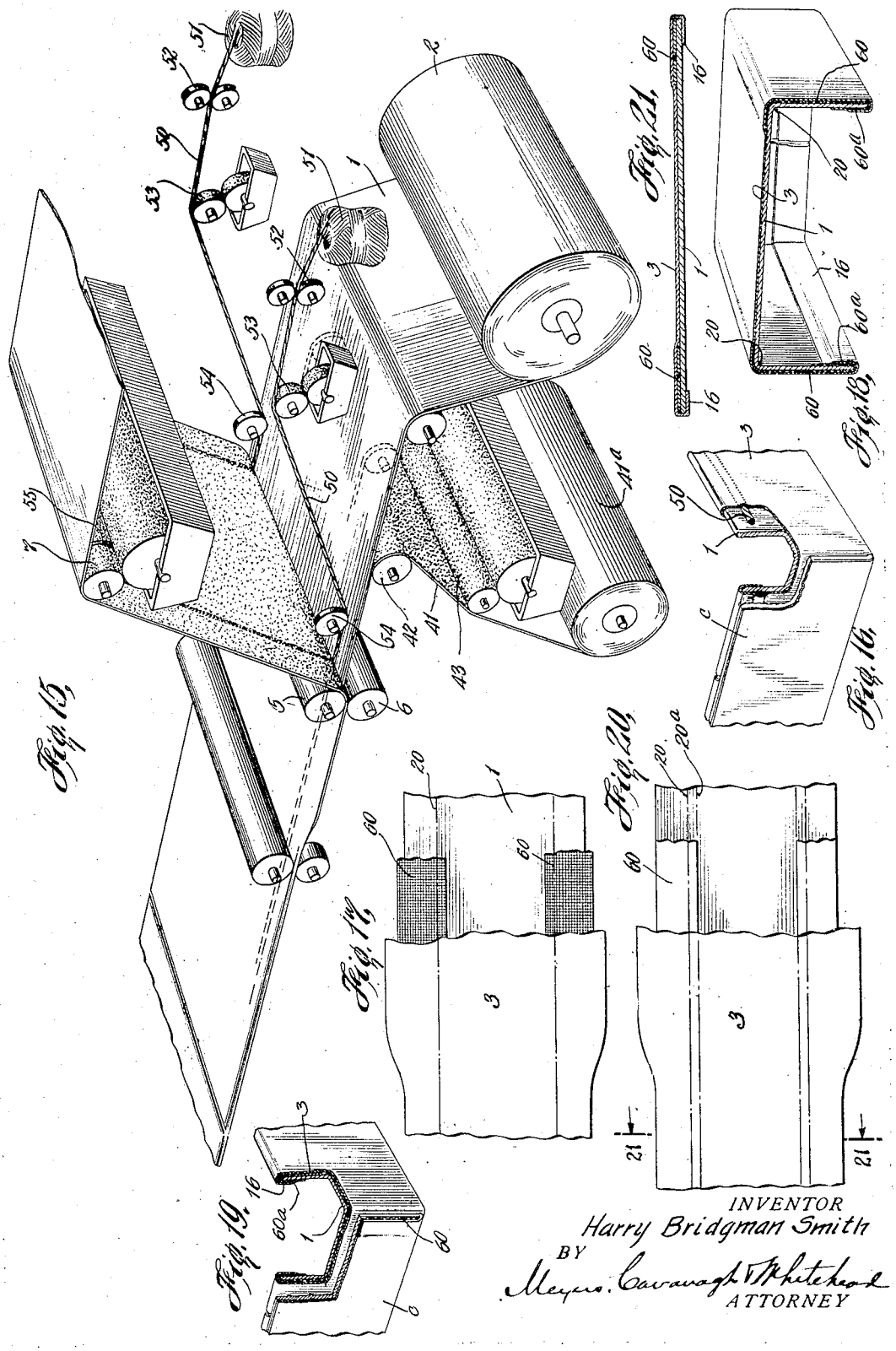


Fig. 15.

Fig. 21.

Fig. 18.

Fig. 16.

Fig. 17.

Fig. 20.

Fig. 19.

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June 10, 1930. H. B. SMITH 1,762,703

BOX AND METHOD OF MAKING SAME

Original Filed Jan. 12, 1923 5 Sheets-Sheet 5

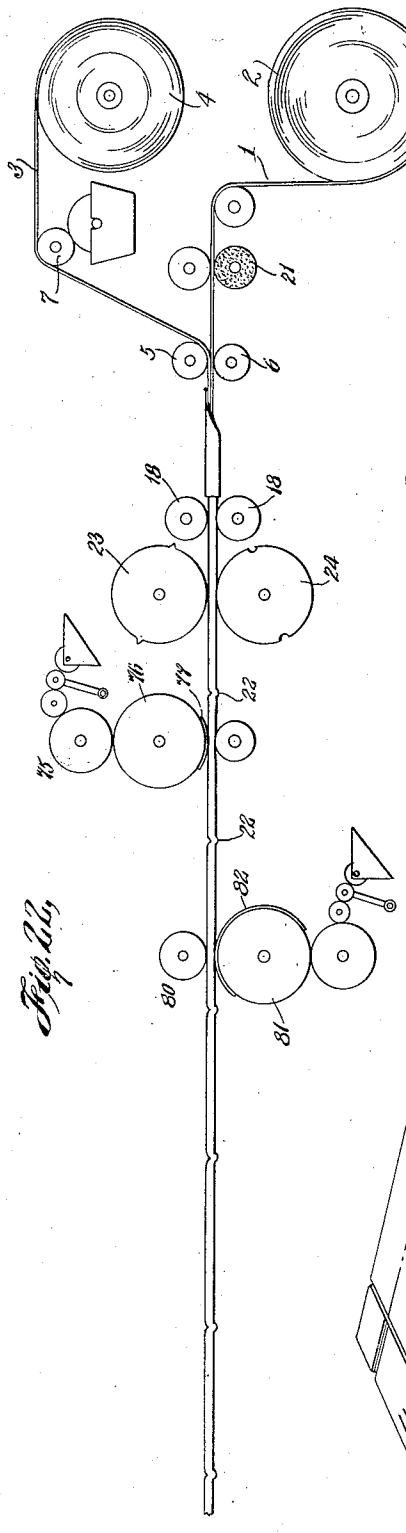


Fig. 22.

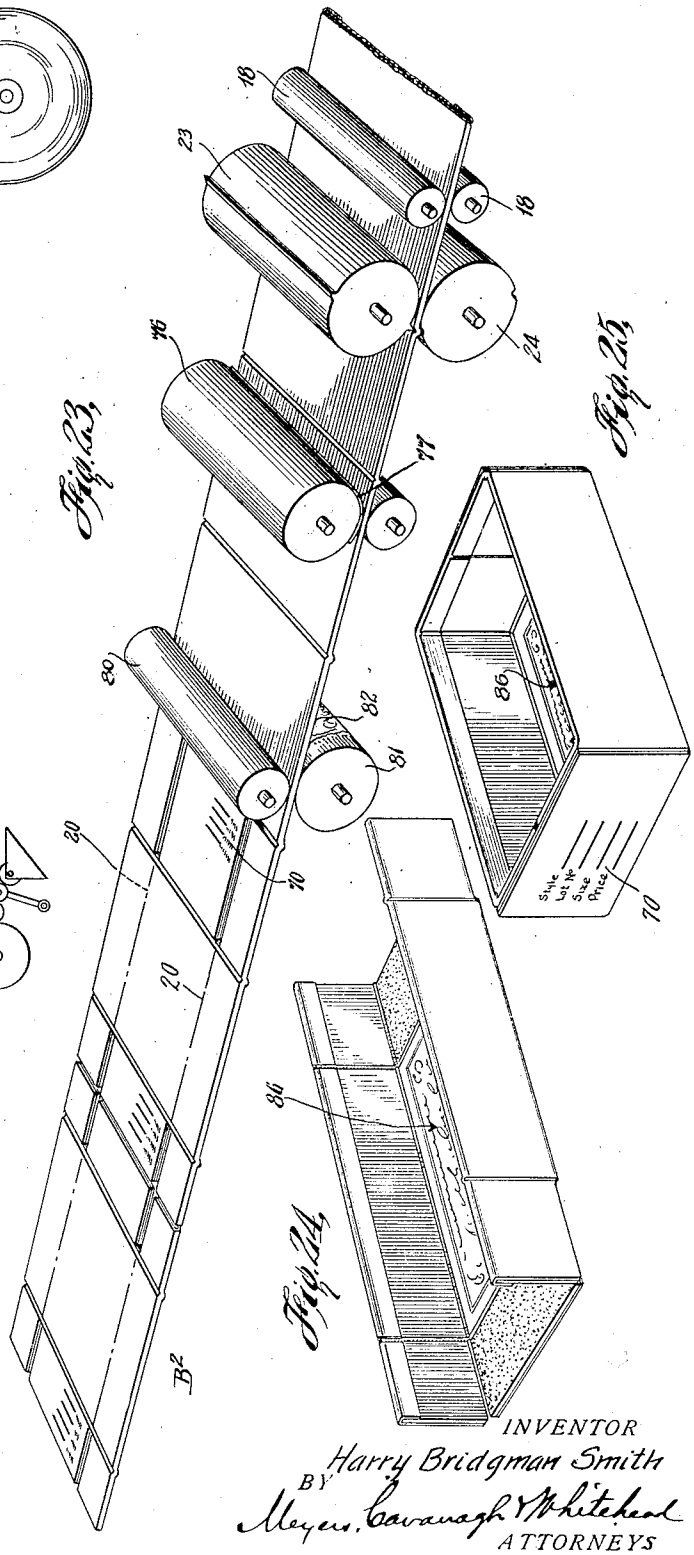


Fig. 23.

Fig. 25.

Fig. 24.

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UNITED STATES PATENT OFFICE

HARRY BRIDGMAN SMITH, OF BROOKLYN, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO HOAGUE-SPRAGUE CORPORATION, OF LYNN, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

BOX AND METHOD OF MAKING SAME

Application filed January 12, 1923, Serial No. 612,168. Renewed September 24, 1926.

This invention relates to new and improved methods of producing boxes in the general class of paper boxes, although the component materials are not necessarily limited to paper.

The present methods and boxes made in accordance with them are similar in certain respects to previous methods and boxes of my invention as disclosed in various patents and pending applications, with important modifications and improvements. The present methods are in general accordance with my previous "continuous" box production methods in that box forming materials are advanced continuously from a source of supply such as a roll, and after suitable operations are performed upon the continuous strips of materials, or continuous assemblies, parts of uniform size and shape are severed from the assembly, producing individual box blanks, which are then folded and secured in box form. The box structures produced by the present methods resemble previous box structures of my invention in their adaptability to production by the "continuous" method as above outlined, and particularly in consisting of a shell or body with a suitably "finished" outer surface and usually having marginal portions of the outer finishing surface or material turned in about the inner edge margin of the box, and also having corner laps which in many cases consist of combined shell and finishing or covering material turned in and overlaid by the end wing portions of the box blank.

The present invention is the result of elaborate study and experimentation with the general object of providing box forms and methods which conform to multifarious requirements and conditions in the art of commercial box making, with the result that boxes of improved construction are supplied at exceedingly low cost and the demands of box consumers are met more satisfactorily than heretofore.

The invention takes into consideration not only the form or structure of the finished boxes but the mutual adaptation of these forms or structures and the production methods; the nature of available materials with the object of producing boxes of relatively high grade or quality with relatively low grade or cheap materials where such economies are desirable, and the adaptation of the structures and the methods of the different materials employed for the foregoing and other reasons; the adaptation of the box or box blank forms to a desirable range of size and dimensional variations; and the demands of box consumers in respect to the labeling or printing of the boxes with advertising or decorative subject matter and the like.

In certain preferred embodiments of the invention as herein disclosed box body or shell material such as card- or fibre-board is advanced continuously from a roll and at a convenient point a continuous strip or web of suitable covering or finishing material, such as paper of suitable quality, is applied to a surface of the shell web with interposed adhesive, desirably in many cases with longitudinal margins of the cover web projecting beyond the edges of the shell. These margins are then turned over and secured; suitable incisions or excisions are made in the continuous materials to free certain parts for subsequent folding, for instance, the corner laps, and also to produce the proper end formation of the individual blanks, longitudinal and transverse score lines or creases are formed in the materials to facilitate folding and the individual blanks are then severed and folded into box form, all this being in general accordance with the previous methods of my invention.

From the point where the cover web is applied to the shell web a continuous strip or web of box forming material is produced, having on one face, that is, the face of the shell covered by the cover paper, a suitably finished surface which is to be the outer surface of the completed box. The method may be understood as commencing, in certain cases, with operations performed upon such a continuous web of box forming material, however produced, and the shell web with its applied cover web is therefore one example of suitably surfaced or finished shell or boxboard material which may be operated upon to produce the individual box forming blanks.

An important object of the present invention, therefore, is to provide methods admitting of the utilization of such substantially complete finished box forming material, whether it consists of card-board or fibre-board, with an originally separate surface sheet of finishing paper, or such card- or fibre-board treated or processed in any suitable way to provide a desirable surface finish. To this end the method steps are in general devised and related to each other so that all necessary operations may be performed on a continuous complete web of box forming material, or upon the web after the assembly of the shell and cover strips has been effected, as previously mentioned; although in certain cases some operations may be performed upon one or another of the continuous materials prior to assembly contact.

In certain preferred performances of the process, and especially in the particular exemplifications shown in the present application, therefore, the invention provides for performing all or substantially all of the operations upon the box forming strip or assembly beyond the point of assembly contact when such materials are originally separate.

The invention includes the creasing or scoring of the continuous box forming web to provide folding lines. These lines may be in a broad sense any suitable score lines or creases. Score lines, however, tend to weaken the materials and are therefore usually avoided. Deep "bead" creases are very desirable as permitting the proper bending or folding of relatively thick or composite material, and in certain preferred instances the transverse folding lines are produced in the form of such deep, gathered, or bead creases. Owing to the nature of the materials and their method of manipulation it is relatively difficult or impracticable in certain cases to form such creases longitudinally of the materials; this is true particularly because the body or shell material in most cases is not readily drawn in laterally by available creasing mechanisms as it progresses longitudinally, to form such creases. To avoid this difficulty and at the same time to provide proper longitudinal fold lines the invention provides, as an important feature, for removing portions of the body or shell material on longitudinal lines of substantial width, this operation being conveniently termed "routing" and being conveniently performed by grinding wheels. While high grade body or shell material, such as material known in the art as folding board, may be creased and folded with relative ease, and considerable latitude is afforded in handling that material when it is used for higher grade boxes, the above mentioned method steps, and particularly the longitudinal routing, permits the use of a relatively cheap grade of body material such as chip or fibre-board, which is relatively brittle, and in which the deep, bead or "gathered" folding creases are produced transversely, as above stated, and the routed folding lines are produced longitudinally, because longitudinal gathered creases are not so conveniently produced in this class of material.

My previous inventions in this art, above referred to, provide covered boxes conforming to all the requirements of the trade for covered boxes of the highest quality and finish, that is to say, they provide boxes the outward surfaces of which are entirely covered and concealed by the cover paper; all the edges of the shell are covered and concealed by the cover paper, and margins of the cover paper are turned in and secured along the inner edge margins of the shell to provide an appearance and finish that is demanded in boxes of this class. An important object of the present invention is to provide production methods, and box forms adaptable to such methods, which closely approach or simulate covered boxes of the highest class just referred to, but in which notable economies are effected by omitting certain items in the "finish", and more particularly by omitting the covering of certain edges of the shell material, and in which, more particularly stated, the side or end edges of the shell end wings may be left more or less uncovered. Boxes of this type are produced by cutting the assembly materials so that along certain edges of the assembly end wings, the cover and shell edges are substantially even or parallel, without any, or any considerable projection of the cover material beyond the shell edges, and when these wing portions are folded up outside the corner laps the shell edges are therefore more or less exposed. This is unobjectionable in boxes of certain types and used for certain purposes, and such boxes may be made at lower cost, both with regard to the method steps and the material, than the more highly finished boxes. In some preferred cases when the blanks are cut in the manner just stated the edges of the cover material may be pressed and stretched over the adjacent edges of the shell material to a substantial extent so that the edges of the shell material are partially or substantially concealed and therefore the completed box presents nearly the same appearance as the most highly finished boxes, without, however, requiring all of the process steps or structural features involved in boxes having completely finished or covered shell edges. This item relates to only one feature of the invention, and other features are adaptable to boxes of other forms than the specific form just mentioned.

One important object of the invention is to provide a method of producing a type of box and box blank which in certain styles

or dimensional forms admits of the continuous box forming web or blank assembly being severed on a single transverse line to produce the individual box blank or blank assemblies. Otherwise, for other forms of boxes or for dimensional variations, the individual blanks are produced by transverse severing and incidental to this severing or by other or subsequent operations, parts may be cut off or excised to produce individual blanks in which the end wings are longer than the corner laps, or vice versa.

In many cases there is a demand for lined boxes, that is, boxes in which the inner surface of the shell material is overlaid by finishing paper of attractive appearance. The invention therefore includes, in connection with other features, methods of producing lined boxes, and method steps for applying lining material to the shell web, or continuous box-forming assembly.

In many cases it is desirable to provide for strengthening the structure either with the object of resisting strains in handling the completed boxes or the strains imposed on them in shipping them with their contents, or to properly reinforce the box blanks to permit proper or easier folding or to reinforce the completed boxes along the fold lines. In certain classes of boxes it is very desirable that the box parts be reinforced near the wall edges, and cords have been placed around these edges to resist breaking strains. The present invention provides methods and method steps for incorporating such a cord reinforcement, and in a broader aspect it also provides for supplying other reinforcements at the stated point in the completed box part or at other points including fold lines, and the reinforcements may consist of cords or strips or webs of sheet material including fabric and paper of suitable grades.

In certain of the broader aspects of the invention, and especially in the claims where definite limitation is not indicated, the word "strips" used in referring to the reenforcing materials, is intended to generically cover cords as well as paper or fabric strips or bands of sheet material, since all these materials are comprised in the general definition of strips as pieces of relatively long and narrow material.

While boxes may be made and finished complete without any imprints or surface decorations, it is of course desirable in many or most cases to have suitable advertising or decorative imprints on the box parts. Individual box users may place their own imprints on the boxes either by printing mechanism which operates directly on the completed box parts or by affixing printed labels. Such methods, however, involve difficulties and additional expense, and the invention therefore provides structures and production methods adapted to provide the desired imprints in the course of manufacture, and in one preferred example as herein disclosed, the desired indicia or designs are imprinted on the outer surface of the continuous cover web before it advances to a point of association with the shell web, suitable precautions indicated insuring proper registry of the individual imprints corresponding to the individual box blanks so that when the individual blanks are cut off from the continuous strip the imprints will be properly located thereon.

The invention also provides in certain cases, for printing suitable indicia or designs upon the cover paper after assembly contact with the shell web, and these imprints may be in the form of suitable "all-over" designs, or they may be smaller designs, panels or "labels" located on one particular part of the cover in the completed box, for instance, an end wall, or panel, or side wall, or the central or body section of the cover area.

The invention also provides for placing suitable imprints upon the inner surfaces of the boxes and particularly for applying any of a great variety of suitable imprints upon the inner or under surfaces of the shell web prior to or after assembly contact with the cover material, and these imprints may correspond to definite blank sections of the shell or assembly, so that when the individual assembly blanks are severed from the continuous assembly the imprints will appear in proper positions on certain inner surface areas of the blank, these of course being areas which will be exposed and visible when the blank is folded into box form.

Important features are the excising of narrow strips of material from the blanks in the operation of severing the corner laps from the end wings to provide for the proper positioning of the corner laps in a completed box, the moistening of the materials, and especially the moistening of longitudinal fold lines of the shell material to facilitate folding, and other features referred to hereafter.

The blank and box structures are quite fully shown and described to enable the process to be fully understood; but such structures are not claimed herein but are disclosed and claimed in divisional applications.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following detail description of the accompanying drawings, which illustrate diagrammatically different production methods embodying the invention. After considering these examples, persons skilled in the art will understand that many variations may be made within the principles of the invention, and I contemplate the employment of any methods which are properly within the scope of the appended claims.

Figure 1 is a side elevation of box forming materials in the course of treatment and assembly to explain the performance of the process in one form.

Figure 2 is a top plan of the same.

Figure 3 is a bottom plan.

Figure 4 is a perspective view.

Figure 5 is a perspective view of a severed individual box blank.

Figure 6 is a fragmentary section enlarged, of the shell and applied cover paper, showing a "routed" longitudinal fold channel.

Figure 7 shows the same "blank" section folded, to illustrate the approximate form of a longitudinal box corner.

Figure 8 is a similar view of a folded blank section, to illustrate the approximate form of a completed transverse box corner.

Figure 9 illustrates an intermediate stage of "folding" or box formation.

Figure 10 is a perspective view of a completed box part produced by the method illustrated in previous figures.

Figure 11 is a detail in section at 11—11, Figure 9.

Figure 12 is a fragmentary detail in perspective of a modified form of box.

Figures 13 and 14 are plan views of modified blank end formations.

Figure 15 is a perspective view of a variation in the process in which reinforcing cords are supplied in the course of production of the continuous blank assembly.

Figure 16 is a fragmentary view in perspective of one corner of a completed box embodying the cord reinforcement as provided in Figure 15, the parts broken away to more clearly explain the structure.

Figure 17 is a plan view of materials in course of assembly sufficiently illustrating a mode of supplying reinforcements in the form of fabric strips.

Figure 18 is a transverse section of a box produced from a blank including reinforcements of the character shown in Figure 17.

Figure 19 is a fragmentary detail in perspective of a corner of the same box with portions broken away.

Figure 20 is a similar view illustrating one mode of supplying paper strip reinforcements.

Figure 21 is a section at 21—21, Figure 20.

Figure 22 is a side elevation of box materials and certain representative mechanisms diagrammatically represented to explain other performances of the process.

Figure 23 is a perspective view of the same.

Figure 24 is a perspective view of an individual blank produced by the process as shown in Figures 22 and 23, partly folded into box form.

Figure 25 is a perspective view of the completed box part.

In the process as exemplified in Figures 1 to 11 inclusive, a continuous strip of box shell or body material 1 is advanced from a roll 2 in the direction indicated by the arrow. This may be any suitable material commonly known as card-board, and it may in some cases be a high grade board of one of the grades known as folding board, but in order to fully realize one of the economical advantages of the invention it may be a very cheap board of the grade known as chip-board. This is a relatively brittle material requiring special treatment for certain purposes as sufficiently explained hereafter.

A continuous strip of cover or finishing material 3, usually paper of a suitable grade to provide the desired surface appearance or finish of the completed box, is advanced from a roll 4 and the two strips or webs are brought together at a suitable point which is in this case the point where they pass together between pressing rollers 5 and 6. Adhesive is supplied in advance of the contact point and this may be applied to either web, but in the present case the cover web is wider than the shell web, with extending margins to be turned over and affixed, and for that reason the adhesive is most desirably applied to the cover web by means of a glue roll 7.

In some cases the cover paper may be plain, that is to say, unprinted, or as furnished in roll form it may be printed, embossed, or otherwise treated or decorated; or else the plain paper as removed from the roll may be printed, embossed, or otherwise treated or decorated to produce the desired appearance or effects in the finished box. The treatment of the paper is exemplified in the present instance by any suitable printing machinery 8, the details of which may vary greatly, but which in a preferred instance is a printing mechanism of the "offset" type in which the impression is produced on a roll 9 and transferred by it to another or offset roll 10, and by the offset roll is impressed on the paper 3 in co-operation with an abutment roll 11 over which the web passes. The printing mechanism may be arranged substantially as a unit; as sufficiently indicated, and it may be adjusted to or fro in the line of web movement as may be necessary to maintain registration of the individual blank sections or printed areas on the web, so that when the web is applied to the shell and subsequently cut at regular intervals to produce individual box forming blanks, the printed cover pieces will be in the proper positions, or otherwise stated, the cuts will be at the proper point. The ink employed may be a quick drying ink to avoid any blurring or improper offsetting of the printed surface, or otherwise the printed web may be conveyed in a circuitous course between the printing machine and the glue roll 7, a break being shown in the paper (Figs. 1 and 2) to indicate that it may be conveyed or manipulated in any suitable way to insure drying of the ink prior to gluing, or sufficiently to avoid

blurring in any of the subsequent operations.

Figures 2 and 4 show one representative printed pattern produced upon the cover web repetitiously, the printing consisting in this case of sections or panels 12, 13 and 14 corresponding respectively to the top or bottom area of the box part as the case may be, the sides and the ends of the completed box part. The dotted lines 15 indicate points at which the continuous cover web is to be severed along with the shell web when the assembly is cut apart to produce individual box blanks.

At a suitable point beyond the point of initial web contact, the projecting cover margins 16 are folded over by any suitable mechanism such as stationary folders 17, and pressed on the under side of the shell web by pressing rolls 18.

From the point of initial web contact, or in some cases from the point of marginal turnover, the assembled materials may be considered in a broad sense as one example of any suitable continuous box-blank-forming web having a suitable surface finish to produce the desired exterior appearance of the completed box, this finish being represented in the present instance by the applied cover paper. The continuous web in this form, with or without overturned or lapped cover margins, may be furnished in a roll, and in that case the present method will be understood as beginning with the feeding of the continuous box-forming web and the operations performed upon it.

At a suitable point in the advance of the materials longitudinal fold lines 20 are produced in any suitable way, these lines consisting in the present instance of channels formed in the shell material by a routing process performed by suitable tools such as the grinding wheels 21. Where the complete method includes the handling of an originally separate shell web as particularly shown in the drawings, the grinding or routing of the longitudinal fold channels may be performed at a point in advance of the initial assembly-contact point, but otherwise this channeling or routing, or the formation of any other suitable style of fold lines, may be performed after the assembly contact, and of course where the materials are handled as a substantially unitary web the formation of the longitudinal fold lines may be effected at any suitable place, for instance at the point indicated by the grinding wheels 21^a, which may be employed by these, or alternately with wheels 21, as may be necessary or desirable.

While the exact shape of the longitudinal folding lines or channels may vary considerably in the preferred instance, and especially when they are produced by routing wheels as above described, these channels 20 are desirably of substantially rectangular cross section as best shown in Figure 6. The effect of the channeling operation is to produce a narrow strip of the shell material, the bottom 20^a of which is of reduced thickness, so that when the cover paper is adhesively applied and the box blank, after severing from the continuous assmbly, is bent along the fold line 20 as best explained in Fig. 7, the side walls of the channel are brought close together and the bend in the shell material of course occurs in the strip 20^a of reduced thickness which is free at the same time to fold inward slightly approximately as shown in Fig. 7. Especially this construction takes the strain of folding largely away from the cover paper and there is no tendency for the cover to break or crack along the fold line as would be the case if the thickness of the shell material were not reduced along this line, or if some other suitable provision for the proper folding of the shell material is not made, for instance, as in the case of the "gathered" or deep "bead" transverse crease lines.

At a suitable point in the advance of the web, which may be conveniently after the longitudinal fold lines have been produced, and where there is a cover-margin turn-over, at a point beyond the point where this turnover is effected, transverse fold lines 22 are produced, and these fold marks or lines may be of any suitable form, but more desirably they are relatively deep creases which may be identified as "gathered" or "groove" creases produced by suitable instrumentalities such as folding or creasing devices carried by cooperating rolls 23 and 24, to insure the easy and proper folding of the material.

In the production of these creases the shell material is gathered, crumpled or broken down to a certain extent, with the principal object of causing the shell material, when the blank is bent along these fold lines, to bend or crumple inwardly, and relieve the cover paper to a sufficient extent of the tension and strain incident to folding, and prevent breaking or cracking of the cover paper along the fold line. Fig. 8 shows a corner of a box folded along one of the beaded fold lines, the thickness of the material being exaggerated to bring out approximately the manner in which the shell material crumples or bends inward producing a projection or bead 22^a on the inside of the box while the cover paper lies smoothly over the exterior of the fold. In a word, this form of crease permits the bending or distortion to take place inwardly in the shell material without undue strain upon the cover material.

It will be understood from the previous statements, and also in connection with later stages of the process, that the order of operations may be varied considerably, and no significance is attached to the order in which operations are performed except in cases where a given operation cannot be performed except before or after some other operation, or when a given operation can more conven-

iently be performed in a certain relation to the other ones.

At a suitable point in the advance of the web the longitudinal fold lines are desirably moistened usually by water applied either to the top or bottom of the web, or both; for instance, moisture may be applied to the upper surface of the cover paper on lines corresponding to lines 20 by any suitable moistening devices such as wicks 25 fed from a tank 26; and moisture may be applied to the fold channels 20 themselves by one or a series of moistening rolls 27 running in the grooves, these rolls being provided with felt or other moisture-carrying peripheries and supplied with water in any desired fashion.

At a suitable point in the advance of the material, in some cases before and in other cases after the moistening operations, longitudinal cuts are made to separate portions of the blank which are to become independently foldable parts of the end structure, specifically in this case, end wings and corner laps, and these cuts may be simple slits, but more desirably for the present purposes the cutting operations consist in the excision of narrow strips of material, producing slots 28 passing entirely through the web material or materials, in the present specific case through the shell and the cover, suitable provision being made for removing the strips cut or punched out.

These cut-outs may be made of complemental cutting members on rolls 29 and 30, Fig. 1, and they are usually in line with the longitudinal fold lines or channels, and of the same width. In other words, the cutting operation consists in removing a certain length of the thin bottom strip of the folding channel.

The advancing assembly or box-forming web is then severed at regular intervals by suitable instrumentalities such as cutting rolls 31 and 32; and in a particular form of box, or in a box of a certain range of dimensions, this severing may be performed by cutting on a single transverse line 33 at regular intervals, producing the individual box blanks B, Figures 4 and 5, the blank consisting of a central or body portion *a*, side wings *b*, end wings *c* and corner laps *d* extending from the ends of the side wings. Each stated portion of the box blank when produced as in the present specific instance by the assembly of shell and cover materials, comprises portions of both materials. The outer margins of the inner surface of the shell are overlaid by the overturned marginal portions 16 of the cover, and the corner laps are separated from the end wings by portions of the slots 28 produced in the previously described manner, and Fig. 5 clearly shows that these slots are most desirably exactly in line with the longitudinal fold lines 20 and of the same width. There is thus produced an inward edge formation 34 of the corner laps adapted for the proper location of the corner laps in the completed box, as explained below.

The blank is shown in Fig. 9 folded into approximate box form with the corner laps *d* turned inward with their inner edges adjacent, and these edges may be more or less widely separated, or they may fit as close together as may be desirable or practicable, a slight space being shown mainly for clearness in illustration. The end wings *c* are turned up outside the corner laps and adhesively secured, the adhesive for this purpose being supplied at any suitable stage of operations. Adhesive is shown in Fig. 5 applied to the inner surfaces of the assembly end wing, and this application may be made while the material is still in continuous web form, or after the individual blanks are severed. An alternative method is to apply adhesive to faces of the corner laps which are outward when folded as shown in Fig. 9. After the end wings are brought against the corner laps the end structure is pressed in one or two stages of operations until the adhesive is properly set or hardened, producing the completed box part (top or body section, as the case may be) sufficiently illustrated in Figures 10 and 11, in which the inturned cover margins 16 extend all around the inner edge margins of the side and end walls, and the edges of these walls are entirely covered and concealed by the cover paper, and all exterior surfaces of the shell are covered by the cover paper or other finished surface of the shell except the side and end edges 35 and 36 respectively of the shell end wings, which are left more or less exposed.

In other words, the box is a very close approximation in structure and appearance to the most expensive grade and most completely finished style of covered box, and the slight departure from the standard of such boxes involved in the partially exposed edges of the shell end wings is not objectionable for many purposes, especially since boxes of the described type may be produced more cheaply than others in which every surface and edge is covered. However, as shown in Fig. 12, in some cases the edges of the cover material adjacent to the shell edges 35 and 36, or either of them, may be pressed over while the adhesive is still moist to partially or entirely overlap the shell edges, as indicated at 37 and 38, Fig. 12. This relative formation of the shell and cover material at these edges may be produced in various ways, for instance, in some cases by the manner in which the combined materials are cut or severed or otherwise by independent pressing operations.

When the outer surface of the web or particularly of the cover web in the present specific example, is printed in the manner described, the exterior surface of the box part so produced exhibits the printed panels pre-

viously referred to in the proper relation to each other and to the position of the box part depending on whether it is a cover or a body part, as sufficiently shown in Figures 10 and 12.

Figures 13 and 14 sufficiently illustrate variations in the structure and method which depend largely on dimensional considerations. For instance, when the box or box blank is of such dimensions or shape that while still "in the flat" the end wings are longer than the corner laps, pieces 39 may be cut away co-extensive with the width of the blank outside the longitudinal fold lines, at the same time that the individual blanks are severed by cutting along the line 33 or before or after as a separate operation, producing the blank-end formation shown in Fig. 13, or when the end wings are shorter than the corner laps a piece 40 may be excised co-extensive with the width of the body portion of the blank, that is, between the longitudinal fold lines, producing the blank-end formation shown in Fig. 14.

The manner of severing the corner laps from the end wings by cutting out strips of material above referred to is particularly adapted to the preferred method of forming deep gathered transverse fold lines 22, as sufficiently shown in the sectional view, Fig. 11. The cut-out strips as above stated, provide margins 34 of the corner laps which, when the box is folded into proper form, as shown in this figure, lie close along the upper surfaces of the creased folds 22 without any tendency to tilt or cock up the corner laps as would be the case if the margins 34 were not produced at the proper place by the above or an equivalent operation.

It will be understood that the process as above described can be performed either partly or entirely by hand or with the aid of tools of elementary simplicity, but an important feature of the invention is the arrangement of the method so that it can be performed in part, or preferably entirely, by automatic machinery which acts rapidly and practically continuously to produce an immense output of boxes per hour, at very small expense. It has not been attempted to describe the mechanisms for all of the operations since the features of such mechanism are to be covered in companion applications, but it is to be understood that suitable automatic or semi-automatic or other devices may be employed at each point to perform the described or equivalent operations.

An important feature of the invention is that it provides what is most conveniently identified above as a "continuous" process of production. In the broader aspect of the invention this word "continuous" is to be understood in its broadest sense as referring either to the advancing of component materials, such as the shell web, cover web, or the combined webs, in a continuous strip until the individual blanks are severed, and it may also be understood broadly to include continuous movement of these materials, that is, without interruption or intermittent action, although the movement of the materials is not necessarily continuous, but it may be intermittent at some one or more points depending on the particular design of machinery by which the process is carried out. Ordinarily the materials advance continuously and in unbroken form to the point of cut-off, and from that point the individual blanks are forwarded rapidly and without any considerable pause to the folding mechanism or mechanisms in which the blanks may actually come to rest for a brief period of time while folding and pressing operations are performed.

In some cases it is desirable to provide the shell material with an inner lining which usually consists of paper of suitable grade and finish to provide a desired interior surface finish of the completed box. Provision is made for applying such a lining in the continuous process as shown in Fig. 15.

A continuous strip or web of lining paper 41 is advanced from a roll 41^a and at a suitable point is brought in contact with the shell web 1, for instance, at a point where the lining web passes over a guide roll 42 and a pressure roll (not shown) may be arranged above the shell web to press the two webs together. Adhesive is previously supplied to unite the webs and this may be applied either to the shell or to the liner, a glue roll 43 being arranged in this particular example to supply adhesive to the inward face of the lining web prior to contact with the shell. As shown in Fig. 15 the lining web is united with the shell in advance of the point where the cover margins are turned over, and this provides for the overlapping of the cover margins upon the lining web which is desirable in most cases. Otherwise, and for example where the cover web does not have projecting margins to be overturned, the lining web may be applied to the shell web at another point subsequent to the point of application shown in Fig. 15. The other operations performed in this case may be substantially the same, and the completed box, for instance, as shown in Fig. 10, may be understood as being lined with the lining paper 41.

It is important in many cases to provide reinforcements additional to the reinforcements provided by the lining or cover paper; and Fig. 15 shows a provision in the complete process for applying reinforcements which are in this instance cords which are to be located about box walls near the free edges thereof underneath the cover paper to prevent improper bulging of the box edges or breaking at the corners under the strains

of service. The reinforcing cords 50 are drawn from spools or balls 51 over guide rolls 52, and when it is desired to apply adhesive to the cords themselves, they are passed over glue rolls 53 prior to their point of incorporation in the continues box-forming web. The cords are then led under guide rolls 54 by which they may be pressed in contact with the advancing shell web near the side margins thereof. Otherwise the cords may not be glued but may be simply advanced and located on the shell web in the manner described, and shortly thereafter the glued cover paper is brought in contact with the shell over the reinforcing cords. When necessary or desirable, additional amounts of glue may be supplied to the cover paper along lines corresponding to the location of the reinforcing cords, and this may be done for instance by providing the glue roll 7 with annular grooves 55, or additional glue rolls may be provided to supply extra glue for this purpose.

The cover paper is then pressed firmly in position on the shell web and the cords are thus held in the proper location and the process is carried through substantially as previously described. When the individual blanks are severed and folded into box form as sufficiently shown in detail, Fig. 16, the cords 50 are located against outer surfaces of the shell side and end wings at a variable point more or less below the edges of the walls, and overlaid by the cover paper. The cords pass across all the corners which mark the intersections of the side wings and corner laps and while the cords are interrupted at the inward edges of the corner laps they are very firmly united at these points to the shell material and the cover material overlying the shell, and the structure at that point is also further reinforced by the adhesively secured end wing structure.

Instead of cords the reinforcements may consist of strips of suitable flexible material such as fabric or paper of suitable grade or toughness, such as Kraft paper or tough wrapping paper. Fig. 17 sufficiently illustrates the application of strips of fabric 60 to the shell web 1 prior to application of the cover web 3. In this instance the reinforcing strips overlie portions of the shell outside the longitudinal fold lines 20 and extend beyond the edges of the shell, and also may as shown, extend beyond the fold lines. Instead of one strip a plurality of strips may be employed at each side of the box or the reinforcement may extend over the entire surface of the shell, with or without projecting margins. The fabric reinforcing strips are applied in a manner generally similar to the method of advancing and applying the cords in Fig. 15 with appropriate changes to provide for handling thin, flat strip material instead of round cord. Fig. 20 shows paper reinforcing strips applied in a similar fashion under the cover paper, in this instance with projecting margins, with the fold lines 20 and 20^a shown in dotted lines to indicate that the blank may be folded so that the reinforcing strip reinforces the fold line or not, as may be desired. Fig. 21 is a section through the completed blank with a reinforcing strip arranged as in Fig. 20, and Fig. 18 is an enlarged section of a blank with a side wing bent up into box form and including a reinforcement of the kind shown in Fig. 17 with a portion of the reinforcing strip overlying the longitudinal fold line at 20, and with an inturned marginal portion 60^a of the reinforcing strip overlying the inner margin of the shell and in turn overlaid by the inturned cover margin and with the reinforcing strip 60 also overlying the entire outer surface of the shell side wing, and this reinforcement will also extend over the surface of the shell corner laps in a manner which will be obvious by comparison with Fig. 19, which shows a sectioned corner of a completed box produced from such a blank.

The process may be carried through after application of the reinforcing strips as in Fig. 17 or 20, substantially as in the previous example, and in brief, the reinforcement application both in the method and in the structure, may be performed in connection with other variations in method and structure previously pointed out.

The invention thus provides not only for rapid, continuous and very cheap production of boxes of superior form and finish, but it provides for very strong box structures reinforced at one or more points so that they may be made to withstand most severe service, such, for instance, as that required of shoe boxes and other classes of boxes in which relatively heavy and irregular articles are packed for shipment in cases and for repeated handling on the shelves of retail stores.

One form of the process as sufficiently illustrated in Figures 22 and 23 provides for printing suitable indicia or designs on the cover paper, in a manner different from that described above in connection with Figures 1 to 4. In one particular case this indicium may be in the form of a pattern or label of limited area, to be located in a definite position on the cover with reference to the position on the completed box, for instance, the printed design in question may be in the form of a "label" to be located on one end of the completed box part; and this exemplification of the process also provides for making the imprints on a continuous cover web after its application to the shell web instead of before application, as previously explained in connection with Figures 1 to 4. While the printed matter or designs as applied in this instance are not necessarily limited to a particular area of the cover as it

appears in the completed box, and may occupy more or less of the entire cover area, the arrangement of the printed pattern in more or less distinct areas or "panels", corresponding to distinct portions of the cover in the completed box, for instance, the main or central area of the box part, or the end or side walls, permits the printed designs and the printing instrumentalities to be arranged so as to avoid interference with the fold lines or creases and especially with transverse fold lines when they are formed or impressed in the box forming materials previous to placing the imprints on the cover. This particular performance of the process also provides for practically any suitable or desired imprints on the inner or under surface of the shell web or continuous blank assembly.

The continuous shell web 1 is advanced from a roll as in the previous examples, and longitudinal fold lines or channels 20 are formed by routing wheels 21 and thereafter the continuous cover web 3 is advanced from a roll and adhesively conditioned by a glue roll and is brought in contact with the shell web between pressing rolls 5 and 6, and the cover margins are turned over and secured and pressed by pressing rolls, all substantially as in the previous examples. In one particular performance of the process, at a point just beyond the point where the cover margins are turned over and secured, transverse fold creases are formed by suitable instrumentalities such as the rolls 23 and 24. The printed subject matter such as the design or end "label" 70, Figures 23 and 25, is then applied by suitable printing mechanism 75, including the printing roller 76 having a plate or electrotype 77 affixed to its surface. The printing plate or electrotype is of sufficient thickness as substantially shown in Figures 22 and 23, and it is arranged on the roller, and the roller is of such diameter and is so driven in conformity with the rate of movement of the continuous assembly, that the printed pattern or label is applied to the central portion of the cover web in a position which corresponds with one of the cover end wings in the completed box, Fig. 25, and also so that the printing rollers do not conflict in any way with the previously formed transverse folding creases, as is sufficiently shown in Fig. 22.

At a suitable point in the advance of the materials and in this particular example, at a point beyond the cover printing location, other printing mechanism 80 is arranged to apply the suitable imprints on the under or inner surface of the shell web, this mechanism including a printing roller 81 bearing a printing plate or electrotype 82, and this roller is also of such a diameter and driven at such a speed as to avoid interference with the transverse folding creases 22 previously formed in the assembly. Figures 24 and 25 show the insignia or design 86 imprinted on the shell web by the printing mechanism, the printed matter consisting in this particular instance of any desired subject matter imprinted on the central or body section of the blank; and of course additional imprints may be made at the same time on inner surfaces of the side wings or corner laps.

Evidently the printing, which is to be observed on the inside of the completed box, may be applied to the under or inner surfaces of the shell web prior to assembly contact, and in that case a quick-drying ink will usually be employed so that the ink will be dry before the web encounters mechanisms which would blur or smudge the printed pattern. In cases where a liner is supplied, as in Fig. 15, printing may be done on the under or "inner" surface of the lining web.

Individual blank assemblies B^2, Figure 3, are severed from the continuous assembly as in previous examples, and these are folded into box form by any suitable intermediate operations sufficiently represented in Figure 4, producing the completed box part of Figure 5, which has substantially the characteristics of the previously described boxes with any of the suitable variations therein, and with the addition of external and internal printed matter produced or provided on the box materials in the continuous process of manufacture.

Figure 1 shows representative printing mechanism 90 in general similar to the printing mechanism 8 previously described, which may be employed when desired to imprint suitable subject matter on a surface of the shell web 1 prior to assembly contact. These imprints on the shell may be of any suitable character as sufficiently explained in connection with Figures 22 to 25 inclusive.

Figure 1 also shows a provision for including in the entire process as there illustrated the insertion of a suitable reinforcing strip or web 100 after the general plan of providing reinforcements described in connection with Figures 15, 17 and 20. The reinforcing strip or web 100 is drawn from a roll 101 and is adhesively conditioned by a glue roll 102 and is then incorporated in the continuous blank assembly by passing the reinforcement between the shell web and the cover web, all the parts being pressed and secured in assembly contact between pressing rolls 5 and 6.

It will be evident from the preceding examples that many features of the general process as explained in connection with different figures of the drawing, and also many features of the box blanks and box structures, may be combined in different ways. For instance, provision may be made in the process as shown in Figures 22 and 23 for incorporating reinforcements or a lining web; a lining web may be supplied in the general process

as shown in Fig. 1 and other variations may be made, too numerous to mention. In most instances it is unnecessary to employ all the process steps or structural features herein disclosed in the production of a single form of box. The invention provides features which may be combined, however, to produce boxes in considerable variety and of various dimensions but all embodying certain common characteristics, as will be sufficiently understood from the preceding explanations.

Words used herein to indicate positions, such as top and bottom, upper and lower, and similar words, are to be understood usually as having only a relative significance because evidently in many instances the relative positions of the materials or of the representative mechanisms illustrated for performing certain operations, may be reversed, or otherwise altered, without departing from the inventive principles involved.

I claim:

1. A method of producing boxes comprising advancing a continuous web of shell material, advancing a continuous web of cover material and adhesively securing it to a surface of the shell web, routing out the shell material to a substantial depth to produce continuous longitudinal fold lines, producing parallel gathered transverse fold creases, cutting the combined materials between certain of the transverse creases on lines substantially co-incident with the longitudinal fold lines, severing the continuous assembly transversely at regular intervals to produce individual covered box blanks, all of said operations occurring in sequence during the advancement of the webs and folding the blanks into box form.

2. A method of producing box blanks, comprising producing gathered transverse folding creases, in continuous combined adhesively connected webs of shell and cover material having in the shell material routed out longitudinal fold lines, excising narrow strips of the combined materials in substantial alignment with the longitudinal fold lines and between transverse folding creases corresponding to adjacent blanks to separate end wing and corner lap formations, and severing the continuous assembly of webs transversely at regular intervals, all of said operations occurring in sequence during the advancement of the webs.

3. A method of producing boxes comprising producing gathered transverse folding creases in combined adhesively connected webs of shell and cover material having in the shell material routed out longitudinal fold lines, excising narrow strips of the combined materials in substantial alignment with the longitudinal fold lines and between transverse folding creases corresponding to adjacent blanks to separate end wing and corner lap formations, severing the continuous assembly at regular intervals in transverse lines substantially midway the transverse folding creases, and folding and securing the blanks successively in box form, all of said operations occurring in sequence during the advancement of the webs.

4. A method of producing box blanks, comprising advancing a continuous web of shell material, advancing a continuous strip of reinforcing material to a point of association with the shell web, advancing a continuous web of cover material and applying it to a face of the shell web over the reinforcing strip, supplying adhesive to secure the reinforcing strip and the cover web, turning projecting margins of the cover web and adhesively securing them to under marginal surfaces of the shell web, producing routed longitudinal folding channels in the shell material, producing parallel transverse folding creases in the combined materials, cutting the combined materials on the lines of the longitudinal folding channels between folding creases corresponding to adjacent blanks, and severing the continuous assembly transversely at regular intervals to produce individual box blanks.

5. A method of producing boxes comprising advancing a continuous web of shell material, advancing a continuous strip of reinforcing material to a point of association with the shell web, advancing a continuous web of cover material and applying it to a face of the shell web over the reinforcing strip, supplying adhesive to secure the reinforcing strip and the cover web, turning projecting margins of the cover web and adhesively securing them to under marginal surfaces of the shell web, producing routed longitudinal folding channels in the shell material, producing parallel transverse folding creases in the combined materials, excising narrow strips of the combined materials on the lines of the longitudinal folding channels between folding creases corresponding to adjacent blanks, and severing the continuous assembly transversely at regular intervals to produce individual box blanks.

6. A method of producing box blanks from an assembly of adhesively connected shell and cover material, comprising advancing a continuous web of the assembled materials, producing individual blank end formations in the web, reducing the thickness of the web on the shell material side along longitudinal lines to provide fold formations, creasing the web on transverse lines to provide fold formations, and severing the web transversely to produce individual blanks each including said end and fold formations.

Signed at New York City, in the county of New York, and State of New York, this 20th day of December, A. D. 1922.

HARRY BRIDGMAN SMITH.