Aug. 16, 1960 S. GOLDSTEIN 2,949,151

METHOD AND MACHINE FOR MAKING TRIPLE WALL CORRUGATED PAPER BOARD

Filed Aug. 16, 1956

3 Sheets-Sheet 1

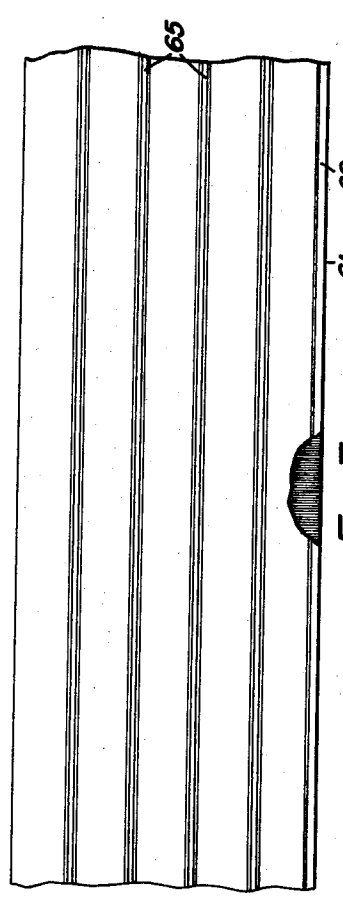


FIG. 3.

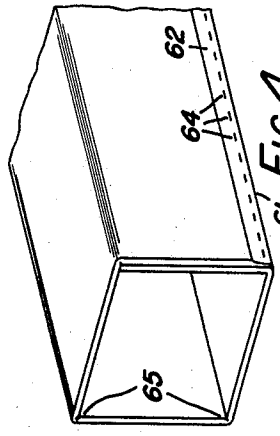


FIG. 4.

FIG. 1.

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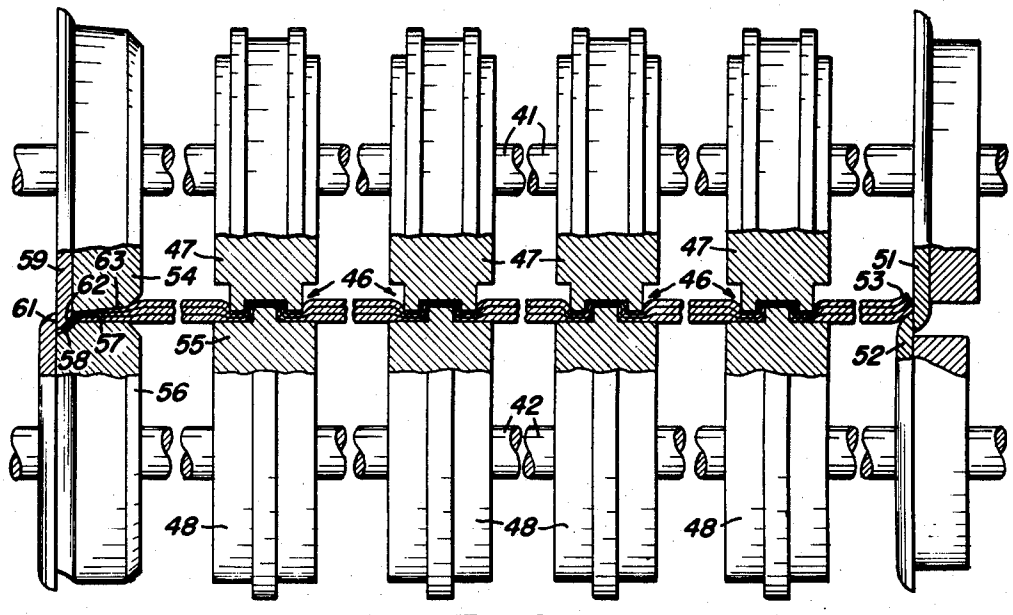


FIG. 2.

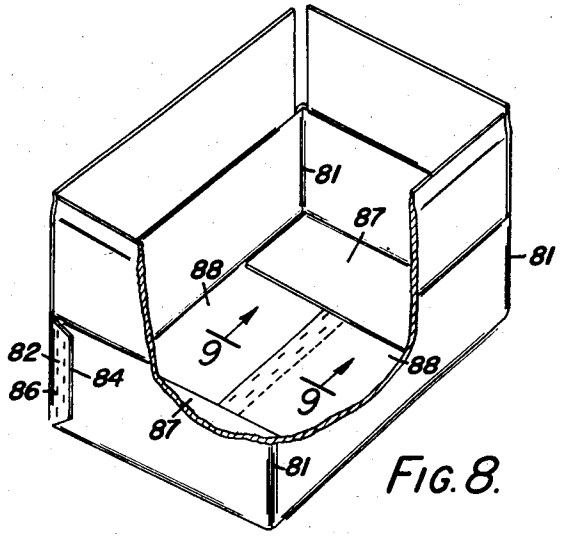


FIG. 8.

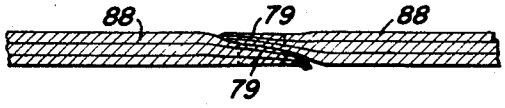


FIG. 9.

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METHOD AND MACHINE FOR MAKING TRIPLE WALL CORRUGATED PAPER BOARD

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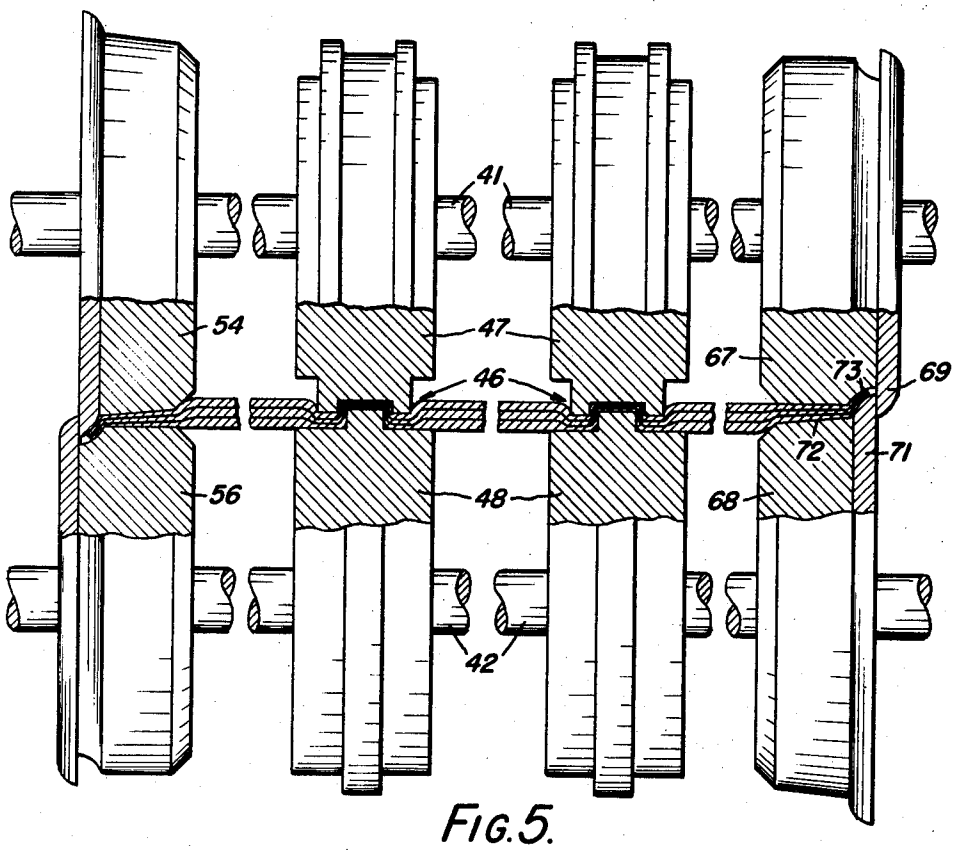


FIG. 5.

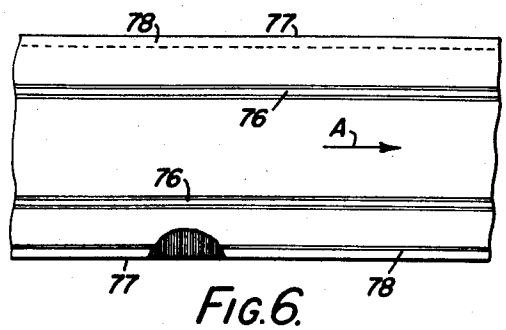


FIG. 6.

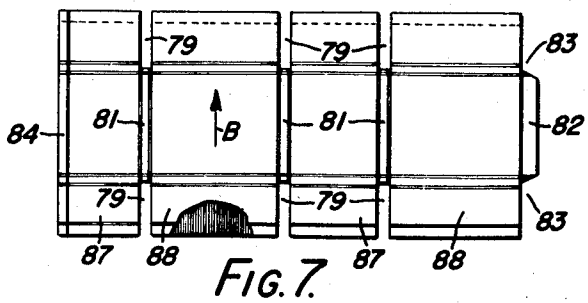


FIG. 7.

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2,949,151

METHOD AND MACHINE FOR MAKING TRIPLE WALL CORRUGATED PAPER BOARD

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Filed Aug. 16, 1956, Ser. No. 604,430

3 Claims. (Cl. 154—33.05)

My invention relates to a method and machine for making triple wall corrugated paper board products.

Corrugated paper board has many uses, the major one of which is the making of cartons for shipping a large variety of products. Such cartons most commonly have been made of double face single wall or ply corrugated paper board. Cartons are also made of double ply corrugated paper board, a structure which combines two corrugated sheets interposed between three spaced liner sheets. While attempts have been made to produce triple ply corrugated paper board in which three corrugated sheets are interposed between four spaced liner sheets, insofar as I am aware, such a composite sheet of corrugated paper board has not been successfully produced commercially to any great extent. Triple wall corrugated paper board has many distinct advantages, particularly in packaging relatively heavy objects and also in protecting relatively frail objects in transit. It is rigid and strong, comparing favorably in strength with wood as a packaging medium, cost considered, and in addition has a cushioning quality which cannot be approached by wood. Reference is made to the co-pending application of Samuel Goldstein and Immanuel Lichtenstein, Ser. No. 383,756, filed October 2, 1953 (now Patent No. 2,759,523).

An object of my invention is to provide a machine for cutting and trimming the edges of a composite sheet comprising three or more corrugated sheets interleaved with facing sheets and the crushing of certain portions of the composite sheet to enable the production of more satisfactory products.

Another object of my invention is to provide, in a machine for making multiple wall corrugated board, a board having at least three corrugated sheets interposed between at least four spaced liner sheets adhesively bonded together, means for sealing the edges of the composite sheet as it is continuously passed through the machine and to prevent destruction of the bond between the outer liner sheets and their adjacent corrugated sheets.

A further object of my invention is to provide a means, in a machine for making triple wall corrugated paper board, for crushing either or both longitudinal edges of the composite board to facilitate the fabrication of the composite board into useful products.

My invention further contemplates a method and machine for trimming the edges of and crushing certain portions of triple wall corrugated board so as to produce more satisfactory products.

Other objects and advantages of my invention will be particularly set forth in the claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic longitudinal view of the combining, scoring and cut off end of a corrugated paper board machine in which the novel features of my invention have been incorporated to enable the production of triple wall corrugated board;

Fig. 2 is a view partly in section taken substantially on

the line 2—2 of Fig. 1 in the direction indicated by the arrows, showing the means for scoring, trimming the edges of and crushing certain portions of the composite sheet;

Fig. 3 is a top plan view of the composite sheet showing the sheet as it comes off the machine and after it has been scored, trimmed and crushed in the manner indicated in Fig. 2;

Fig. 4 is a perspective view of an elongated box with open ends which are closed by any suitable means made from the composite sheet shown in Fig. 3 and particularly used for shipping elongated heavy objects;

Fig. 5 is a view similar to Fig. 2 showing the arrangement of scoring, trimming and crushing rolls for producing a regular slotted carton in accordance with my invention;

Fig. 6 is a top plan view of the composite sheet after it has been scored, trimmed and crushed;

Fig. 7 is a view showing a regular slotted carton box blank after it has been passed through a rotary slotting machine;

Fig. 8 is a perspective view showing the box blank of Fig. 7 in partially erected condition; and

Fig. 9 is a sectional view taken substantially on a line 9—9 of Fig. 8.

In Fig. 1 I have shown the combining end of a corrugated paper board machine. Concerning the parts of the corrugated paper board machine not shown, it is sufficient to state that the sheets of paper are corrugated transversely of the direction of travel through the machine and adhesively applied to liner sheets all in a manner well known in the art to which this invention applies.

The above mentioned co-pending application is directed to the production of triple wall corrugated paper board that is a composite board comprising at least three corrugated sheets interposed between at least four spaced liner sheets. In steps previous to those shown in Fig. 1, three sheets **11**, **12** and **13** are corrugated and the ridges of the corrugation are adhesively secured to liner sheets **14**, **15** and **16** thus forming three composite sheets of single face corrugated paper board.

The three sheets of single face corrugated paper board are brought into juxtaposition and brought over guides **18**, and pass over hot preheating drums **19**. These preheating drums are supplied with high temperature stream by means not shown but will known in the art. The drums **19** may be supported by a frame **21** which also serves as a support for arms **22** which carry idler rollers **23**. The frame **21** may be supported in any suitable manner, as indicated at **24**, from the main part of the machine, generally indicated by the numeral mounted **26**.

An outer liner sheet **27** on a rollstand (not shown) passes around an idling roller **28**, around a preheating drum **29** and thence around idling rollers **31** in a position to be adhesively secured to the corrugated sheet **13**. The three sheets of single face corrugated paper board, thus preheated, are brought to gluing rolls **32** where glue is applied to the ridges of the corrugations which extend transversely of the direction of travel of the webs of paper. The four webs of paper are brought together beneath a belt **33**. The belt **33** may be of canvas or any other suitable material and is mounted on pulleys **34** one of which constitutes a driving pulley driven by means not shown. The belt **33** is weighted with metal rollers **35** and passes through a heating and drying section **36** wherein the composite sheets comprising a liner sheet and a corrugated sheet are adhesively secured to the adjacent liner sheet of the next adjacent composite sheet and the lowermost composite sheet is secured to the outer liner sheet **27**. From the heating section the composite sheet, the seven layers of paper adhesively secured

together, pass through a cooling section 37 to give the adhesive an opportunity to cool and set. In the above mentioned application, there is disclosed a temperature and time or speed relationship for the passage of the composite board through the heating and drying section to secure a proper bond of the layers of paper together. This constitutes no part of my present invention.

From the drying and cooling sections of the combining machine, the composite board passes to a scoring, trimming and crushing machine. This machine has not been shown in detail since scoring machines of this general type are old. It is sufficient for the purposes of this invention to state that the scoring machine comprises a pair of shafts 41 and 42 which are mounted in suitable side plates 43 (Fig. 1) and are driven by an electric motor (not shown).

One of the problems encountered in connection with the making of triple wall corrugated paper board lies in securing a proper scoring area or scoring strip lengthwise of the web as it travels through the machine and transverse to the direction of the corrugations, to enable the bending of the board at the scoring area without breaking or tearing the board. In a single or double ply paper board a line of scoring is adequate to enable the folding of the sections on opposite sides of the score line at right angles to each other. However, paper board comprising three or more corrugated sheets interposed between liner sheets, is relatively thick and a strip or area of scoring, as distinguished from a line of scoring, is required to prevent breaking of the outer liner sheet as two adjacent sections of the board are bent at right angles to each other. A method and means for producing a strip of scoring is described in the above mentioned copending application and is indicated generally at 46, the scoring rolls being indicated at 47 and 48. Reference is made to that application for a specific discussion of the preferred method of making the scoring strips in the composite paperboard and the construction of the scoring rolls 47 and 48.

Box blanks are usually shipped flat by the manufacturer thereof to the customer for assembly, erection and filling with the material to be shipped. In the case of ordinary merchandise shipped in single or double ply cartons, the securing of the flaps together to form, for example, a regular slotted carton may be accomplished by conventional adhesives. However, a regular slotted carton, as shown in Fig. 7, made of triple wall corrugated board or made of still additional plies, is intended to be used for packaging relatively heavy materials. A box blank made of the medium shown in Fig. 3 folded into box shape as shown in Fig. 4, is intended for packaging rugs, carpets, linoleum, metal tubing and other heavy materials.

In making boxes of the above described types, it is desirable that the flaps of the boxes shown in Figs. 4 and 8 be stitched together for added strength. Stitching machines of the type contemplated are well known in the art and need not be described. It is sufficient to state that the stitching machine drives a staple or rather a row of staples through the plies and clinches the ends of the staples. I have found that conventional stitching machines or at least those normally employed for stitching cartons do not have a wide enough throat to receive composite board made up of seven or more plies of paperboard. Moreover, the staples are difficult to drive because of the cushioning effect of the corrugations and the air trapped therein. For these reasons, I have found it desirable to crush one or more of the flaps of the blank to facilitate stitching. I have found that this can be accomplished by modifying a standard scoring machine.

A further problem encountered is that when the web of paper reaches the duplex scoring machine it is still relatively moist and the adhesive binding the plies together has not completely "set." When an attempt is made to crush certain portions of the box blank particularly when the crushing is done along an edge of the web as it passes through the machine, possibly due to the crushing pressure employed or for other reasons of which I am not aware, the facing sheet of the side of the composite sheet adjacent the crush roll pulls away from the web as the web leaves the crush roll. That is, as viewed at the left of Fig. 2, the upper liner sheet usually together with the corrugated sheet adjacent thereto, pulls away from the web thereby producing a product which is not acceptable.

In Fig. 2 I have shown diagrammatically a conventional scoring machine modified to produce the scores required to enable bending the paperboard; showing how the cut off knives are arranged; and showing how the board is crushed and the crushed portion sealed to prevent parting or separation of the layers of paperboard in the manner above stated for the purpose of producing the board material shown in Fig. 3. Preferably the composite board is trimmed along one edge by knives 51 and 52 mounted on the shafts 41 and 42. These knives are largely conventional although the blank, as indicated at 53, is crushed to a slight extent. However, in a simple shearing operation no particular problem is encountered in having the layers of the paperboard pull apart.

In the roll structure and method of my invention a strip along the opposite edge of the paperboard is crushed between rolls 54 and 56. This is accomplished by making the roll 56 of the same diameter as the scoring rolls at 55 and making the crush roll, the upper roll or roll 54, somewhat larger in diameter whereby a strip 57 along the edge of the composite board is crushed at shown. Roll 56 is provided with an annular groove 58 into which an enlarged annular part 59 of the roll 54 enters as the paperboard is sheared or trimmed at the edge as indicated at 61. The groove 58 and the enlarged annular part 59 are formed on complementary radii whereby the pressing action is smooth and non-shearing or tearing as the edge of the board is forced into the groove simultaneously with the shearing action at 61. As shown this operation flattens and turns the edge downward as shown at 62.

The arrangement of the rolls shown causes a sealing or a substantially complete closing of the flutes of the corrugations. An approximate sealing of the edge of the board occurs which prevents layers of the composite board from pulling apart as the paper board leaves the crush rolls. I have further found that if the surface of the crush roll 54 is tapered slightly, as indicated at 63, a still further improved product is produced and the tendency of layers to pull apart along the area or strip of crush is further reduced to substantially negligible proportions.

After the composite board has been scored, trimmed or cut off and crushed as indicated at Fig. 2, it appears as shown in Fig. 3. The paper board is then cut off in the desired lengths to produce an elongated box one end of which is shown in Fig. 4. The box is then folded on the scoring strips 65 into a rectangle as shown and a line of wire stitching is applied as shown at 64. Due to the crushing of the flap, no difficulty is encountered in applying the staples by standard stapling machines. Moreover, the reduction in the resilience of the material results in more secure clinching of the staples.

In Fig. 5 I have shown the arrangement of the scoring, crushing and trimming rolls for producing a regular slotted carton of triple wall corrugated paper board. The scoring rolls 47 and 48 are the same as those shown in Fig. 2 and more particularly described in the above mentioned copending application. However, in making a regular slotted carton, both edges of the web are crushed. The crushing and trimming rolls 54 and 56 being the same as that described in connection with Fig. 2 and the same parts have been correspondingly numbered and need not be further described. At the right the crush rolls have been indicated by the numerals 67 and 68 and the

knife edges by the numerals **69** and **71**. The crush rolls **67** and **68** are inverted or reversed from the position shown of the rolls **54** and **56**, that is, the lower roll **68** is the crusher roll and is tapered, as indicated at **72**, while the upper roll **67** has the annular groove **73** for the reception of the annular enlargement **71** whereby to crush and seal the other edge of the composite board.

After the web of composite paper board has passed through the scoring, trimming and crushing rolls shown in Fig. 5, the web appears as shown in Fig. 6 in which the strips of scoring are indicated by the numeral **76**, the cut and sealed edges by the numeral **77** and the crushed strips at and adjacent the edges by the numeral **78**. The composite board shown in Fig. 6 is cut off in suitable lengths to make a regular slotted carton, by means not shown but which are conventional, and the carton blanks further processed in a rotary slotting machine which is a piece of equipment well known in the art. In moving the carton blank through the rotary slotter, the blank is turned at right angles from the direction of its passage through the combining and scoring machine above described, the blank being passed through the slotter in the direction of the corrugations to cut slots **79** therein and score lines **81**. The rotary slotter which I employ differs from a standard slotting machine in that it is equipped with means for crushing the strip **82**, making cut outs **83** and crushing a flap **84**.

In making up a regular slotted carton from the carton blank of Fig. 7, the blank is first folded on the score lines **81** so that the flap **87** overlies the flap **84**. The crushed parts are then stitched together, as indicated at **86**, in Fig. 8. Thereafter the bottom is formed by infolding flaps **87**. Thereafter flaps **88** are infolded to overlie the flaps **87**. The carton blank and the flaps **88** are made of such dimensions that when the flaps **88** are infolded the crushed edges **78** will overlap, as shown in Fig. 9, for the reception of wire staples applied by a standard stitching machine. After the merchandise to be packed is placed in the container, the top of the box is closed and stitched in the same manner as the bottom of the box.

While I have shown and described the preferred method and machine of my invention and the articles produced thereby, it will be apparent that various modifications and changes may be made therein, particularly in the form and relation of parts, without departing from the spirit of my invention as set forth in the appended claims.

I claim:

1. A method of making multiple wall corrugated paper board which comprises interposing at least three corrugated sheets between at least four liner sheets spaced by said corrugated sheets, adhesively securing the sheets together to form a composite sheet, partially drying the composite sheet to bond the several sheets together whereby the sheets are incompletely set, forming score lines in said incompletely set composite sheet longitudinally thereof at spaced intervals between the edges thereof and trimming and crushing a strip along at least one edge longitudinally thereof, the flutes of the corrugations extending transversely to the longitudinal direction of crushing, the crushed strip being tapered toward the edge of the composite sheet and the flutes at the edge being squeezed to an extent such that they are substantially sealed.

2. Crushing and trimming means for corrugated paper board having fluited sheets interposed between liner sheets comprising, in combination, a pair of rotatable crush rolls mounted in cooperative superimposed relation, said crush rolls having trimming elements at their edges, the crushing surface of at least one of the crushed rolls being tapered, one of said crush rolls having an annular groove adjacent its trimming element and the other of said crush rolls having an annular enlarged part adjacent its trimming element adapted to mate with the groove in the first crush roll to squeeze the fluted sheets passing therethrough to an extent such that they are substantially sealed.

3. Crushing and trimming means in accordance with claim 2 in which said groove and said enlarged part are each approximately arcuate in shape.

References Cited in the file of this patent

UNITED STATES PATENTS

1,769,883	Langston	July 1, 1930
1,914,207	Knight	June 13, 1933
2,048,684	Carr	July 28, 1936
2,187,335	Wagner	Jan. 16, 1940
2,289,909	Greenwood	July 14, 1942
2,345,411	Moeller	Mar. 28, 1944
2,485,020	Staude	Oct. 18, 1949
2,550,455	Davies	Apr. 24, 1951
2,575,257	Boulware	Nov. 13, 1951
2,637,251	Spiess	May 5, 1953
2,718,348	Montfort	Sept. 20, 1955
2,727,676	Tilly	Dec. 20, 1955

FOREIGN PATENTS

167,492	Austria	Jan. 10, 1951