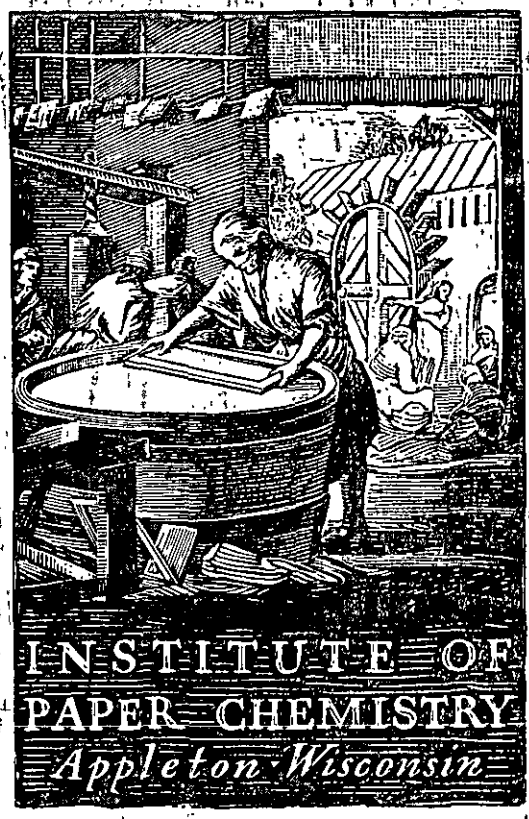

COMPARATIVE STACKING EVALUATION OF FIVE WET-PACK POULTRY-TYPE BOXES

Project 1108-18

Progress Report Two

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

September 25, 1957

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

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INTRODUCTION

This study was initiated by the Fourdrinier Kraft Board Institute for the purpose of comparatively evaluating the performance of five types of containers for the wet-pack poultry trade. Two sets or types of containers were developed by the Kieckhefer Container Company; a third type of container originated with the International Paper Company; a fourth type of container was submitted by the St. Regis Paper Company; the fifth type was impregnated at The Institute of Paper Chemistry.

The evaluation of the containers was carried out under cold storage conditions, utilizing stack tests of the loaded containers. Fresh, whole, eviscerated chickens were used to fill a portion of the boxes for each set, while the remainder of the boxes were filled with a simulated commodity load.

MATERIALS

The five sets of containers evaluated in this study are identified in general terms as follows:

File No.	Set No	Manufacturer
175396	1	Kieckhefer Container Company--Corrugated top and solid fiber bottom
175397	2	Kieckhefer Container Company--Corrugated top and bottom
175398	3	International Paper Company
175399	4	St. Regis Paper Company--Fome Cor board
175400	5	Impregnated at the Institute

The appearance of the cases is illustrated in Figure 1. All boxes were full telescope style with inside dimensions of 22 by 16 by 8 inches. Sets 1 (cover), 2, 3, and 5 were A-flute boards. Box specifications are summarized in Appendix A.

COMMODITIES

A. CHICKENS

For this study two boxes in one of the two stacks for each set were filled with fresh, whole eviscerated birds. Twenty-four birds were packed in each box. The birds were obtained from a local supplier and had been slaughtered on August 21, 1957. They were delivered to the Institute on the afternoon of August 22 wet-packed in the customary wirebound crates and were stored in the cold room overnight. The birds averaged about 2.35 lb. in weight.

B. DUMMY PACKAGES

For this study ten boxes were each filled with 24 dummy packages having about the same volume and density as whole eviscerated

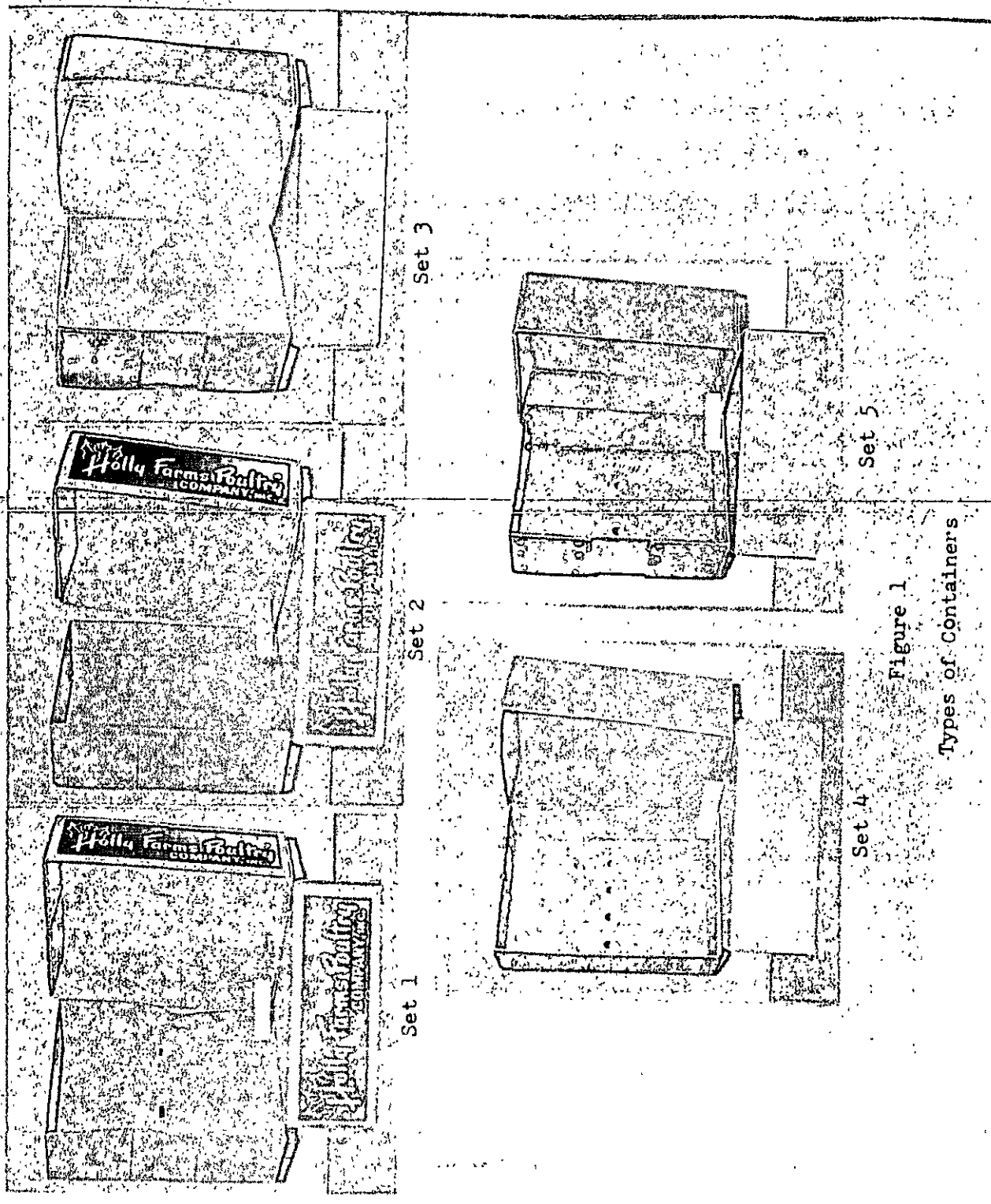


Figure 1 Types of Containers

chickens. The composition of the packages consisted of 0.75 lb. wet wood shavings together with 1.45 lb. sand. This mixture was placed in polyethylene bags (6 by 3-1/2 by 15) and tied off to form a package about 8 inches long. Filling of the packages was completed on August 13 and the entire 1200 plus packages were stored in the cold room at 35 to 40°F. from that date until they were packed on August 23, 1957.

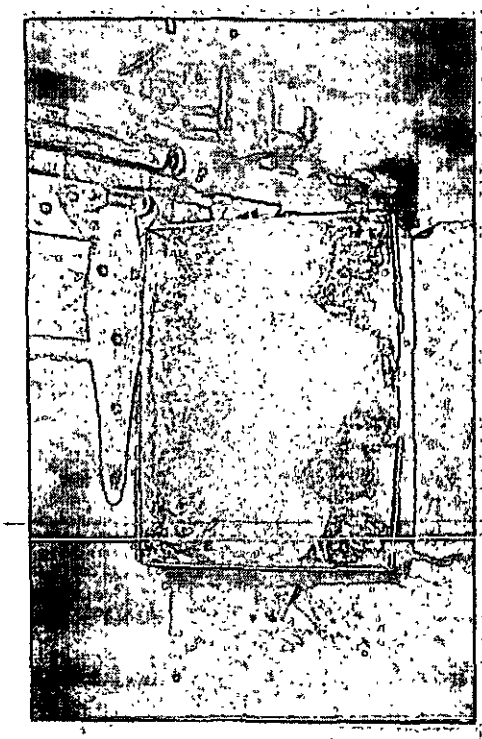
GENERAL PROCEDURE

Packing operations were carried out during the morning of August 23, 1957. During the packing operation, the following weights were obtained:

1. Empty box.
2. Bird or commodity weight.
3. Ice
4. Total box weight.

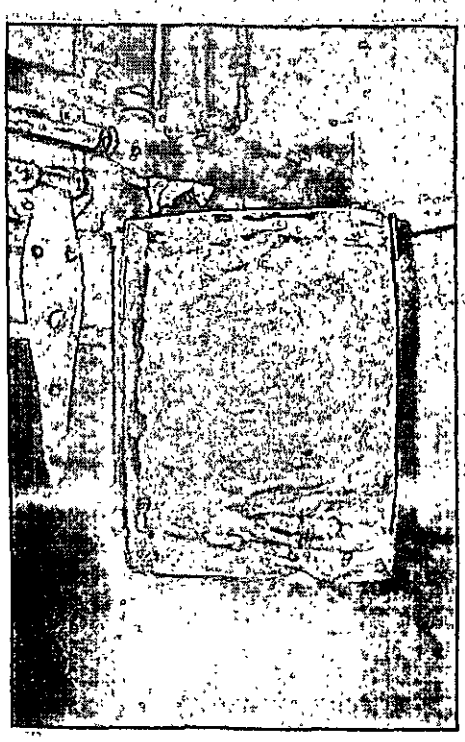
Twelve chickens or dummy packages were placed in the bottom of each box in two rows of six each, about 7-1/2 pounds of ice was added, and twelve chickens or packages were placed on top of the bottom layer. Sufficient ice was then spread over the top layer to bring the total weight of ice to about 15 lb. Figure 2 illustrates the appearance of two of the filled boxes.

Two boxes from each lot were filled with chickens while the remaining 10 boxes for each lot were filled with 24 dummy packages, (prepared as previously described). The packing operation was begun about 8:30 a.m. and was completed about 10:00 a.m. All boxes, to be filled with chicken, were packed first and stored in the cold room until the packing operation was complete.



24 Dummy Packages Plus Ice

Figure 2



24 Birds Plus Ice

Appearance of Boxes after Filling

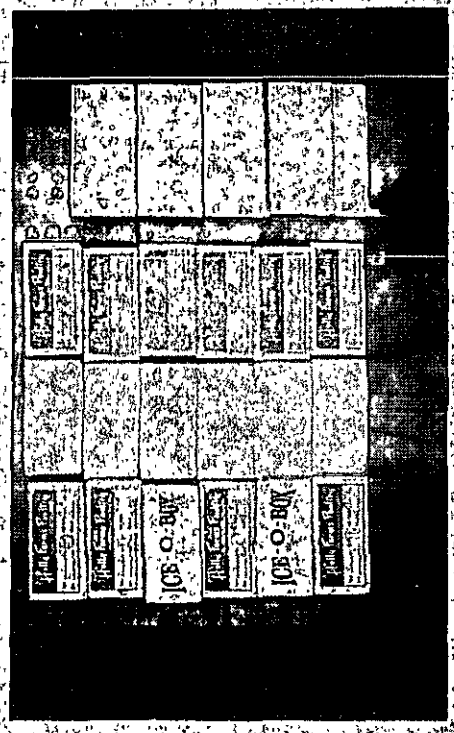


Figure 3

Stack Appearance in Truck

When the packing operation was completed, the boxes were stacked in proper order in an insulated truck. The floor of the truck was wet down thoroughly prior to placing the boxes in the truck. Figure 3 shows the placement of the first five stacks in the front of the truck. Stacks shown in the photograph are--from left to right--sets 1, 4, 2, 5 (back stack) and set 3 just in front of set 5. The journey in the truck covered 100 miles and followed U. S. Highway 10 from Appleton to downtown Two Rivers, Wisconsin, and back. The truck returned to the Institute about 3:00 p.m. and no troubles were encountered due to shifts in the load or toppling of the stacks.

The boxes were then stacked on carefully leveled platforms in the cold room. For each set there were two stacks (A and B) of six boxes each. Stack A consisted of two boxes filled with chickens and four boxes filled with dummy packages. The two boxes filled with chicken were the bottom two boxes in the stack. In stack B all six boxes were packed with the dummy packages. The boxes were placed in each stack in exactly the same order as was used in the truck "carry."

Small sections of wire screening were placed at each corner of the top of the (1) top box and (2) bottom box to assist in the measurement of changes in stack height. After each stack was erected, the location of a plumb bob, suspended from the ceiling, was marked on the surface of the top box and used as a reference in measuring the inclination of the stack. Measurements of the change in height at the four corners of the top box and bottom box were made at daily intervals throughout the

test period. These measurements were recorded to the nearest 0.05 inch. The test period lasted seven days for the stacks containing two boxes of chickens and 11 days for the remaining stacks. Storage temperature and humidity were 36 ± 2°F. and 86 ± 3% relative humidity.

When the tests were completed at 7 and 11 days, the weight of ice remaining in each box was obtained as well as the total weight of each box plus contents and the weight of the empty box. Observations regarding the presence of delamination, feel, etc., were made as the stacks were disassembled.

PROCEDURE--SPECIAL TESTS

A. BULGE TESTS

At the suggestion of Mr. E. Dahill, a trial was made to investigate the merits of a special stiffener in the bottom of a box to reduce the amount of deflection. For this purpose, two boxes of set 5 type were evaluated. The first box served as a control and was packed with 24 dummy packages and 15 lb. ice in the same manner as was done in the regular stacking tests. The second box was packed in the same manner as the control except that a V-shaped stiffener constructed from the same wax-impregnated board was inserted in the bottom of the box. Figures 4a and 4b show the scoring diagram for the stiffener and an edge view of the section as placed in the box.

After filling, the boxes were then rested on 2 by 4 pieces of lumber along the long edges of the box as shown in Figure 5. A top load

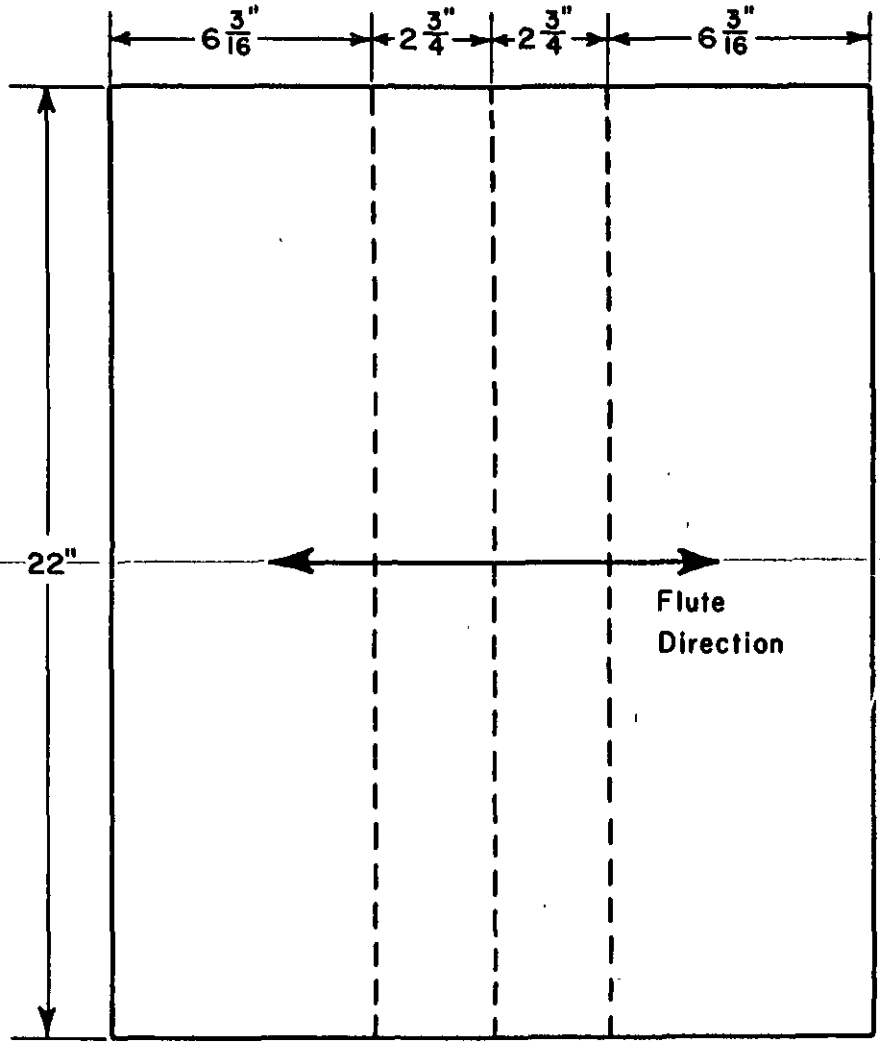


Figure 4a

Scoring Diagram

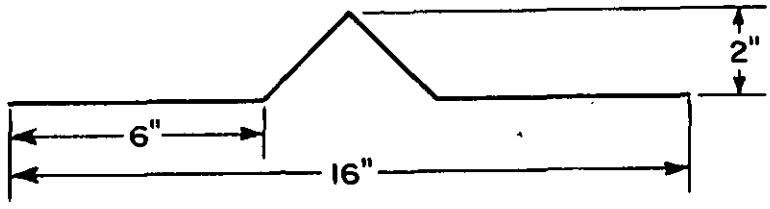


Figure 4b

Edge View as Placed in Box

Figure 5
Top Loaded Set 5 Boxes with and without Stiffener

Figure 6
Top Loaded St. Regis Fome-Cor Boxes Filled with Ice

of 310 lb. was then placed on the top of each box. Measurements were taken to determine the amount of bulging taking place at the center of the bottom at periodic intervals through an 11-day period.

B. TESTS ON ST. REGIS FOME-COR BOXES

Two boxes, as forwarded by the St. Regis Paper Company, were evaluated in the manner described below:

Each box was filled with 70 lb. crushed ice and then top-loaded with 310 pounds. A photograph of one of the loaded boxes is shown in Figure 6. Measurements were then taken at each corner during the test period to determine the change in height of the boxes.

DISCUSSION OF RESULTS

PART I--STACK TESTS

As mentioned previously, two stacks of six boxes each were set up for each of the five types of containers evaluated in this study. At periodic intervals the following measurements were made on each stack:

1. Inclination of stack
2. Height of stack at top of top box
3. Height of stack at top of bottom box.

A summary of the inclination measurements may be found in Table I. In the table it may be noted that both stacks for sets 1, 2 and 4 exhibited

TABLE I

INCLINATION OF STACKS

Exposure, days	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom A[a]	B[b]	Set 2 Kieckhefer-- Corr. Top and Bottom A[a]	B[b]	Set 3 International Paper Co. A[a]	B[b]	Set 4 St. Regis-- Fome-Cor A[a]	B[b]	Set 5 Institute Impregnated (35%) A[a]	B[b]
1	0.15	0	0.10	0.10	0.30	0.30	0.05	0.10	0.20	0
2	0.20	0	0.20	0.10	0.30	0.60	0.15	0.10	0.60	0.05
3	0.20	0.05	0.20	0.10	0.40	0.70	0.15	0.10	1.40	0.15
4	0.20	0.05	0.25	0.15	0.50	0.80	0.15	0.15	2.15	0.20
5	0.35	0.10	0.30	0.15	0.70	0.95	0.20	0.15	3.50	0.25
6	0.35	0.10	0.35	0.20	0.75	1.00	0.20	0.15	4.70	0.30
7	0.35	0.15	0.40	0.20	0.85	1.05	0.20	0.15	5.80	0.30
11	--	0.20	--	0.25	--	4.00	--	0.20	--	0.50

[a] Stack A was made up of 2 boxes of chickens and 4 boxes of dummies

[b] Stack B was made up of 6 boxes of dummy packages

extremely small inclinations after 7 and 11 days, respectively. The stacks of set 3 boxes exhibited somewhat greater inclinations; however, the inclinations seemed acceptably small up to at least 7 days. With respect to set 5, it may be noted that one of the stacks exhibited an excessively large inclination, while the other showed little more inclination than did the stacks of sets 1, 2 and 4. In the case of both sets 3 and 5, stack inclination was associated with a slipping of the cover of a box over the case immediately underneath. Figures 7, 8, and 9 illustrate the appearance of the stacks after 5, 7, and 11 days, respectively.

The changes in height of the stacks at the top and bottom boxes are summarized in Tables IIa and IIb, respectively. Referring to the tables, it may be noted that extremely small changes in height were recorded for the stacks of sets 1, 2, and 4. Somewhat larger changes in height were noted for set 3 and one of the stacks of set 5 exhibited large changes in height. As mentioned previously, these changes in height were associated with the slipping of the cover of a box over the box underneath. While Stack A from set 5 behaved in this manner, Stack B from set 5 exhibited changes in height of about the same magnitude as sets 1, 2, and 4.

The boxes were examined when the stacks were disassembled and a summary of the observations may be found in Table III. In general, it may be noted that the covers of the boxes from all sets tended to dish inwards from 1/2 to 1-1/2 inches with the exception of the St. Regis Fome-Cor

TABLE II-a

CHANGE IN HEIGHT OF STACKS

Exposure, days	Change in Height at Top Box, inches				
	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom	Set 2 Kieckhefer-- Corr. Top and Bottom	Set 3 International Paper Co.	Set 4 St. Regis-- Fome-Cor	Set 5 Institute Impregnated (35%)
	Stacks with 2 boxes chickens and 4 boxes of dummy packages				
1	0	0.10	0.25	0	0.15
2	0.05	0.10	0.40	0.05	0.30
3	0.05	0.15	0.50	0.05	0.45
4	0.05	0.15	0.55	0.10	0.85
5	0.10	0.15	0.70	0.10	1.35
6	0.10	0.20	0.80	0.10	1.75
7	0.10	0.20	0.80	0.10	2.25
	Stacks with 6 boxes of dummy packages				
1	0.05	0.05	0.20	0.05	0.05
2	0.05	0.05	0.35	0.05	0.10
3	0.05	0.10	0.50	0.10	0.15
4	0.05	0.10	0.55	0.10	0.20
5	0.10	0.10	0.60	0.10	0.20
6	0.10	0.10	0.70	0.10	0.20
7	0.10	0.10	0.80	0.10	0.20
11	0.10	0.10	1.40	0.10	0.30

TABLE II-b

CHANGE IN HEIGHT OF STACKS

Change in Height at Top of Bottom Box, inches

Exposure, days	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom	Set 2 Kieckhefer-- Corr. Top and Bottom	Set 3 International Paper Co.	Set 4 St. Regis-- Fome-Cor	Set 5 Institute Impregnated (35%)
	Stacks with 2 boxes chickens and 4 boxes of dummy packages				
1	0.05	0	0.05	0.05	0.05
2	0.05	0	0.15	0.05	0.10
3	0.05	0	0.20	0.05	--
4	0.05	0.05	0.30	0.05	0.55
5	0.05	0.05	0.30	0.10	0.90
6	0.10	0.05	0.35	0.10	1.10
7	0.10	0.05	0.35	0.10	1.40
	Stacks with 6 boxes of dummy packages				
1	0.05	0.05	0.05	0	0
2	0.05	0.05	0.10	0.05	0.05
3	0.05	0.10	0.10	0.05	0.10
4	0.05	0.15	0.10	0.05	0.15
5	0.05	0.15	0.15	0.05	0.15
6	0.05	0.15	0.25	0.05	0.20
7	0.05	0.15	0.25	0.05	0.20
11	0.05	0.15	0.50	0.05	0.25

TABLE III

REMARKS ON APPEARANCE OF BOXES AFTER UNSTACKING

	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom	Set 2 Kieckhefer-- Corr. Top and Bottom	Set 3 International Paper Co.	Set 4 St. Regis-- Fome-Cor	Set 5 Institute Impregnated (35%)
"Dishing in" of cover	about 1 to 1-1/2 in.	about 1 to 1-1/2 in.	about 1/2 in.	Neg.	about 1 to 1-1/2 in.
"Puddles" on cover	No	Yes	Yes	Neg.	Yes
Delamination					
Bottom box	Yes (cover)	Yes	Yes	None	Yes
Other boxes	No	Yes	Yes	None	Yes

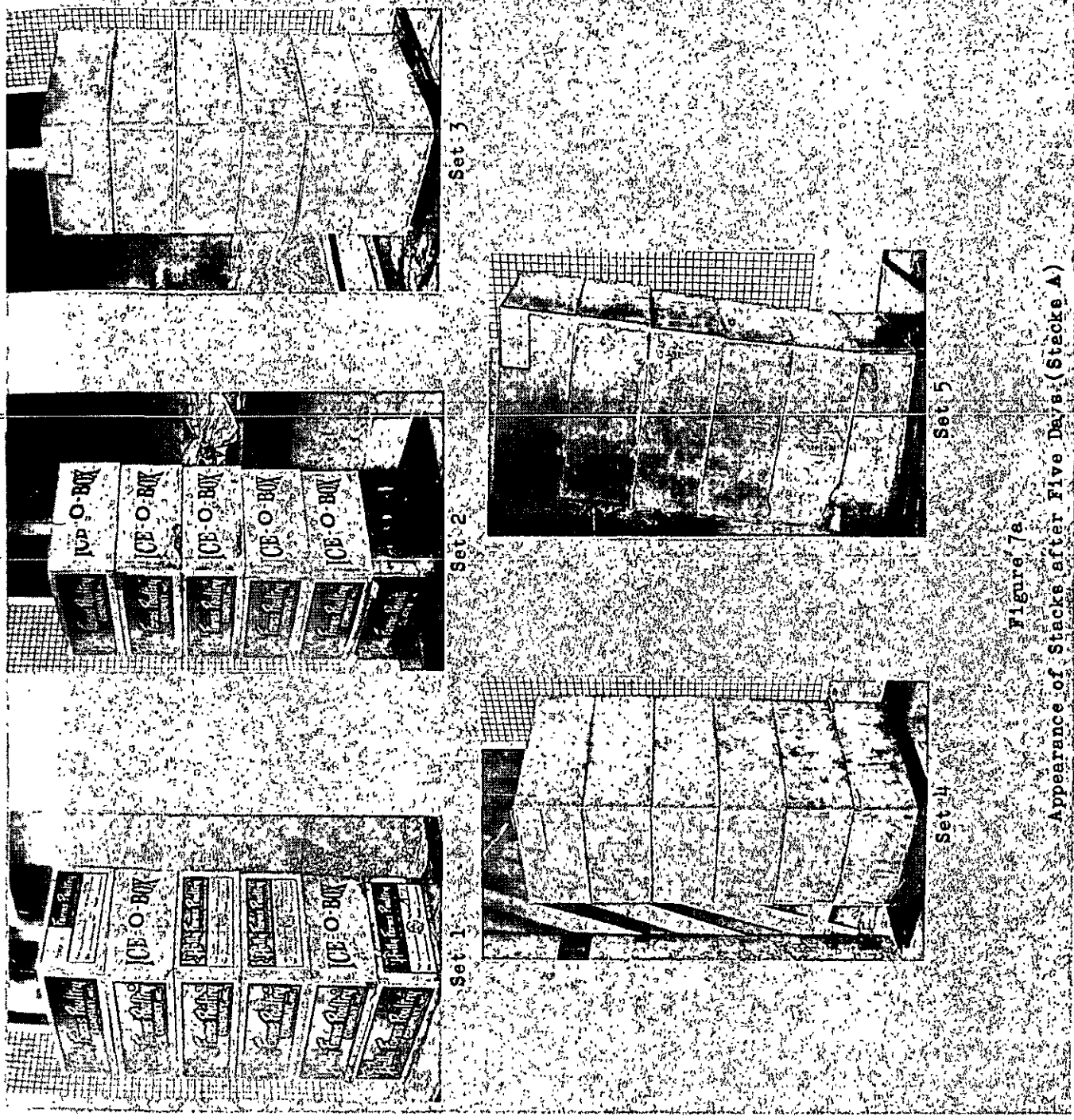
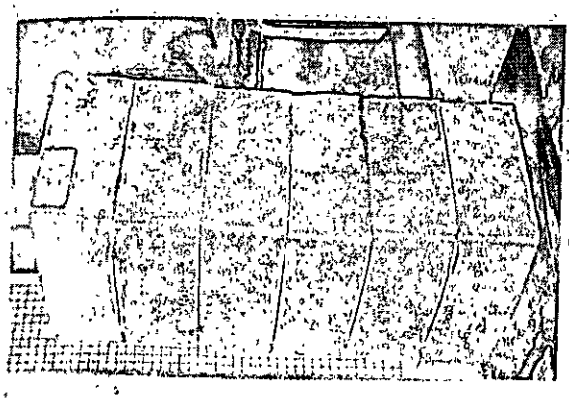
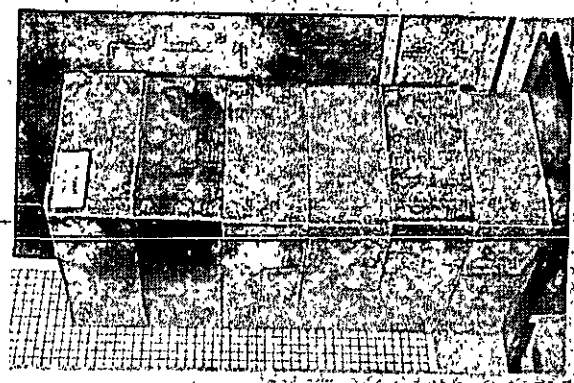


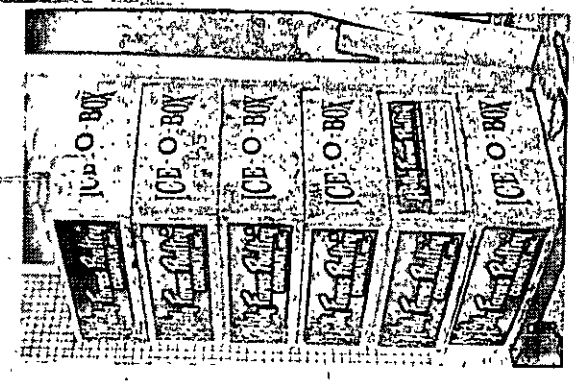
Figure 7a. Appearance of Stacks after Five Days (Stacks A)



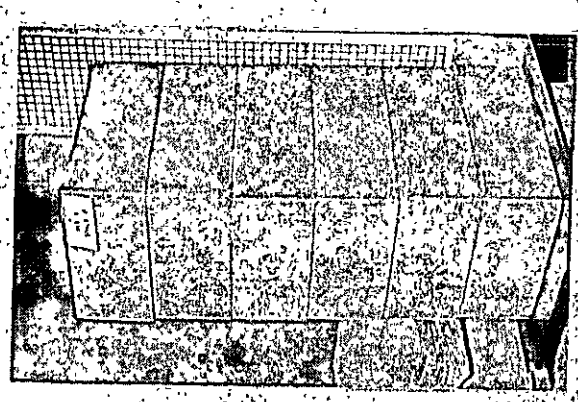
Set 3



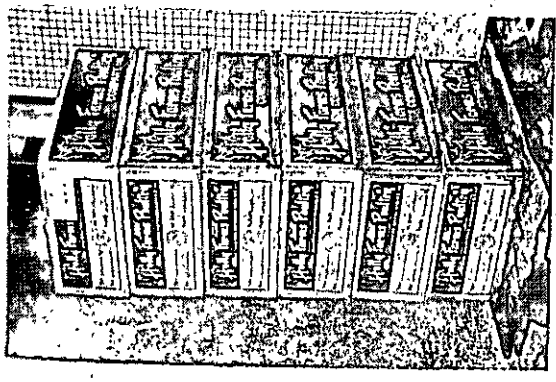
Set 5



Set 2



Set 4



Set 1

Figure 7b Appearance of Stacks after Five Days (Stacks B)

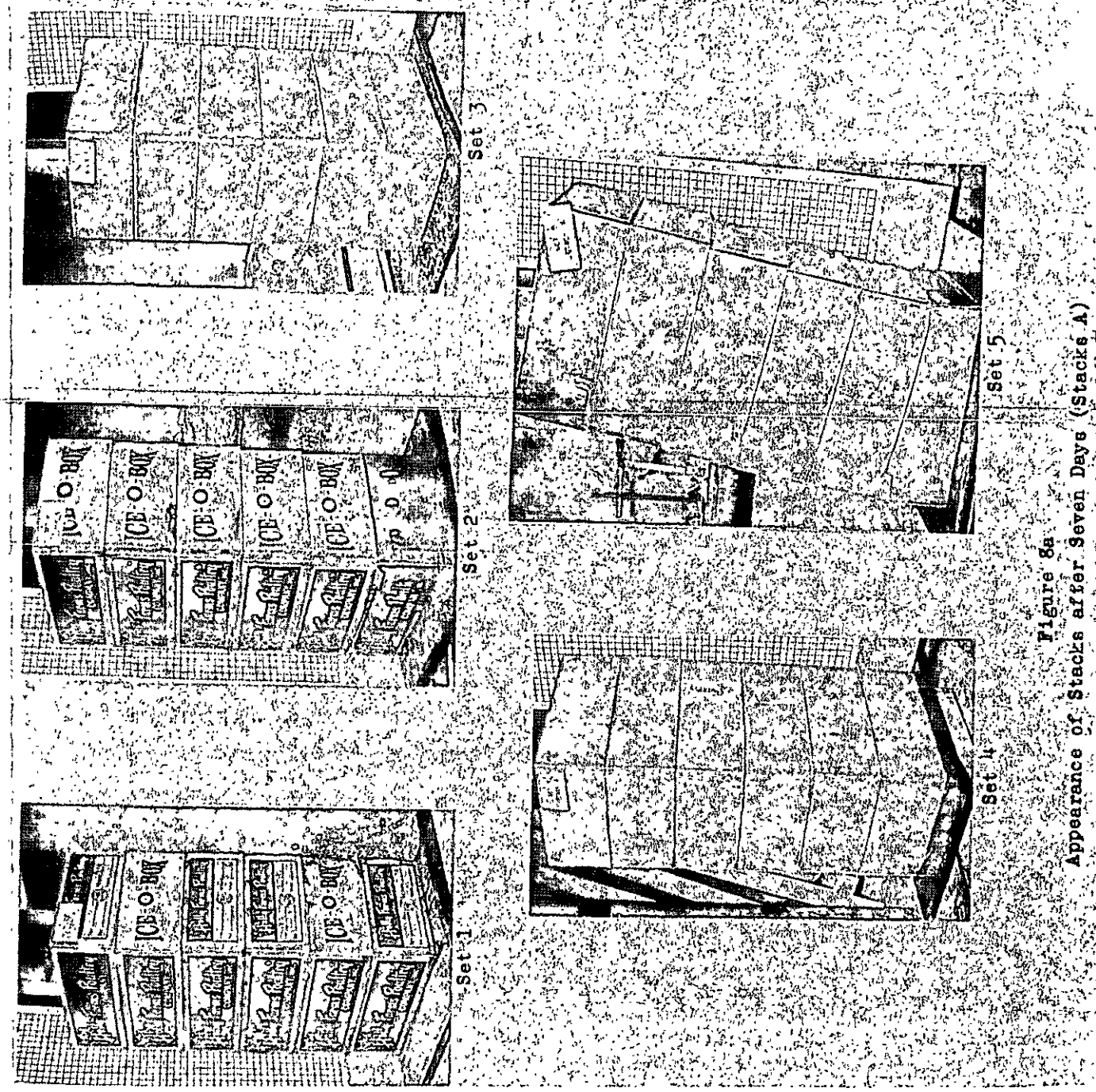


Figure 8a
Appearance of Stacks after Seven Days (Stacks A)

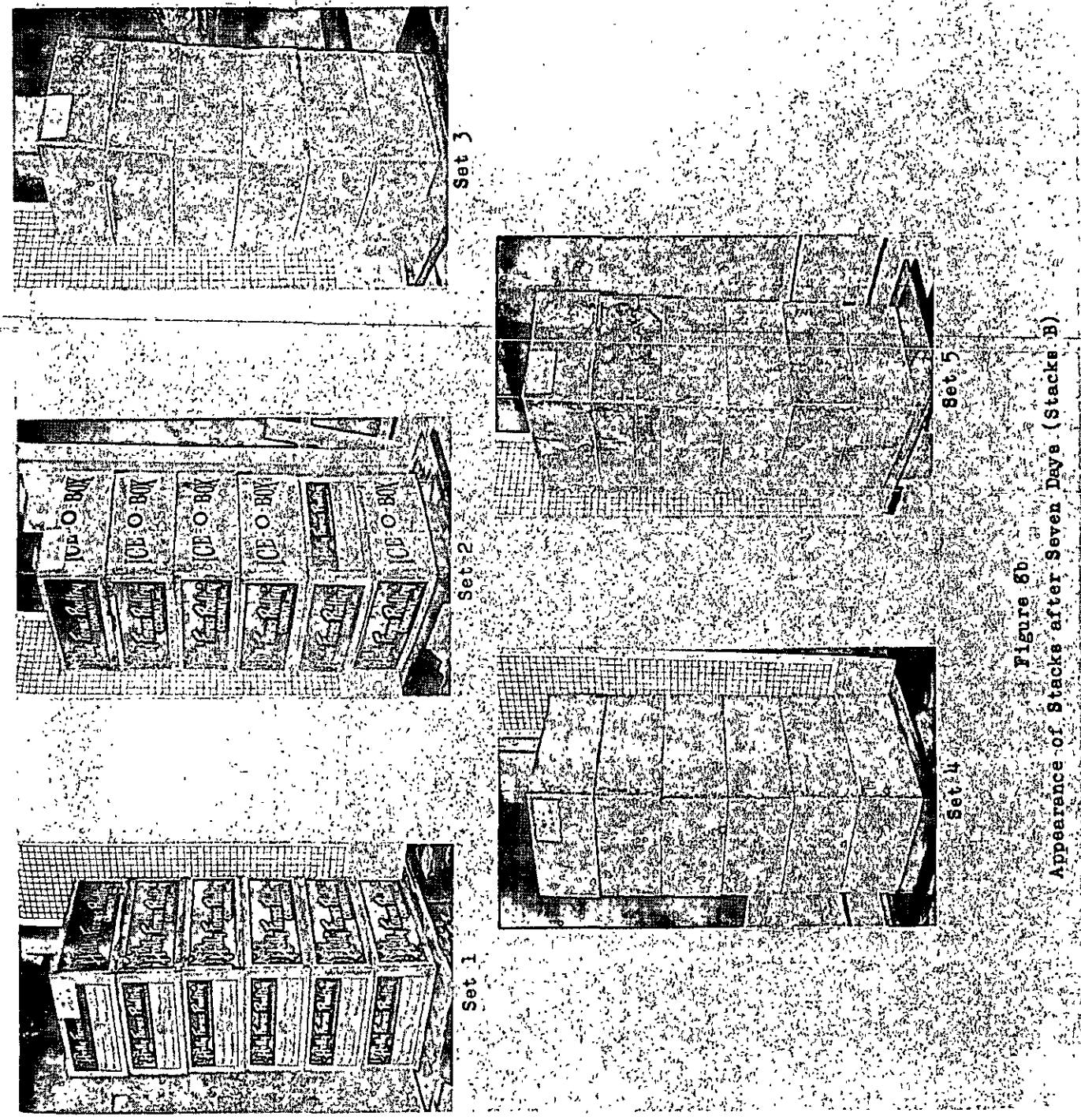


Figure 8b
Appearance of Stacks after Seven Days (Stacks B)

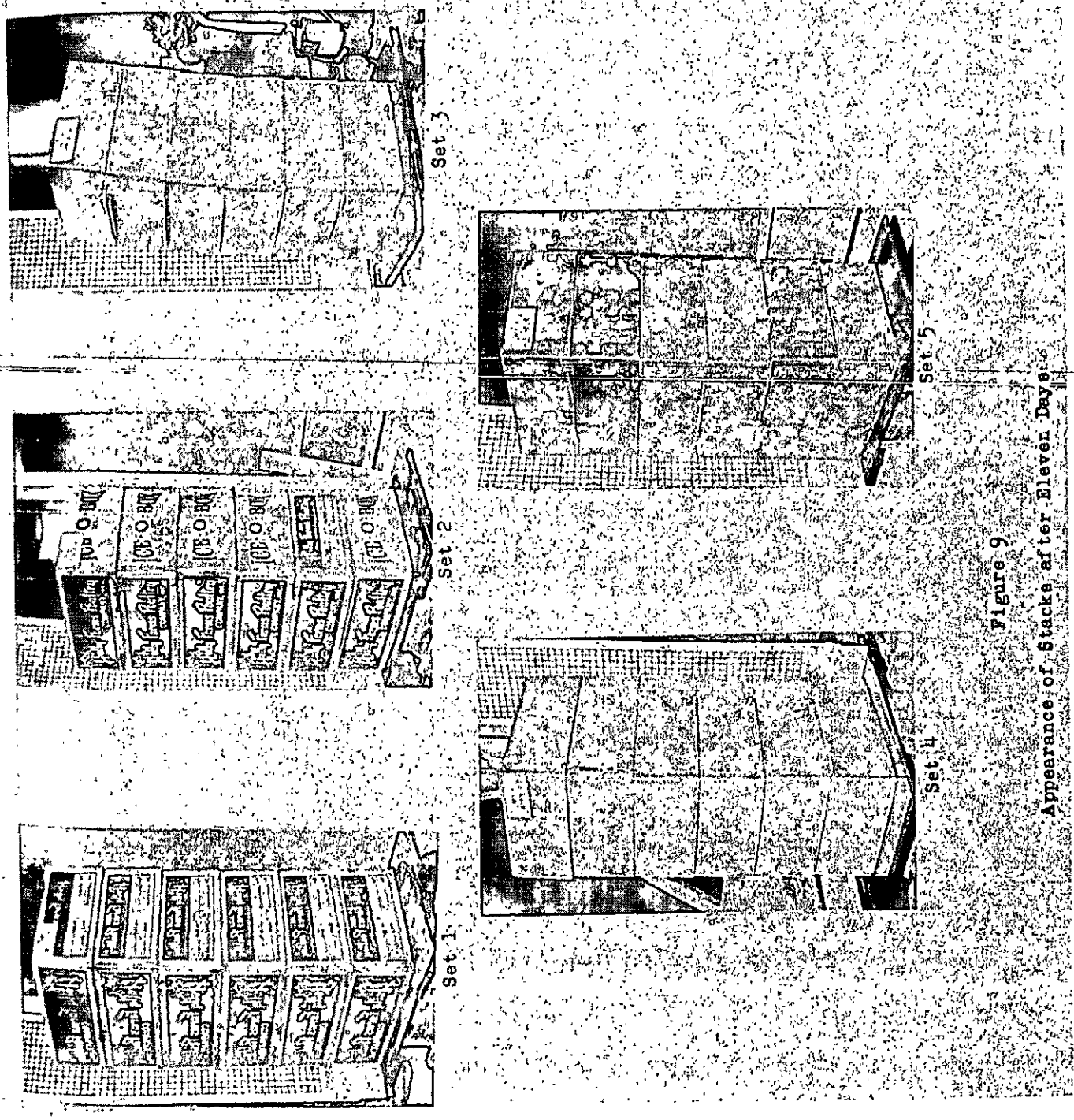


Figure 9
Appearance of Stacks after Eleven Days

boxes. As a result, puddles of water collected in the covers of the boxes although the drain hole in the covers of set 1 apparently minimized this phenomena for set 1. With respect to delamination, it was observed that

1. For set 1 the covers of the lower boxes in the stack exhibited delamination for a distance of about 2 inches up on the cover.
2. For set 2 single-face delamination occurred to about the wicking point (about 1-1/2 inches up on the cover) and almost totally in the corners of the lower boxes. Both cover and body sections of the lower boxes were "soft" to the touch.
3. For set 3 it was observed that blisters formed on the cover and body surfaces indicating poor adhesion. The bottom and top surfaces of the boxes were "soft"--particularly in the neighborhood of the scorelines.
4. The St. Regis Fome-Cor boxes (set 4) exhibited no delamination or wicking and were in excellent condition.
5. For set 5 delamination could be observed in the vicinity of the drain holes and the bottom and top surfaces of the boxes were "soft"--particularly in the scoreline regions.

As was discussed previously, the ice was weighed when the boxes were filled and then at the end of the study when the boxes were unpacked. The loss of ice over the stacking period is summarized in Table IV. Referring to the table, it may be noted that the losses of ice were most

TABLE IV

LOSS OF ICE AFTER SEVEN AND ELEVEN DAYS

Box No.	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom		Set 2 -- Kieckhefer-- Corr. Top and Bottom		Set 3 International Paper Company		Set 4 St. Regis-- Fome-Cor		Set 5 Institute Impregnated (35%)	
					Stack A[b]					
	Start	7 days	Start	7 days	Start	7 days	Start	7 days	Start	7 days
1 (bottom)	13.8	1.5	15.3	2.1	14.4	2.7	15.1	3.4	15.9	2.4
2	18.6	1.9	14.8	5.4	14.5	6.3	14.6	5.9	15.5	6.2
3	15.0	4.2	15.3	5.6	15.3	7.3	15.3	7.5	15.2	7.8
4	15.3	3.2	15.0	5.4	14.9	6.6	15.6	7.7	15.3	5.8
5	15.3	3.4	15.5	5.8	15.4	6.7	15.3	7.0	15.2	6.0
6 (top)	15.0	1.7	15.1	2.5	15.2	3.8	15.6	2.8	15.2	2.1
Composite Av.	15.5	2.6	15.2	4.5	15.0	5.6	15.2	5.7	15.4	5.0
Change, %[a]	--	-83	--	-70	--	-63	--	-62	--	-68
					Stack B[c]					
	Start	11 days	Start	11 days	Start	11 days	Start	11 days	Start	11 days
1 (bottom)	15.1	0.6	15.0	0.6	15.2	0.7	15.3	2.4	15.0	0.6
2	15.3	2.1	15.0	3.7	15.0	2.6	15.3	5.0	15.2	4.0
3	15.3	3.1	15.0	4.5	14.9	2.3	15.6	5.0	15.3	4.1
4	15.0	3.4	14.8	4.0	14.9	3.1	15.3	5.0	15.1	3.2
5	15.5	1.6	15.0	4.0	15.2	1.9	15.4	3.9	15.1	3.0
6 (top)	15.6	0.2	15.0	0.5	14.9	0.0	15.4	0.9	15.2	0.7
Composite Av.	15.3	1.8	15.0	2.9	15.0	1.8	15.4	3.7	15.2	2.6
Change, %[a]	--	-88	--	-81	--	-88	--	-76	--	-83

[a] Based on composite average weight at "start."
[b] Boxes 1 and 2 were each filled with 24 birds, the remainder of the boxes were filled with 24 dummy packages/box.
[c] All boxes were filled with 24 dummy packages.

severe in the top and bottom boxes as might be expected. For the "A" stacks, which were disassembled after 7 days, the losses in ice on an average basis ranged from 62 to 83%. The loss of 83% took place in the boxes constructed with solid fiber bottoms which seems reasonable if the solid fiber has a higher thermal conductivity than the corrugated boards. The lowest loss of ice occurred in the Fome-Cor boxes, though the corrugated boxes were nearly as effective in reducing ice losses and it may be questioned whether the differences are significant.

After 11 days ("B" stacks) the average loss of ice ranged from 76% (set 4) to 88% for sets 1 and 3. While no particular cause for the poorer performance of set 3 (as compared to its performance in the "A" stacks) can be made, the results would appear to indicate that

1. Set 4 (St. Regis Fome-Cor) was most effective in reducing ice losses.
2. The corrugated boxes (sets 2, 3 and 5) were nearly as effective if not equally effective as set 4 in reducing ice losses.
3. Set 1 (corrugated top and solid fiber bottom) appeared to be least effective in reducing ice losses.

It should be mentioned, however, that even though the boxes contained about 5 lb. of ice after 7 days' storage, the distribution of the ice in the boxes was hardly sufficient to afford real protection to the contents. With such a relatively small amount of ice, the carcasses of some birds may be without the protection afforded by contact with the melting ice.

In addition to ice weights, the boxes themselves were also weighed at both start and end. The results are summarized in Table V. Referring to the table, it may be noted that on the average the boxes of set 1 absorbed the least water while the boxes of set 5 picked up the most water.

To conclude this phase of the discussion, the following conclusions may be drawn:

1. With respect to stacking performance, sets 1, 2 and 4 exhibited the smallest values of inclination and change in height. Stack B of set 5 gave values near those for sets 1, 2, and 4 while stack A of set 5 developed a large inclination.
2. With respect to their insulating qualities as reflected by the loss in ice during the storage period, set 4 appeared to give the best performance, while set 1 appeared to be least effective in reducing ice losses. Sets 2, 3, and 5 appeared to lose only slightly more ice than set 4.

PART II--SPECIAL TESTS

As mentioned previously, tests were made to evaluate the merits of a special stiffener suggested by Mr. Edward Dahill. The stiffener basically consisted of a V-shaped corrugated board member placed in the bottom of a box. It was thought that such a member could reduce the bulging of the bottom of boxes which so frequently occurs in "wet" tests of this type. For example, such bulging occurred in the previous tests of wet pack poultry type boxes described in Progress Report One to the Fourdrinier Kraft Board Institute, Project 1108-18, "An investigation of the stacking performance of B-flute V3c containers filled with chicken."

TABLE V

CHANGE IN BOX WEIGHT

Box No.	Set 1 Kieckhefer-- Corr. Top and Solid Fiber Bottom		Set 2 Kieckhefer-- Corr. Top and Bottom		Set 3 International Paper Company		Set 4 St. Regis-- Fome-Cor		Set 5 Institute Impregnated (35%)	
					Stack A					
	Start	7 days	Start	7 days	Start	7 days	Start	7 days	Start	7 days
1 (bottom)	5.18	6.00	4.19	5.65	3.37	4.53	2.88	3.64	3.60	5.12
2	5.16	5.88	4.21	5.11	3.29	3.95	2.90	3.62	3.50	4.55
3	5.22	5.79	4.22	4.90	3.40	3.94	2.92	3.48	3.58	4.43
4	5.24	5.75	4.27	4.90	3.31	3.93	2.94	3.57	3.45	4.20
5	5.21	5.81	4.25	4.99	3.35	3.84	2.93	3.49	3.56	4.23
6 (top)	5.21	5.79	4.20	4.76	3.30	4.00	2.89	3.44	3.59	4.18
Composite Av.	5.20	5.84	4.22	5.05	3.34	4.03	2.91	3.54	3.55	4.45
Change, %[a]	--	+12.3	--	+19.7	--	+20.7	--	+21.6	--	+25.4
					Stack B					
	Start	11 days	Start	11 days	Start	11 days	Start	11 days	Start	11 days
1 (bottom)	5.15	5.90	4.24	5.11	3.31	4.07	2.94	3.57	3.47	4.43
2	5.17	5.91	4.22	5.03	3.29	3.86	2.91	3.51	3.59	4.45
3	5.23	5.87	4.26	5.04	3.31	3.92	2.94	3.54	3.49	4.38
4	5.22	5.87	4.24	5.04	3.35	3.89	2.91	3.47	3.67	4.50
5	5.21	5.86	4.22	4.98	3.32	3.89	2.88	3.56	3.66	4.52
6 (top)	5.19	5.75	4.28	4.97	3.30	3.76	2.87	3.36	3.60	4.32
Composite Av.	5.20	5.86	4.24	5.03	3.31	3.90	2.91	3.50	3.58	4.43
Change, %[a]	--	+12.7	--	+18.6	--	+17.8	--	+20.3	--	+23.7

[a] Based on composite average weight at "start."

Measured changes in the central deflection of the bottom of the box are summarized in Table VI. In Table VI it may be noted that the effect of the stiffener member was to decrease the central deflection by about 0.25 inch. Thus, while some improvement resulted from using the stiffener in the form described herein, it may be questioned whether the degree of improvement was sufficient to merit its use.

In addition to the above tests, two of the Fome-Cor type boxes, forwarded by the St. Regis Paper Company were evaluated under somewhat more severe conditions than were the other types of boxes. These special tests were suggested by the St. Regis Paper Company to better illustrate the type of performance to be expected from the Fome-Cor construction under adverse conditions. For this purpose two boxes were filled with 70 pounds of ice and each was top-loaded with 310 pounds.

Measurements of the change in height of the box over the 11-day test period are summarized in Table VII. As may be noted in the table, one of the boxes exhibited extremely small deflections over the test period--not exceeding 0.3 inch. The other box exhibited greater deflections (near 0.7 inch) but no evidence of failure could be observed in either box.

TABLE VI

EFFECT OF V-SHAPED STIFFENER ON BULGING

Cumulative Exposure, days	Change in Central Deflection, inches	
	Control	With Stiffener
1	0.25	0.05
2	0.55	0.25
3	0.65	0.45
4	0.75	0.45
5	0.75	0.50
6	0.85	0.55
7	0.85	0.55
11	0.85	0.65

TABLE VII

SPECIAL TESTS ON ST. REGIS PAPER COMPANY BOX--FOME-COR BOARD
(File No. 175399)

Special Top-Loaded Stack Test

Exposure, days	Average Height, Change, inch	
	Box 1	Box 2
1	0.594	0.213
2	0.676	0.251
3	0.676	0.249
4	0.679	0.260
6	0.679	0.263
7	0.683	0.266
11	0.692	0.273

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R. C. McKee

R. C. McKee, Chief, Container Section

APPENDIX A

BOX SPECIFICATIONS

Set No. 1. File No. 175396. Kieckhefer Container Company

General: corrugated top section and solid fiber bottom section.

Size: 22 by 16 by 8 inches

Board specifications:

(a) Cover (A--flute)

D.F. liner: 33-lb. kraft Melamine duplexed with 20-lb. asphalt to 45-lb. highly waterproof kraft.

Corrugating medium: 28-lb. high size Dual Arch (apparently two 28-lb. sheets laminated with waterproof adhesive).

S.F. liner: 69-lb. kraft Melamine

Adhesive: waterproof

Drain holes: one 1/4 by 1-1/2-inch slot centered in cover.

Flute orientation: vertical in sides.

Laps: inside on ends.

(b) Body: 0.080 special solid fiber waterproof board.

33-lb. kraft Melamine duplexed to 0.028 highly sized chipboard with 20-lb. asphalt.

Drainholes: three 1/2 by 1-1/2-inch slots in bottom (two on scorelines)

Laps: outside on sides

Source: specifications forwarded by E. Dahill 7-26-57 and dated 7-23-57.

APPENDIX A--Continued

BOX SPECIFICATIONS

Set No. 2. File No. 175397. Kieckhefer Container Company

General: Ice-o-box, corrugated top and bottom sections

Size: 22 by 16 by 8 inches

Board specifications:

(a) Cover (A-flute)

D.F. liner: 33-lb. kraft regular waterproof duplexed with 20-lb. asphalt to 33-lb. kraft Melamine treated.

Corrugating medium: 28-lb. high size neutral sulfite

S.F. liner: 69-lb. kraft Melamine treated.

Adhesive: waterproof

Drainholes: none

Flute orientation: vertical in sides.

Laps: inside on ends.

(b) Body (A-flute)

D.F. liner: 33-lb. kraft Melamine treated duplexed with 20-lb. asphalt to 33-lb. standard waterproof kraft.

Corrugating medium: 28-lb. high size neutral sulfite.

S.F. liner: 33-lb. kraft Melamine treated duplexed with 20-lb. asphalt to 33-lb. standard waterproof kraft.

Drainholes: four 3/4-inch diameter holes at slot ends.

Flute orientation: vertical in side.

Laps: outside on sides

Source: specifications forwarded by E. Dahill 7-26-57 and dated 7-23-57.

APPENDIX A--Continued

BOX SPECIFICATIONS

Set No. 3. File No. 175398. International Paper Company

General: Wax-coated corrugated top and bottom sections

Size: 22 by 16 by 8 inches

Board specifications:

(a) Cover (A-flute)

D.F. liner: 69-lb. kraft with wax coating containing 20% polyethylene

Corrugating medium: two 10-lb. kraft laminated with 2-mil. polystyrene

S.F. liner: 33-lb. kraft laminated to 0.0035 aluminum foil.

Adhesive: waterproof

Drainholes: none

Flute orientation: vertical in ends.

Laps: inside on ends

Special: wax dipped 1/2-inch along short dimension of blank.

(b) Body

D.F. liner: 69-lb. kraft with wax coating containing 20% polyethylene

Corrugating medium: as above

S. F. liner: 33-lb. kraft laminated to 0.0035 aluminum foil.

Adhesive: waterproof

Drainholes: four 5/8-inch diameter holes at slot ends

Flute orientation: vertical in sides

Laps: outside on sides.

Special: wax dipped 1/2 inch along long dimension of blank.

APPENDIX A--Continued

BOX SPECIFICATIONS

Set No. 4. File No. 175399. St. Regis Paper Company

General: Fome-Cor top and bottom sections

Size: 22 by 16 by 8 inches

Board specifications:

(a) Cover (180 to 190-point thickness)

Outer liner: 42-lb. kraft

Core: cellular polystyrene (approximately 4 lb./ft.^{3})

Inner liner: 42-lb. kraft

Drain holes: none

Laps: inside in sides

(b) Body (180 to 190-point thickness)

Outer liner: 42-lb. kraft

Core: cellular polystyrene (approximately 4 lb./ft.^{3})

Inner liner: 42-lb. kraft

Drain holes: four 1-inch diameter holes equispaced across bottom--also deep slotted

Laps: inside on ends.

Set No. 5. File No. 175400. Wax-Impregnated Type

General: Corrugated top and bottom sections

Size: 22 by 16 by 8 inches

Board specifications:

(a) Cover

D.F. liner: 42-lb. kraft liner

Corrugating medium: 33-lb. bogus

S.F. liner: 42-lb. kraft liner

Adhesive: waterproof (resorcinal starch)

Drain holes: none

Flute orientation: vertical in sides

Laps: inside on ends

(b) Body

D.F. liner: 42-lb. kraft

Corrugating medium: 33-lb. bogus

S.F. liner: 42-lb. kraft

Adhesive: waterproof (resorcinal starch)

Drain holes: two 1-1/4-inch diameter drain holes equispaced across bottom and four 3/4-inch drain holes at slot ends

Flute orientation: vertical in sides

Laps: outside on sides

(c) Special: cover and body impregnated with 35% wax (Mobilwax "D")