Convection Oven Times and Temperatures for Bakery Products

by

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INTRODUCTION

As a part of F.N.I.A. #510 (543) the author selected to learn about the operation of convection ovens; primarily the new one in the Central Bakery at Bennett Residence Hall at Oklahoma State University, Stillwater, Oklahoma.

Specific objectives of this report were to establish a baking time and adequate temperature in the convection oven for numerous bakery products. The oven used was a Montague (gas) convection oven (Model #115).

Each product was prepared by the regular personnel. The methodology varied with the employee and the type of product. Employee hesistancy to use the new convection oven became obvious as the research progressed, and pointed out a natural need for explanation and training.

To maintain production and to utilize the available bakery personnel to better advantage pies, rolls, and some cakes were assembled and refrigerated from 12 to 20 hours before baking. An additional reason for following this procedure for pies was that previous experience had shown a better final crust was obtained.

REVIEW OF LITERATURE

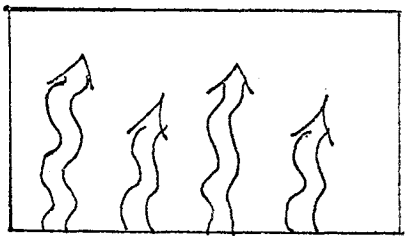
All references in the literature about convection ovens have been written concerning electric oven operation, therefore research for gas oven operation depended on information from dietitians and home economists with the gas firms.

Two operation procedures are stressed in the use of the electric oven: a) to put a pan of water in the oven when roasting meats, b) to remember that air must circulate for the oven to do a proper job (so too much should not be crowded on each shelf) (1). Since heat is even on all sides, there is no need to turn food around. The circulation of air within the oven with measured force speeds cooking, reduces shrinkage, and insures baking or roasting uniformity (2). Hot air, when given an extra push by a fan system scientifically engineered into the oven, has just enough impetus to break down the layer of "dead" air that surrounds the product. This combines with conducted heat (from the bottom of the oven) and radiated heat (from the top or along the sides) to make the baking process faster. Savings in baking time of from 25 to 60% have been recorded by electric convection ovens (3).

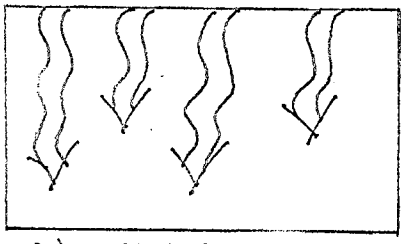
Electric convection ovens are every bit as efficient and flexible as their conventional counterparts. Because there is no combustion there is no need for heat wasting flues. The oven chamber is completely enclosed for constant (and economical) recirculation of warm air.(3).

Food on any of the multiple-shelves of a high velocity oven need not be turned around during baking because the convection heat envelopes all sides evenly. Depending upon what you are baking, using convection ovens may mean adjustments in a) the length of baking time, b) the degree of top heat for some products, and c) baking temperature. Baking time in both the high and low velocity ovens will be rapid. Care must be exercised in using a convection oven for extremely delicate pastries that might not withstand forced-air baking (3).

Conventional ovens employ conducted and radiated heat as a) and b) below.

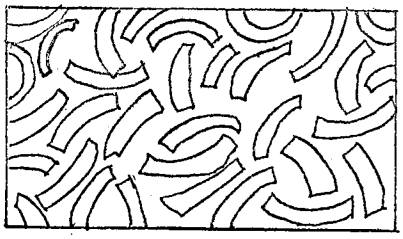


a) conducted heat



b) radiated heat

The convection oven utilizes a) and b) as well as a fan to produce even heat as in c) below.



a) convected heat

CONVECTION OVEN

The oven is a small compact unit. The over-all dimensions of the Montague (gas), model # 115 are 31½"H x 38⅝"W x 39½"D for the oven compartment. Pole legs are an optional feature in place of a rack holding section or an other oven section. The oven used in this experiment was placed on pole legs at a height of 40½" above the floor.

Capacity

The oven interior dimensions are 26"W x 27"D x 20½"H. Guide racks of nine positions are installed in the Montague (gas) convection oven (Model #115). The oven is equiped with five shelves. During the research project the top shelf was not used. There is insufficient clearance between this shelf and the top door in its open position, because some rise is expected in most bakery products. The re-spacing to utilize the top shelf will not leave equal clearance between the shelves on the nine position guide racks. The number of useable shelves for bakery products which rise (depending upon height) is one,three, or four shelves.

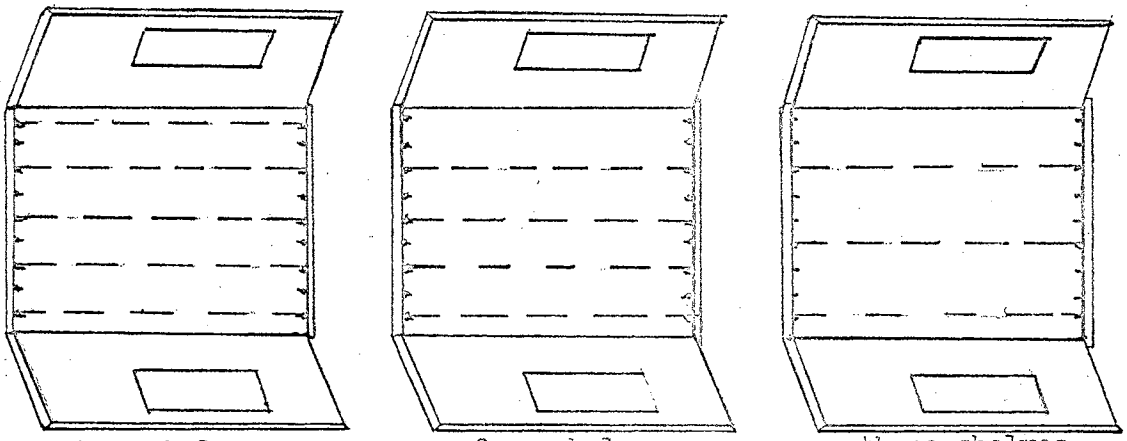
To eliminate individual handling of pies, topped with meringue, sheet pans were used. One sheet pan will hold four 9" pie tins. Because of the height of the meringue pies only three shelves were used.

For even browning of the products a staggered positioning of pans is suggested. Sheet pans should be put in one lengthwise and

the next one widthwise, alternating until oven capacity is reached.

Five 9" pie tins may be placed on each shelf with adequate staggering and still leave sufficient space for air circulation. Two cake pans (10 1/8" x 16") may be placed on each shelf, utilizing four shelves of the five available shelves. Staggering the pans in a lengthwise and widthwise position should be followed.

Illustrations on the oven shelf arrangement are listed below.



five shelves four shelves three shelves

For adequate use and safety in handling heavy pans when lifting them in and out, the oven should be placed at a satisfactory height. The oven used in this study was set on pole legs at a height of 40½" above the floor. In this position the top shelf is 56½" from the floor.

Operation

A recessed control panel is located in a vertical position along the right side of this oven. The lever for turning the gas on and off, a thermostat, light switch, fan switch, and a timer (1 hr.)

compose the controls.

The oven is turned on by pressing in on the gas lever and turning it in a counter clockwise motion until it stops (half circle). Heat to the desired thermostat setting is obtained in approximately 15 to 20 minutes.

From operating the oven during this study period, it was discovered that the fan should be turned on at least ten minutes before the product is to be placed in the oven. The fan is utilized to circulate the air within the oven to maintain an even heat. This gives an even browning to all products, and eliminites turning or moving products while baking.

To rapidly cool the oven the door must be opened and the fan turned on. If the thermostat has been re-set to the desired temperature, the thermostat light will go on when the temperature has been reached. The doors may be re-closed and baking continued. The oven chamber is sealed and will not expel air through a flue as a conventional oven, therefore less heat is lost.

BAKERY UNIT OPERATION

The bakery unit is a seven day operation. All bakery products for the campus food service units are made in this unit.

Daily personnel schedules:

Three employees work from 12:01 a.m. to 8:00 a.m. .

One employee works from 4:00 a.m. to 1:00 p.m. .

One employee works from 6:00 a.m. to 3:00 p.m. .

Two employees work from 8:00 a.m. to 5:00 p.m. .

One employee (delivery man) works from 5:00 a.m. to 2:00 p.m. .

All of the employees were very cooperative and interested in the operation of the convection oven. No formal training on the oven had been given to the employees, and only superficial information was given during this study. Each employee felt that the new oven would have to be "used" by them or upper management would not be as willing to procure other new equipment.

Before this study some sporadic baking had been done in the convection oven by the employees. General comments were "it does not bake any faster than the conventional oven," and "I can't turn my back on the oven for it browns to fast."

Mr. Harvey Johnson, chief baker, is a very capable employee. He did not hesitate to keep the other employees on production. During the span of this study, it was noted that Mr. Johnson put in extra long hours (10 to 11). In some instances this is necessary to maintain production, but the quality of the products show the strain.

Physical arrangement of this unit manifests cramped quarters. The new convection oven was placed in the only available space next to the stack ovens, but it was turned facing the isle rather than facing into the bakery unit like the other stack ovens. Eminent plans for remodeling are in the offing so further comments will not be made at this time.

EXPERIMENT DATA

The information accumulated has been put into chart form.

Example

Item	Products	Pre Fan	Pre Ref.	Convection		Conventional	
				Temp.	Time	Temp.	Time

Description of Charting

Pre-fan column was checked to denote that the oven fan was turned on ten minutes before product was placed in the oven. This procedure was begun in order to have an oven evenly heated to the thermostat setting. It was noted that the light indicating correct temperature would go off when pre-set thermostat temperature was reached. When the product was placed in the oven and the fan was turned on, a recovery period of approximately 10 minutes was needed to bring the temperature (indicated by light) up to the pre-thermostat setting. The lapse of time during which products were placed in the oven was negligible and would not warrent that much loss of heat. A simple test of setting the thermostat and waiting until the light went off and then starting the fan showed that the thermostat light would go back on for approximately ten minutes, until the set temperature was reached. Later information from home economists using gas equipment showed that, while written directions did not indicate fan and fuel should be turned on at the same time

to obtain an evenly heated oven, this step is recommended.

Pre-refrigerated column was included to indicate use of a product which had been assembled previously and placed under refrigeration for 12 to 20 hours before baking off. Other products were baked as assembled.

Times and temperatures are recorded for the convection and the conventional ovens. All temperatures are listed in Fahrenheit degrees.

Chart

Item	Products	Pre Fan	Pre Ref.	Convection		Conventional *	
				Temp.	Time	Temp.	Time
A	Apple Pie		x	350°F	35 min.	425°F	30 min.
	Apple Pie	x	x	350°F	25 min		
B	Apple Crisp		x	350°F	30 min.		
C	Apricot Pie		x	350°F	35 min.	450°F	30 min.
	Apricot Pie	x	x	350°F	25 min.		
D	Cherry Pie	x	x	350°F	28 min.	425°F	30 min.
	Cherry Pie	x	x	350°F	25 min.		
E	Cornbread	x	x	325°F	30 min.	400°F	35 min.
	Cornbread	x	x	325°F	30 min.		
F	Fruit Rolls			400°F	20 min.	400°F	20 min.
	Fruit Rolls			400°F	20 min.		
G	French Bread	x		350°F 250°F	5 min. 15 min.	400°F	30- 40 min.
	French Bread	x		325°F	30 min.		
H	Meringue Top			350°F 375°F	7 min. 5 min.	375°F	12 min.
	Meringue Top			325°F	10 min.		
	Meringue Top			335°F	10 min.		
	Meringue Top	x		335°F	8 min.		
	Meringue Top	x		350°F	8 min.		
	Meringue Top	x		350°F	8 min.		

* Fowler, Sina and Bessie Brooks West. Food for Fifty. New York: John Wiley & Sons, 1953.

Item	Products	Pre Fan	Pre Ref.	Convection Temp.	Convection Time	Conventional * Temp.	Conventional * Time
I	Peach Criso Pie	x	x	350°F	25 min.		
J	Pie Shells			400°F	5 min.	450°F	10 min.
	Pie Shells			350°F	10 min.		
	Pie Shells			350°F	12 min.		
	Pie Shells			325°F	20 min.		
K	Raisin Pie		x	350°F 300°F	15 min. 15 min.	425°F 375°F	15 min. 15 min.
	Raisin Pie	x		325°F	35 min.		
L	Bro. & Ser. Roll			275°F	20 min.		
	Bro. & Ser. Roll			275°F	26 min.		
M	Bro. & Ser. Roll (baked off)		x	375°F	10 min.		
N	Dinner Rolls (baked off)	x		375°F	12 min.	375°F 400°F	 20 min.
O	White Cake (round layer)			350°F	25 min.	350°F	30 min.
	White Cake (round layer)	x		325°F 300°F	20 min. 10 min.		

* Fowler, Sina and Bessie Brooks West. Food for Fifty. New York: John Wiley & Sons, 1953.

Apple Pie - A

Test I

1. The product had been assembled ready to bake for the next day and refrigerated for approximately 20 hours.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached, the product was placed in the oven.
3. Four pies were taken from the refrigerator and placed in the oven with two pies per shelf, utilizing the two center shelves of the available five shelves.
4. The product was baked for 35 minutes.
5. The pies were an uneven golden brown color.
6. The baking time was not shortened from that of the conventional time.

Test II

1. Same as in Test I, #1.

2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached the oven fan was turned on for apporximately ten minutes, until the light again indicated that the set temperature had been reached.
3. Same as in Test I, #3.
4. The product was baked for 25 minutes.
5. The pies were an even golden brown color.
6. Actual baking time was less, but the oven was a "more even" heat due to the pre-fan circulation of air.

Apricot Pie - B

Test I

1. The product had been assembled ready to bake for the next day and refrigerated for approximately 20 hours.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached, the product was placed in the oven.
3. Four pies were taken from the refrigerator and placed in the oven with two pies per shelf, utilizing the two center shelves of the available five shelves.
4. The product was baked for 35 minutes.
5. The pies were an uneven golden brown color.
6. The baking time was not shortened from that of the conventional time.

Test II

1. Same as in Test I, #1.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached the oven fan was turned on for approximately ten minutes, until the light again indicated that the set temperature had been reached.
3. Same as in Test I, #3.
4. The product was baked for 25 minutes.
5. The pies were an even golden brown.
6. Turning on the fan before the product was put in the oven shortened the baking time by ten minutes.

Apple Crisp - C

Test I

1. The product had been assembled ready to bake for the next day and refrigerated for approximately 20 hours.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached,the oven fan was turned on for approx-

imately ten minutes, until the light indicated that the set temperature had been reached.
3. Two pans (10 1/8" x 16" x 2¼") were placed on each of the two center shelves in a staggered position (one pan was placed in lengthwise and the other pan in widthwise).
4. The product was baked for 30 minutes.
5. The apple crisp was evenly browned.
6. The staggering of pan positions gave a more even browning to the product.

Cherry Pie - D

Test I

1. The product had been assembled ready to bake for the next day and refrigerated for approximatley 20 hours.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached, the oven fan was turned on for approximately ten minutes, until the light indicated that the set temperature had been reached.
3. Six pies were taken from the refrigerator and placed in the oven with three pies per shelf, utilizing the two center shelves of the available five shelves.
4. The product was baked for 28 minutes.
5. The pies were a dark golden brown color.

Test II

1. Same as in Test I, #1.
2. Same as in Test I, #2.
3. Same as in Test I, #3.
4. The product was baked for 25 minutes.
5. The pies were a light golden brown color.
6. The degree of acceptable browning should be standardized and all employees informed.

Cornbread - E

Test I

1. The product is made in a set quantity (13 doz. muffins) and refrigerated until needed. The product is then poured into baking pans (10 1/8" x 16" x 2¼").
2. The oven thermostat was set for 325°F. When the thermostat light indicated the set temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.

3. Two pans were placed on the two center shelves in a staggared position.(one lengthwise and the other pan widthwise).
4. The product was baked for 30 minutes.
5. The cornbread was done and was evenly browned.

Test II

1. Same as in Test I, #1.
2. Same as in Test I, #2.
3. Same as in Test I, #3.
4. Same as in Test I, #4.
5. Same as in Test I, #5.

Fruit Rolls - F

Test I

1. This product was assembled, cut, placed on sheet pans (18" x 25" x 1") and set to rise at room temperature on open transportation racks.
2. The oven thermostat was set for 400°F. When the thermostat light indicated the set temperature had been reached, the product was placed in the oven.
3. When the desired rise was obtained, the product was placed in the oven to bake.
4. Five sheet pans were placed on the five shelves of the oven.
5. The pans were placed in a straight line one on top of the other.
6. The product was baked for 20 minutes.
7. Extreme uneven browning. Each sheet pan of rolls were dark brown at the back, brown at the front, and light brown in the center. The pans on the top and bottom shelves were unevenly browned but to a lesser degree of variation.

Test II

1. Same as in TestI,#1.
2. Same as in Test I, #2.
3. Same as in Test I, #3.
4. Same as in Test I, #4.
5. The pans were staggared with one pan placed in lengthwise and the next one in widthwise, alternating the other pans until capicity was reached.
6. The product was baked for 20 minutes.
7. The fruit rolls were evenly browned.

French Bread - G

Test I

1. The product was assembled, cut, placed on sheet pans (18" x 25" x 1") and proofed for approximately 20 minutes.
2. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Two sheet pans with three loaves per pan were placed on the two center shelves.
4. The product was baked for five minutes. Then the temperature was reduced to 250°F. To rapidly cool the oven the doors were opened and the fan was turned on until the thermostat light indicated that the temperature had been reached. The oven door was closed and baking was continued for another 15 minutes.
5. The bread baked to fast and was a dark brown color.

Test II

1. Same as in Test I,#1.
2. The oven thermostat was set for 325°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Three sheet pans with three loaves per pan were evenly spaced within the oven in staggered positions.
4. The product was baked for 30 minutes.
5. The bread was an acceptable product and was golden brown in color.

Meringue Top - H

Test I

1. The meringue was made and placed on top of the pies just before they were to be baked.
2. The oven shelves were rearranged. Three shelves were evenly spaced in the oven. This was done to give more width between shelves to accomodate the height of the meringue.
3. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached, the pies were placed in the oven.

4. Six pies were placed in the oven with two pies per shelf, utilizing all three shelves.
5. The product was baked for seven minutes.
6. It was noted that the meringue was not browning evenly and not browning fast enough. The outer rim of the pie crust was over baking.
7. The oven temperature was turned up to 375°F, and continued baking for five more minutes.
8. The product was unevenly browned. The peaks were very brown and the outer pie crust was a dark brown.

Test II

1. Same as in Test I, #1.
2. Same as in Test I, #2.
3. The oven thermostat was set for 325°F. When the thermostat light indicated that the desired temperature had been reached, the pies were placed in the oven.
4. Same as in Test I, #4.
5. The product was baked in ten minutes.
6. The meringue was set and evenly baked to a light brown color.
7. Comments later indicated that the color was too light and that some of the topping was not done.
8. The degree of acceptable browning should be standardized and all employees informed.

Test III

1. Same as in Test I, #1.
2. The meringue was spread to cover the outer pie crust.
3. Same as in Test I, #2.
4. Same as in Test I, #3.
5. Four pies were placed in the oven with three pies per shelf, utilizing all three shelves.
6. The product was baked for ten minutes.
7. The meringue was unevenly browned.

Test IV

1. Same as in Test I, #1.
2. The meringue was more evenly spread to cover the top of the pie, but did not cover the outer crust.
3. Same as in Test I, #2.
4. The oven thermostat was set for 335°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
5. Same as in Test III, #5.
6. The product was baked for eight minutes.
7. The meringue was an even light brown color..

8. Comments later indicated that some of the meringue topping was not done.

Test V

1. Same as in Test I, #1.
2. Same as in Test IV, #2.
3. Same as in Test I, #2.
4. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
5. Same as in Test III, #5.
6. The product was baked for eight minutes.
7. The meringue was set and evenly baked to a medimum brown color.

Test VI

1. Same as in Test I, #1.
2. Same as in Test IV, #2.
3. Same as in Test I, #2.
4. Same as in Test V, #4.
5. Twelve pies were placed in the oven with four pies per sheet pan.
6. The sheet pans were used to minimize the handling of individual pies.
7. Same as in Test V, #6.
8. Same as in Test V, #7.

Peach Crisp Pie - I

Test I

1. The product had been assembled ready to bake for the next day and refrigerated for approximately 20 hours.
2. The oven thermostat was set for 350°F. When the thermostat light indicated the set temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Four pies were taken from the refrigerator and placed in the oven with two pies per shelf, utilizing the two center shelves of the available five shelves.
4. The product was baked for 25 minutes.
5. The peach crisp was evenly browned.

Pie Shells - J

Test I

1. The pie crust dough is mixed and shaped into single pie crusts. Each crust is put into the bottom of a metal 9" pie tin. An empty pie tin is then placed on top of the pie crust to maintain its shape during baking.
2. The oven thermostat was set for 400°F. When the thermostat light indicated that the desired temperature had been reached, the pie shells were put into the oven.
3. Two sets of pie tins were placed together and put on the oven shelf upside down, utilizing the three center shelves of the available five shelves.
4. The product was baked for five minutes.
5. The shells were unevenly browned. The bottom pie crust in the set had barely started to bake.

Test II

1. Same as in Test I, #1.
2. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached, the pie shells were placed in the oven.
3. Nine pie tins were placed upside down on the three center shelves. There were three pie tins per shelf.
4. The product was baked for ten minutes.
5. There was still uneven browning with some spots not done.

Test III

1. Same as in Test I, #1.
2. The oven thermostat was set for 325°F. When the thermostat light indicated the set temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Twelve pie tins were placed upside down, with four pie tins per shelf, utilizing the three center shelves.
4. The product was baked for 20 minutes.
5. The shells were an even golden brown color and completely done.

Raisin Pie - K

Test I

1. The product was assembled just before baking time.
2. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached, the pies were placed in the oven.

3. Four pies were placed in the oven with two pies per shelf, utilizing the two center shelves of the availfive shelves.
4. The product was baked for 15 minutes.
5. The temperature was reduced to 300°F. To rapidly cool the oven the doors were opened and the fan was turned on until the thermostat light indicated that the temperature had been reached. The oven door was closed and baking was continued for another 15 minutes.
6. The pies baked too fast and the crust was dark brown in color.

Test II

1. Same as in Test I, #1.
2. The oven thermostat was set for 325°F. When the thermostat light indicated the set temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Twelve pies were placed in the oven with three pies per shelf, utilizing the four lower shelves.
4. The product was baked for 35 minutes.
5. The pies were done and the crust was an even golden brown.

Brown and Serve Dinner Rolls (Brown and Serve Stage) - L

Test I

1. The product was assembled, cut, placed on sheet pans, and proofed for approximately 20 minutes.
2. The oven thermostat was set for 275°F. When the thermostat light indicated that the desired temperature had been reached, the product was placed in the oven.
3. Four sheet pans were placed in the oven in a straight line one on top of the other.
4. The product was baked for 20 minutes.
5. The rolls were just beginning to hold their shape. Upon cooling the tops of the rolls wrinkled slightly. Uneven "browning" was prevalent.

Test II

1. Same as in Test I, #1.
2. Same as in Test I, #2.
3. Four sheet pans were placed in the oven in a staggered position (alternating one in lengthwise and another in widthwise).
4. The product was baked for 26 minutes.

5. The rolls maintained their shape and did not wrinkle when cooled. A tinge of browning was evident with even coloring.

Brown and Serve Rolls (baked off) - M

Test I

1. The brown and serve rolls were taken from the refrigerator, where they had been placed three hours before. This step was done because all brown and serve rolls would be refrigerated before being transported to the different areas, where they would be baked off.
2. The oven thermostat was set for 375°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Four sheet pans were placed in the oven in staggered positions.
4. The product was baked for ten minutes.
5. The rolls were done and an even light golden.brown.

Dinner Rolls (baked off) - N

Test I

1. The product was assembled, cut, placed on sheet pans, and proofed for approximately 20 minutes.
2. The oven thermostat was set for 375°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Four sheet pans were placed in the oven in staggered positions.
4. The product was baked for 12 minutes.
5. The rolls were done and an even dark golden brown.

White Cake - O

Test I

1. The batter was assembled and put into 9" round layer cake pans.
2. The oven thermostat was set for 350°F. When the thermostat light indicated that the desired temperature had been reached the product was placed in the oven.
3. Four cakes were used with two cakes per shelf, utilizing the two center shelves of the available five shelves.

4. The product was baked for 25 minutes.
5. The cake baked too fast. A thicken and cracked crusty top was noted.

Test II

1. Same as in Test I, #1.
2. The oven thermostat was set for 325°F. When the thermostat light indicated that the desired temperature had been reached the fan was turned on for approximately ten minutes, until the light again indicated that the oven temperature had been reached.
3. Six cakes were used with three cakes per shelf, utilizing the two center shelves of the available five shelves.
4. The product was baked for 20 minutes. Then the temperature was reduced to 300°F. To rapidly cool the oven the door was opened and the fan was turned on, until the thermostat light indicated the lower temperature had been reached. The oven door was closed and the product was baked for ten more minutes.
5. The cake still baked too fast. By lowering the temperature for the last ten minutes, an acceptable cake was produced.
6. The cakes were an even golden brown color.

CONCLUSION

The Montague convection oven model # 115 is a smaller unit than the conventional stack oven, but very compact.

The outstanding features of these ovens are less floor sapce with a more even baking and browning. The evenness of baking and browning is accomplished by the innovation of a fan in the baking chamber. The fan, when turned on approximately ten minutes before the product is to be baked, gives the oven heat. This fan is left on during the baking period to insure air circulation which eleminates dead pockets in the oven chamber. No turning or shifting of products is necessary to obtain an even baking and browning.

Very little saving in baking times was evident in this study. The author feels that this is an overly stressed advertising point and should not be put first as a feature of this oven.

REFERENCES

1. _____. "Oven Ready." Institutions Magazine, Volume 53, p. 64, August 1963.

2. _____. "1963 Electric Ovens." Food Service Magazine, p. 32, January 1963.

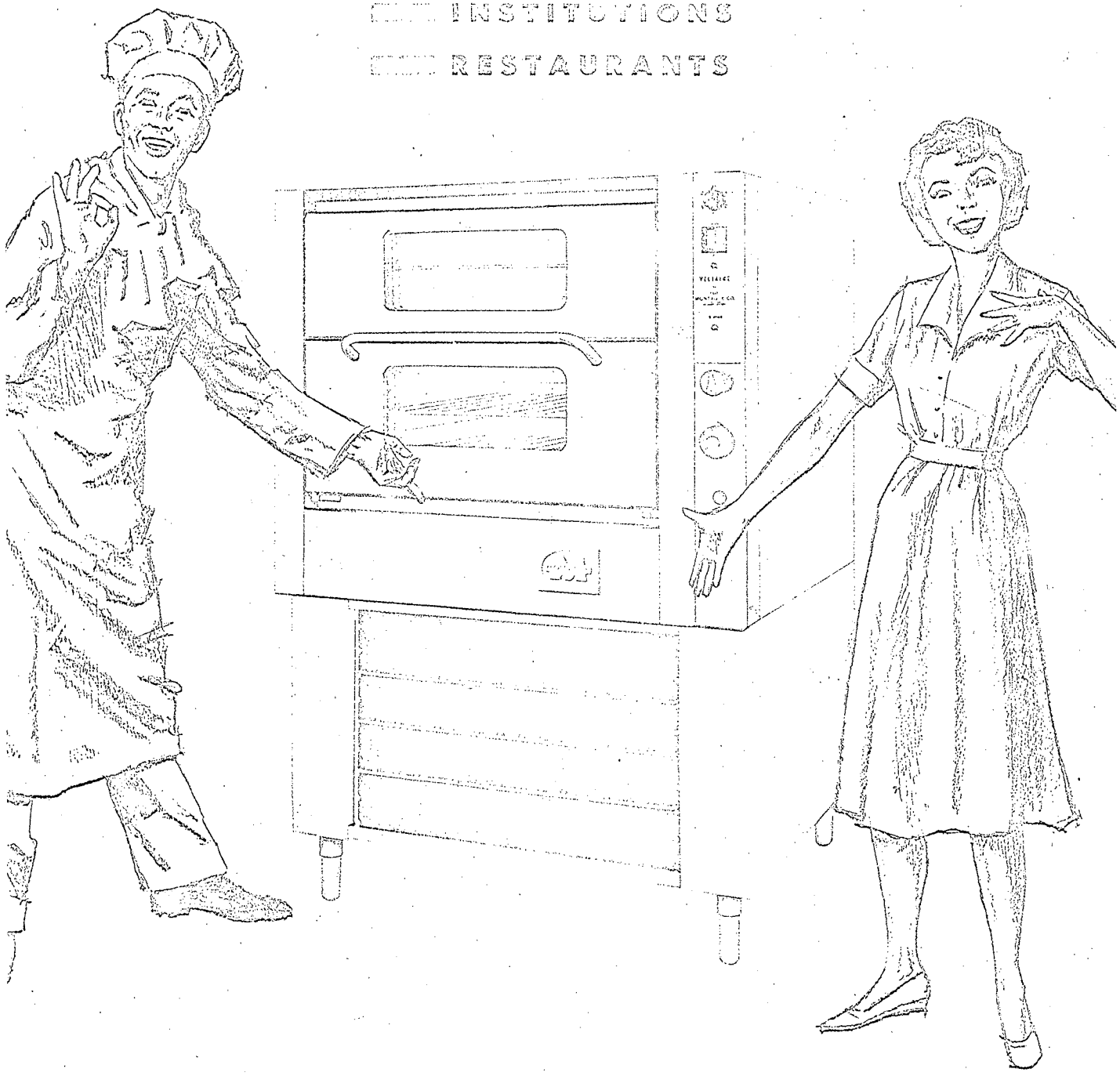
3. _____. "An Up-To-Date Look At Convection Ovens." Food Service Magazine, p. 53, April 1963.

"VECTAIRE"

CONVECTION OVENS

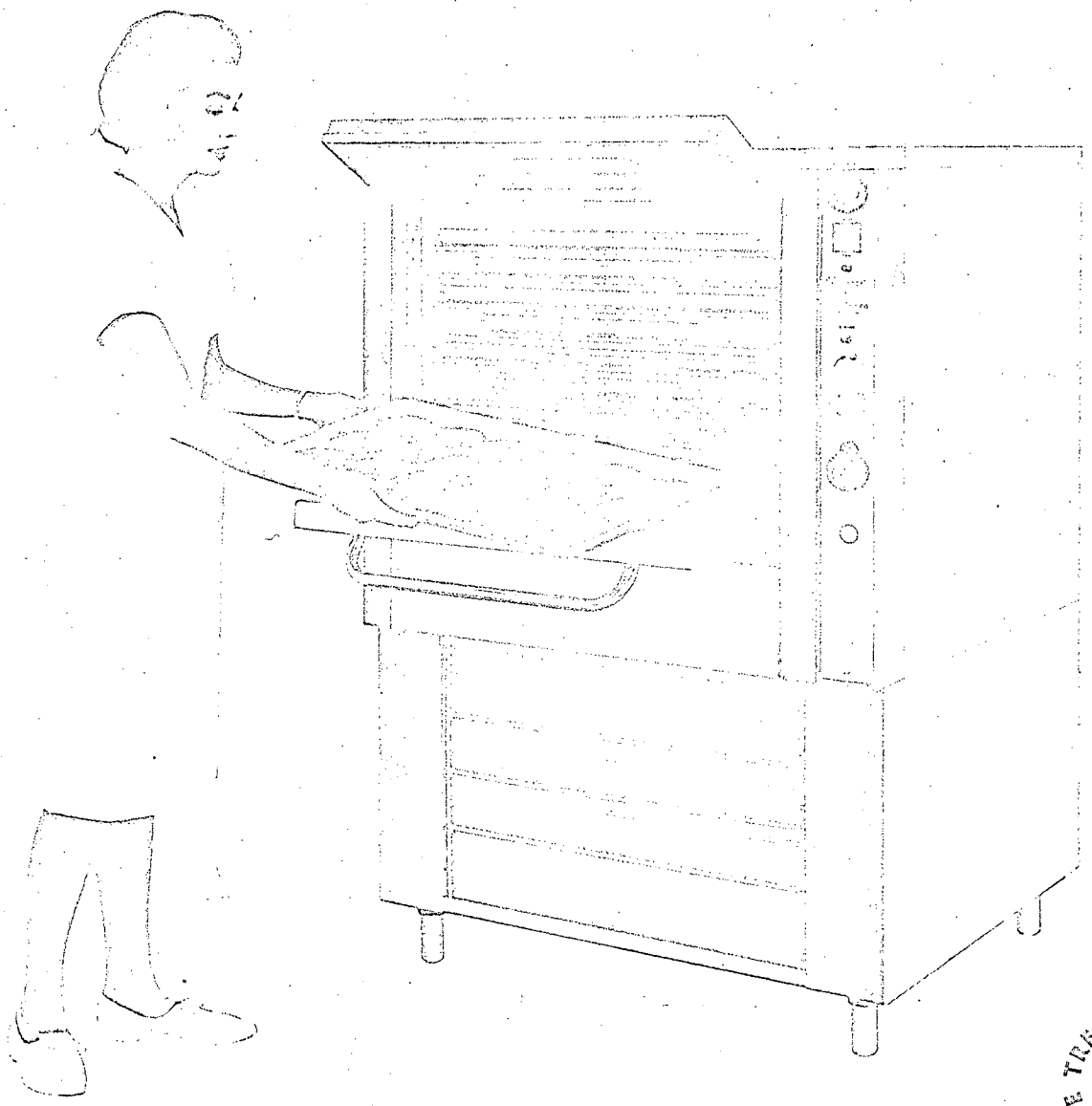
for

- SCHOOLS
- INSTITUTIONS
- RESTAURANTS



MONTAGUE

CITING NEW DISCOVERY IN "SHRINKLESS" ROASTING AND BAKING



THE TREND IS TO GAS

ire gives you all the advantages of conventional and rotary ovens combined into one compact unit akes up less than ten square feet of floor space. Just one Vectaire equals the output of ovens three its size; it cuts meat shrinkage to as little as eight percent; and it bakes pastries without shifting and g . . . all in less time than you ever thought possible. The photograph above illustrates the speed ıge capacity of Vectaire — in this case, a loading of nine 18" x 26" pans containing a total of 216 ırger patties (six-to-a-pound size). Baking time — only six minutes!

you will like best about Vectaire is the complete ease and simplicity with which you can turn out / baking and roasting with consistency. There are no gadgets . . . just four simple controls: a one- batch timer, thermostat, light switch, and fan switch (the fan shuts off when door is opened).

VECTAIRE—for speed, economy, ease, and satisfaction!

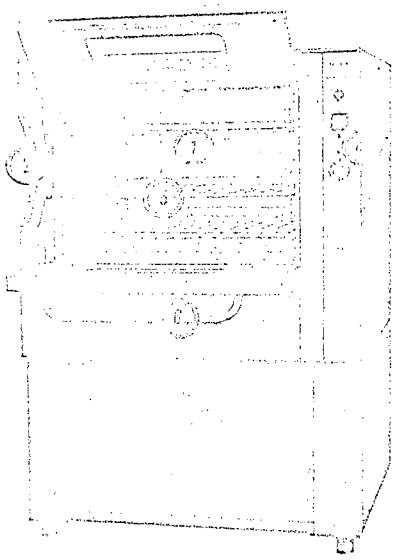
WOMEN in particular find *Vectaire* easy to work with despite its heavy duty construction for restaurant and institutional use. Its conveniences include space-saving twin doors, weight counter-balanced to open at a touch; a working height that is just right for women, which takes the work out of loading and unloading smooth exterior and removable oven rack guides t make clean-up a breeze; double insulation for cool more comfortable kitchens; and simple controls.

HOW VECTAIRE WORKS

Conventional ovens perform well, with the possible disadvantage that pastries baking close to the oven walls tend to brown more quickly than those placed near the center of the oven. Too, when roasting meats, temperatures must be kept low to avoid undue shrinkage and low-temperature roasting takes valuable time.

Vectaire solves these problems by means of a sealed oven chamber and an especially designed fan and baffle system. The fan and baffle create mild air eddies that distribute heat uniformly throughout the oven chamber. These air eddies (convection currents) also break up the moisture blanket which forms around foods — acts as an insulator to slow the transfer of heat.

By dispersing the moisture blanket and insuring absolute uniform temperatures, heat transfer is rapid and complete. Pastries receive a uniform baking regardless their position in the oven. Meats can be roasted in far less time than is required by conventional ovens, and shrinkage can be held to as little as eight percent.



1. Easy to clean: Hing fan baffle swings asi Oven light is protected easily accessible. Rem able 9-position rack guid

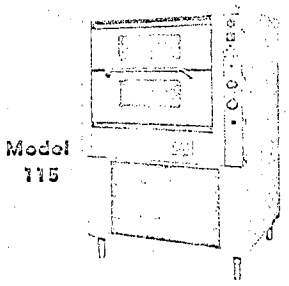
2. Heavy insulation (t types) for cooler, mo comfortable kitchens.

3. Optional 9-position ra guides in base unit for ra storage and cooling.

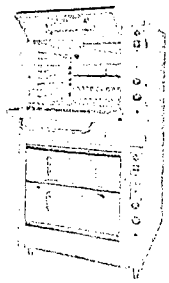
4. Easy to operate. Just s the temperature contro turn on the gas, and swit on the fan. The fan shu off when door is opene Also included are a 6 minute batch timer and i terior oven light switch.

5. Roomy oven—26" wid 27" deep, 20" high. A commodates as many as nii 18" x 26" pans of such iter as hamburger patties ar cookies.

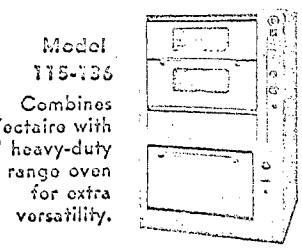
6. 115,000 BTU input p deck for fast preheat quick recovery.



Model 115



Model 2-115



Model 115-136

Combines Vectaire with 36" heavy-duty range oven for extra versatility.

CAPACITIES OF VECTAIRE

Pans	Number	Racks
Roasters	4	4
Sheet Pans (18x26)	9	9
Sheet Pans (11x18)	18	9
Cobbler Pans (12x18)	10	5
Utility Pans (Full Size)		
6"	6	3
4"	8	4
2"	10	5

Pans	Number	Racks
18S Size Pans		
6"	12	3
4"	16	4
4"	20	5
Pie Pans		
9"	30	5
8"	40	5

Typical Baking and Roasting Times*. VECTAIRE will reduce baking time from 30 to 40 percer and reduce roast shrinkage to as little as 8 percent.

Product	Time in Minutes	Temperatures °F.
Baking Powder Biscuits	12	375
Cornbread	30	350
Macaroni	30	350
Rice	30	325
Apple Crisp	30	325
Baked Apples	35	300
Cookies, (Oatmeal)	10	375
Custard Pudding	30	325
Rice & Raisin Custard	30	325
Sheet Cake	15	375
Upside Cake	25	325
Sauerkraut	20	350
Fish Sticks	8	350
Corned Beef & Cabbage	35	325
Liver & Onions	27	400-350
Cheese Delights	25	300
Fried Chicken	25	325
Meat Loaf	70	275
Spanish Rice	42	450-400

Product	Time in Minutes	Temperatures °F.
Hamburger Patties	6-8	400
Spaghetti & Ground Beef	47	450-400
Tuna & Noodles	30	400
Weiners	35	400
Beef & Vegetable Stew	100	400-350
Cheese Sandwich	8	350
Cabbage (Fresh)	40	400
Carrots (Fresh)	75	325
Beans (Frozen)	24	400
Broccoli (Frozen)	20	400
Corn (Frozen)	20	400
Peas (Frozen)	15	400
Potatoes (Baked)	40	400
Roasts — Medium Done — 5 lbs. Each		
Roasts Beef (boneless)	2 hrs.	275
Roast Pork (loin)	2 hrs.	300
Roast Lamb (leg)	2 hrs.	275
Roast Veal (shoulder)	3 hrs.	275

*A complete set of 40 recipes giving ingredients, procedures, times, and temperatures is included with every Vectaire oven.

Interior shall measure 26"W x 27"D x 20½"H and be lined with reinforced 16-gauge steel (stainless optional). Plated 9-position rack guides shall be removable. Two lights shall be furnished with unit.

Doors shall be twin-type, one counterbalancing the other, and edged with silicon seals. Viewing window in each door shall be of heat tempered glass.

Insulation to consist of one, 1-inch thickness ea. of thermobestos and 6# fiberglass.

Burner: Duplex-type, shall be capable of burning 115,000 BTU/hr.

Racks: Five 26" x 27" racks with non tip feature shall be provided with raised rear support.

Control System shall consist of thermostat, liquid pressure type, with steel capillary tube, and 100% shut off safety pilot shall be liquid pressure type, mercury filled. Burner valve to be manual (Electric controls optional). Quick-acting door switch for fan motor. Indicating lights shall be provided for fan motor and burners. Batch timer (1 hr.) shall be mounted on control panel. All controls to be located within an insulated, vented, recessed compartment.

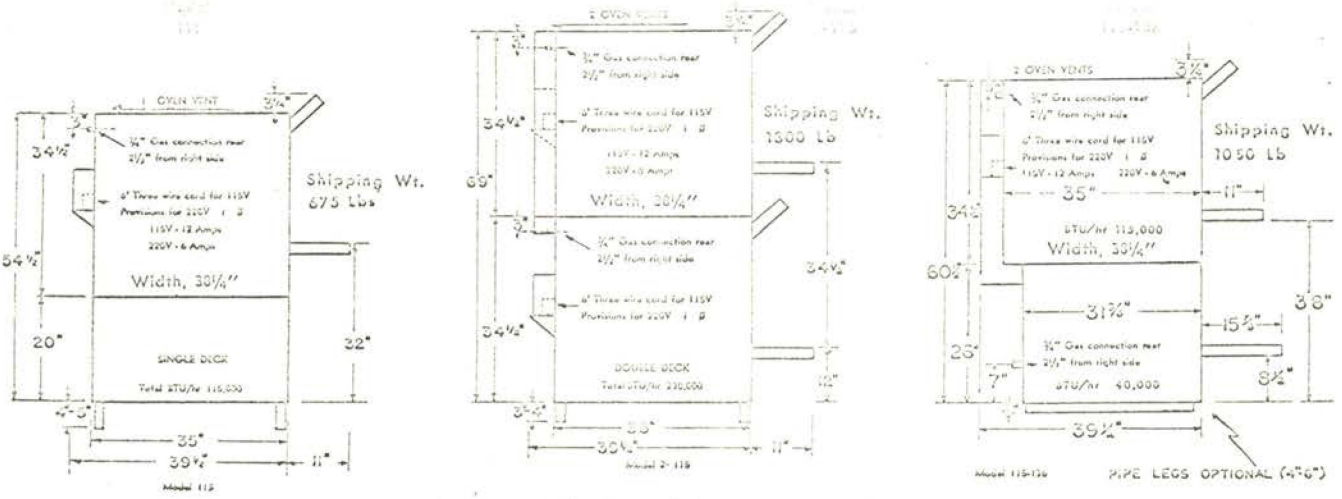
Motor shall be pancake type, air cooled, ¾ h.p., 110V-220V, single phase, ball bearing sealed with high temperature grease (3 phase available).

Base shall be 18 ga. and enclosed to have provision for 9-position removable rack guides. Feet to be adjustable.

Finish shall be s.s. front (upper section) with balance in gray hammertone. (Sides, top, and backs available in s.s.).

Refractory Firebox panel shall be removable without use of screws, control panel to be easily removable.

Draft Diverter: When specified, shipped with draft diverter for direct connection to 8" oval vent.



r. High, Bellingham
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n. School, Durham
Bakery, San Diego
hool, LaVerne
School, Sacramento
Elem. School, Portland
School, Portland
. Hi School, Portland

Albany Jr. Hi School, Albany
Tops Restaurant & Lounge, Albany
Cosmopolitan Hotel, Portland
Gourmet Bazaar, San Jose
Mayfair School, Fresno
Pomona Unified Schools, Pomona
Merrifield Elem. School, Duncanville
Zuider Zee Restaurant, Dallas
Harry's Chuck Wagon, Tracy
River Queen, Portland
Country House Restaurant, Kelso
La Mirada Hospital, La Mirada
Campbell Soup Co., Sacramento
La Petite Resteurant, Oakland
Hotel Broadview, Wichita
Scott's Bakery, Anaheim
Sabella's Rest., San Francisco
J. R. Peterson School, Huntington Beach
Huntsville Elem. School, Huntsville
Cheshire Inn, St. Louis
Fresno City Schools, Fresno
Luther Elem. School, Live Oak
Pleasant Ridge Union School, Grass Valley
Waddles, Portland
Portland Sanitarium Hosp., Portland
Barts Landing Rest., Yakima
Shadowbrook Rest., Capitola
Sunset Oaks Country Club, Rocklin
Carlton Hills Country Club, Los Angeles
Watsonville Hi School, Watsonville

Washington Elem. School, Alameda
Holiday Inn, Sedalia
Holiday Inn, Enid
Orange Hi School, Orange
Carl's Char Broiler, Anaheim
Bon Marche, Seattle
El Charro Rest., San Jose
French Hospital, San Francisco
Turlock Elem. School, Turlock
Alhambra School (Hi), Martinez
Warwick Hotel, Houston
Elks Club, Santa Ana
Ortega School, Pacifica
2-Boys Inn, Ontario
Roosevelt Jr. Hi School, Lakewood
Mayfair Hi School, Lakewood
Mermac's, Downey
Brad's Restaurant, Vancouver
Monterey Bay Academy, Watsonville
Roswell Truck Stop Cafe, Roswell
Lewiston Sr. Hi School, Lewiston
The Combo, Flagstaff
Ruddock Elem. School, Covina
Wells Fargo, Carmel Valley
Hume Lake Conf., Fresno
Knotts Berry Farm, Buena Park
Kapiolani School, Hawaii
Waiakea Waena Sch... Hawaii
Hilo Intermediate School, Hawaii
Kalanianaole School, Hawaii

Peace Corps School, Hawaii
Lathrop High School, Fairbanks
Benson High School, Benson
Train School, Omaha
Tucson Public Schools, Tucson
The Hoyt Hotel, Portland
Rainier Beach School, Seattle
Chick 'N' Ette, Las Vegas
Lebanon Cumminity Hospital, Lebar
Walgreens, Chicago
J's Cafeteria, Dallas
Thornhills Cafeteria, Houston
Juno Crosby's, Honolulu
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College of Notre Dame, Belmont
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Downey Sr. High, Downey
The Surfer, San Diego
Lincoln Jr. High
Holiday Inn, Kirksville
Inn America, St. Louis
Glen's Hik'ry Inn, Oklahoma City
Washington School, Bethel
Marlin School, Marlin
Needham School, Lodi
Muskogee Schools, Muskogee

Design improvement may affect change to specifications without notice.