

The Willamette Valley Farm Kitchen

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SUMMARY

PURPOSE OF STUDY

The purpose of the study described in this bulletin was to determine the equipment, arrangement, and minimum dimensions of kitchens that make adequate provision for the needs of Willamette Valley farm families.

SINK CENTER

A sink unit 8' 2" long, consisting of a 32-inch flat-rimmed sink, upper and lower cabinets at either side, and a shallow cabinet above the sink, was found to provide the counter space needed for the activities carried on at this center, and storage space for all supplies and equipment used in connection with them, with the exception of "company" dishes. In this plan the length of the left side is 32 inches and that of the right 36 inches. When the right and left sections were made of equal length, the unit was increased to 8' 6" (Figure 3).

Where company dishes were stored at the sink, the total amount of supplies and equipment to be stored exceeded, for all cooperators, that which is available above and below work counters of minimum size. When all of this material was stored in the cabinets above and below the sink work counters, the unit averaged 10' 0" in length.

MIXING CENTER

A table 25½"x36" was found to provide the minimum desirable amount of work space at the mixing center. The storage space below it was sufficient in the majority of cases for sugar and cereals that are purchased by cooperators in lots of 10 pounds or more. Other supplies and the equipment allotted to this center could usually be stored in a floor-to-ceiling cabinet 20"x26" (outside dimensions), making a total of 62" of wall space required for this center. No cabinet above the mixing table was included in this ensemble (Figure 8B).

STOVE CENTER

A floor-to-ceiling cabinet 15" wide (inside measure) was usually found to provide sufficient space for articles used at the stove, such as frying pans, that are equipped for hanging (Figure 11B).

The space above and below the wood compartment of a box 40" long (over-all measure) usually afforded sufficient storage for all supplies and equipment allocated to the stove center (Figure 10A). The space above a wood lift 24" long afforded sufficient storage in 7 out of 12 cases (Figure 10E).

SUMMARY—*Continued*

MIXING CENTER AND STOVE CENTER COMBINED

When cabinets for the mixing center and stove center were planned as a unit, the installation that required the least wall space consisted of a 36-inch mixing table with 36-inch upper cabinet, and a floor-to-ceiling cabinet with shelves, slots for flat articles, and a section for articles to be hung.

OTHER EQUIPMENT REQUIRED FOR COOPERATOR NEEDS

- A draft cooler 18"x30" or 24"x24" (outside measure).
- A mechanical refrigerator of four-to-five cubic-feet capacity.
- A meal table 40"x78".
- A utility table 24"x30", for the kitchen without a dining area.

TRAVEL ESTIMATES

The bases for judging the convenience of proposed kitchen arrangements were estimates made of the travel that would be required of a worker in doing routine kitchen work in a year's time.

The following rule was found to be helpful in producing low-mileage floor plans: Arrange the kitchen so that the sum of the distances between range, sink, and meal table (or dining-room door) is as small as possible.

ROOM-PLANNING PROBLEMS STUDIED

Major factors in planning kitchens for the group selected for study were the type of fuel used for cooking, and the use of the kitchen for serving meals. Four room-planning problems were chosen for study, varying as follows with respect to these two factors:

1. Wood and electricity used for cooking; dining area provided
2. Electricity only used for cooking; dining area provided
3. Wood and electricity used for cooking; dining area not provided
4. Electricity only used for cooking; dining area not provided

In arriving at solutions to the first problem, all possible sequences of equipment, doors, and chimney were tested (within the limits of the standards set up); dimensions were determined and travel estimates made.

The articles of equipment used in connection with each problem were those found to be representative as to kind and dimensions, when the detailed plans for the various centers were compared.

SUMMARY—Continued

KITCHEN FLOOR PLANS

No kitchen arrangement was developed that is distinctly superior to other arrangements either in area or travel estimates. Rather, there are various low-area and low-mileage arrangements differing principally in the convenience of the meal table or "family" center.

Problem One: Equipment includes wood-and-electric range, and meal table (Figure 15). Five types of arrangement were distinguished (Figure 16), varying in the relative position of meal table and working area. In Type A the meal table occupies the center of the open space enclosed by the pieces of working equipment when they form a "U". In Types B and C there is partial separation of the working area from the dining area or family center, while in Types D and E the separation is complete. Generally speaking, the areas of the minimum-sized kitchens of the various types vary in proportion to the degree of separation of the working and family areas. The area of the smallest kitchen of each type, when the sequence of working equipment is unbroken by doors is as follows: Type A, 178.7 square feet; Type B, 188.4 square feet; Type C, 200.0 square feet; Type D, 206.0 square feet; Type E, 209.4 square feet.

Of the various solutions developed for Problem One, the kitchen with the lowest travel estimate would require 162 miles of walking per year.

Problem Two: Equipment includes electric range and meal table (Figure 21). The smallest kitchen developed contains 153.0 square feet. The smallest kitchen of each arrangement type, when an electric range was used, is from 20 to 26 square feet smaller than the smallest kitchen of the corresponding type that was equipped with a combination wood-and-electric range. Travel estimates for the low-area kitchen were approximately 155 miles per year.

Problem Three: Equipment was the same as for Problem One except that a utility table 24"x30" with one chair was substituted for the meal table and six chairs. The smallest kitchen developed has an area of 148.2 square feet.

Problem Four: Equipment was the same as for Problem Two except for substitution of utility table for meal table.

The smallest kitchen developed has an area of 115.1 square feet. The narrowest kitchens were found to be lowest in area.

The Willamette Valley Farm Kitchen*

by

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DESCRIPTION OF STUDY

THE PROBLEM

WHAT is a good size for a farm kitchen? If the room is too small, work space is crowded and storage facilities inadequate, resulting in lack of order, discomfort, and loss of time. If the room is too large additional steps and time for the worker are required, and the initial cost of the structure as well as the continuous cost of keeping the room clean and in repair is unnecessarily high.

The problem of the study described in this bulletin was to determine the size of an adequate kitchen for the farm dwelling. Specifically:

- (1) The floor and wall space required for each of the various centers of a kitchen, when adequate provision is made for the activities and storage needs of a specific group of families, and
- (2) The dimensions of the kitchen that provides adequate floor and wall space for all centers, and is arranged to permit efficient routing of activities.

The study was limited to the requirements of farm families living in the Willamette Valley of Oregon. The farms of this section are capable of producing the meat, poultry, and dairy products, as well as the fruits and vegetables, sufficient for a well-balanced and varied diet. Farm families in this area are homogeneous to a decided degree with respect to habits of work and living.

INFORMATION OBTAINED

To obtain the information required for this study the investigator chose at random 14 of the 24 families interviewed for a larger study of the Willamette Valley farmhouse. These were living on general farms in various parts of the valley. They own their own farms, averaging 126 acres, located, on an average, 6 miles from a trading center. Households varied in size from 2 to 9 persons, with an average of 4.6 persons.

From 4 to 9 full-afternoon visits were made to each home, of which 2 to 4 visits were devoted to kitchen requirements. A complete list of articles to be stored in the kitchen, their dimensions and frequency of use, was obtained. This information included brands and sizes of packages com-

* More detailed information concerning this study is contained in a report which is available from the Department of Home Economics, Agricultural Experiment Station, Oregon State College

† Acknowledgement is given to Dorothy Schreiner, Grace Henderson, and Ruth Thayer for their contributions to this investigation.

monly purchased. Cooperators were asked to enumerate and describe articles of equipment that they were planning to replace or add to their stock. Information was also obtained as to the kind of work done in the household, scale of operation, help received by homemakers, methods of work, and the preferences of homemakers as to the location and arrangement of the kitchen and as to the amounts of supplies to be kept there. Where the amounts stored or uses of the kitchen at the time of the interview seemed to be the result of circumstances that might be temporary, "what we usually do" was substituted for present practice.

KITCHEN PLANS MADE

Following is a summary of the procedure followed in determining the size and arrangement of the Willamette Valley farm kitchen.

A. The first step in planning for each household was to determine the number, uses, and location of minor and major areas of the entire house, allocating every function to some area, and taking into consideration the preferences of the cooperator, scale of operation, present practice, requirements of the function, and efficiency of the house as a whole.

B. Detailed plans were then made for the fourteen cooperators. Procedure in planning each kitchen was as follows:

1. Every function assigned to the kitchen was allocated to a center, a given function being allocated to the same center for all cooperators.
2. Articles to be stored in the kitchen were grouped with respect to convenience in use, with the exception of perishable foods. The latter were grouped with respect to similarity of storage conditions required, into those requiring refrigeration and those for which a draft cooler suffices.
3. Detailed plans were made for each center.

The procedure followed in making plans for the various centers was: (1) to determine by experimentation the minimum dimensions of working surfaces required by the type and scale of operation of work done in the Willamette Valley farm kitchen; (2) to determine the vertical and front-to-back dimensions of storage space available above and below these working surfaces, allowing for construction; (3) to determine for each cooperator the lengths of cabinets that would provide her with adequate working surfaces and storage space.

Storage facilities were planned to provide for all articles listed in inventories, in locations desirable from the standpoint of convenience in use.

More than one plan was made for each center, wherever variations in methods of storing supplies and equipment suggested the possibility that some arrangements might take less space than others.

C. The completed plans for the various centers were compared for the purpose of noting the range in dimensions of installations planned for the fourteen cooperators, and of noting where a high degree of similarity suggested the possibility of dimensions and arrangements that would suit a large proportion of Willamette Valley farm families.

D. Finally, kitchen arrangements were worked out that provide adequate wall and floor space for the units required by the average cooperator, and require the least walking in doing kitchen work.

FUNCTIONS OF THE KITCHEN

SUMMARY OF FUNCTIONS ALLOCATED TO KITCHENS OF COOPERATORS

A fundamental principle in planning the various parts of the house is that each part should be planned to suit the function or functions it is likely to be called upon to serve. The first step in kitchen planning, therefore, is to list the functions of the kitchen.

This listing was undertaken as part of the first step in the Farm Home study, which involved the planning of the entire house. Every function, major and minor, was allocated to some part of the house. In making decisions concerning the allocation of specific functions, the desires of the family (as expressed by the homemaker during the interviews), present practice, scale of operation, and efficiency in the use of the entire house were taken into consideration.

For all cooperators the kitchen was assumed to be the only place in which meals would be prepared or dishwashing done. Washing clothes and egg packing were assigned in all cases to some place other than the kitchen. Ironing was assigned to the kitchen in 7 out of the 14 cases. For 12 of the 14 households the service of everyday meals was listed as a kitchen function, but in all cases a dining area was also provided outside of the kitchen. Where there were children under six years of age, it was assumed that they might be playing in the kitchen during the morning.

Supplies and equipment in current use in connection with kitchen processes were assigned to the kitchen for storage. "Company" dishes were, in some installations, stored in the kitchen, but not the silver and linen used only for company meals. Articles used in cleaning floors and walls were stored elsewhere, also large quantities of food, and large, seldom-used articles of equipment.

CONSIDERATIONS IN ALLOCATION OF FUNCTIONS

"Dirty work." In considering what functions might be assigned to the kitchen it was assumed that running water would be available in another workroom, and all tasks that would be classed as "dirty work" were allocated to it unless there was a specific reason for doing them in the kitchen.

Canning. For the cooperators in the kitchen-planning study, decisions as to whether canning would be done in the kitchen or in an auxiliary workroom were based on their statements as to the amounts canned at a time and as to preferred ways of managing their canning and other food preservation.

Food storage. Storehouses are required for the fruits, vegetables, meat, and poultry products, produced on the farms of the Willamette Valley. Hence provision for the storage of these products in the kitchen was limited to that required for small amounts.

Egg packing. On general farms in this region egg-production is on a comparatively small scale, perhaps only a case or two per week being marketed. As it is more convenient to pack eggs on a table in the place where the eggs are stored till marketed than to do the work in the kitchen, egg packing was in no case listed as a kitchen function.

Laundry work. Cooperators were almost unanimous in favoring a place outside the kitchen for washing, but they consider it quite satisfactory to iron in the kitchen, since this is a "clean" job.

The majority prefer the portable to the built-in board, so that when it is necessary to do the ironing in the afternoon or evening, the homemaker can take it into the living room where she can talk with the family or listen to the radio while she irons. The portable ironing board was allocated to a hall closet for storage.

Meal service. Preferences of cooperators were taken as the basis for decision as to whether or not provision would be made for serving meals in the kitchen. All of those who now serve meals in the kitchen favor the practice, whether they have dining rooms or not.

The practice of dining in the kitchen seems to be a practical one for this area. It saves work for the homemaker. If the kitchen is orderly and attractive and if the dining table is in a light, well-ventilated corner, there is no objection to dining in the kitchen from the standpoint of attractiveness in surroundings. During the short period of the year when the room may be too warm for dining in comfort the table may be moved to an adjoining porch.

Another reason for serving family meals in the kitchen is that it makes for a better distribution of the functions in the house where the dining room must be used for other purposes than meal service, or where it is combined with the living room. Company meals are not of frequent occurrence and are usually served on Sunday. Hence, they can be served in the dining room, or the dining area of the living room, without much interference with its other functions. But there is bound to be interference if everyday meals are served in an area that is also used for sewing, child's play, study, and as a farm office.

Storage of dishes. Everyday dishes were in all cases assigned to the kitchen for storage. In some of the arrangements provision for storage of dishes used only for company meals was made in the kitchen. These are the cases where it seems best to plan that the dining room or dining area of the living room will also be used for other purposes than the service of meals, and a dish cupboard would emphasize its use as a dining room.

Storage of silver and linen. Silver and linen used only for company meals were not given a place in the kitchen. The reason is that a serving table is always desirable in the dining room and the space beneath it is suitable for the storage of these articles. A test showed that for all cooperators the space available below a table twenty-two by forty-three inches was adequate for the storage of the silver and linen used only when there were guests.

Storage of cleaning supplies and equipment. The cleaning closet should be near the kitchen, but it is often easier to design a suitable location in an adjacent hall than in the kitchen itself. All farmhouse plans for cooperators have been made to include back halls, hence no provision has been made in any of the kitchens for a cleaning closet.

Drying wet garments. During the rainy season work clothes and play clothes must be hung where they will dry over night. An alcove or ventilated closet opening from the back hall will be found adequate. Hence no special provision has been made for drying wet garments in the kitchen.

Child's play. After the older children have gone to school in the morning the preschool child will usually want to play where he can talk to his mother. Several cooperators suggested that table and floor space be provided for play within the kitchen but outside the working area, also that provision be made in the kitchen for storing the play equipment that is used there.

Telephone. The telephone should be located near the kitchen and also near the door leading to farm buildings. All farmhouses planned for cooperators include back halls, and this location is more suitable for the telephone than the kitchen.

AMOUNT OF WORK DONE IN KITCHENS OF COOPERATORS

The scale of operation for food preparation and meal service is indicated by the extent to which families do their own baking, and the number of persons served at meals. All the cooperators customarily bake all cakes, pies, and cookies used by their households, and all but three bake bread. Only 2 of the 14 cooperators usually prepare meals for more than 5 persons. Only 3 had to serve more than 12 persons when the number of farm helpers was at its maximum for the year. Half of the cooperators commonly serve 12 persons at company meals, but none serve more than that number.

The scale of operation for canning is indicated by the number of sealed containers used. The average for the 14 cooperators was 387 quarts. Twelve cooperators usually can meat and 10 usually can fish. Many jars are used more than once.

STANDARDS FOR KITCHEN PLANNING

UNITS OF THE KITCHEN

The following list of units of the kitchen was used as a guide in planning kitchens for individual cooperators, to make sure that provision was made for all functions. The list includes the needed work surfaces and the equipment and supplies used at each surface.

Articles for storage were grouped with the following considerations in mind:

The mode of storage (shelves, bins, drawers) should be suited to the shape, size, weight, and character of the material stored.

Economy of construction may require the separation of shelves, drawers, and bins, but it can be assumed that all shelves for a given center, all drawers, or all bins, will be built as a unit.

Cooking equipment, and food supplies for which room temperature is satisfactory, should be grouped together if used at the same center, and if they require the same type of storage arrangement (shelf, drawer, hook).

Food supplies should be stored at the temperatures required to prevent undue deterioration.

Detailed lists of articles stored in connection with each center are included in the sections of this bulletin dealing with the various centers. Where an article of equipment is used for more than one purpose (as pan

used both for rinsing dishes and for making bread), it was assigned to the center where it is most frequently used. If it is used at one center as much as another, it was stored with other articles of similar size and form.

Foods requiring washing were assigned to the sink center. Decisions as to whether or not specific foods require washing were based upon the consideration of their treatment prior to reaching the kitchen and the claims of packers as to the cleanliness of the packaged product.

Sink center

Sink proper—for processes requiring water or draining.

Dishwashing tables—for receiving soiled dishes, stacking, and draining.

Sink food table—where foods are handled that require washing.

Place for: garbage container; stool.

Storage space for: dishes, dishwashing supplies and small equipment; dishpans and drainers; food supplies kept on shelves; equipment kept on shelves; equipment kept in drawers; equipment that can be hung; vegetable cutting board; clean dish towels and hand towels; towels in use; drinking glasses in use; flower containers; floorcloth; empty fruit jars, before taking to food-storage room; food containers for cooler and refrigerator, when not in use.

Stove center

Stove proper—heated surface, oven, warming oven or shelf.

Adjacent work area or unheated surface where short mixing jobs can be done.

Storage space for: food supplies kept on shelves; equipment kept on shelves; equipment hung; equipment kept in drawers; fuel.

Mixing center

Table where bread, pastry, etc., are prepared.

Storage space for: food supplies kept on shelves; food supplies kept in bins or drawers; equipment kept on shelves; equipment kept in drawers; equipment hung; pastry and meat boards.

Serving center

Surface for: bread cutting, filling dishes for the table, etc.

Storage space for: food supplies kept on shelves; dishes; small utensils kept in drawers; food kept in special containers—bread, cakes, cookies; board for cutting bread.

Draft cooler

Work surface for use in rearranging cooler.

Cooler space.

Refrigerator

Work surface for use in rearranging contents.

Refrigerated storage space.

Dining center

Meal table and chairs.

Nearby surface for placing tray.

Storage space for: silver and linen; electrical appliances used at meal table; articles not requiring washing or filling after each meal (as salt shakers, sugar bowl).

Planning center

Table or desk where writing can be done.

Shelves for books and files.

Drawers for papers.

Rack for drying wet towels**Wastepaper basket****Unassigned storage**

Articles used in preparing child's food; articles used in feeding child in kitchen; unopened canned goods; kitchen aprons in use; clean aprons; clean rags; stepping stool for reaching high shelves; lap table and low chair.

Articles used in the kitchen that may be stored outside

Articles used only in connection with food preservation; equipment used only on special occasions (as turkey roaster); articles used in connection with the separating and care of milk, butter making, egg packing and storage, and ice-cream making; picnic kit; water jugs; table leaves; removable table top.

Ironing center

Ironing board.

Table for sorting and laying flat articles.

Place for garments on hangers.

Storage for iron and other equipment.

Rest and play; child care

Table and at least two chairs.

Storage for child's playthings.

Child's high chair.

EQUIPMENT**Plumbing and electricity**

A sink with drain and piped hot and cold water was included in the equipment for which floor allowances were made, and it was assumed that electricity would be available for heat, power, and light. Farmhouses of the better type in this section are so equipped.

Facilities for food preservation

Floor allowance was made for a draft cooler large enough to hold all perishables, as well as for a mechanical refrigerator large enough to hold food materials for which refrigeration is especially desirable. This plan

was made on the assumption that the refrigerator is not likely to be operated except during the warmer months, also that the combined area required for the two utilities would certainly suffice for a refrigerator large enough for all perishables, if in the lifetime of the house this would be desirable.

Stove

A wood range is favored by most cooperators, as the majority of the farmers in this area produce their own wood. Stoves that do not heat the kitchen are desired for summer use and for short-time cooking processes. Electric or gas ovens are favored because of the possibility of temperature control. In view of these considerations, the kitchen plan should include a flue, and wall space should be provided of sufficient length to accommodate a combination stove or two small stoves. If only one stove is used this wall space will permit a work surface adjacent to it. When the combination stove is used this is not often needed, as it is seldom that both parts of the stove are in use at the same time.

Cabinets

Built-in cabinets were planned to supply work-table space, and to provide storage room for equipment and for all supplies that can be kept at room temperature.

All plans provide a mixing table, and work counters at either side of the sink. The reason that the sink work counter was not made to serve the purpose of a mixing table is that the height of the latter needs to be lower than that of the sink rim.

Most of the cooperators in the study required more storage space than that afforded by cabinets above and below work surfaces of the minimum length required for their uses. Current articles on kitchen planning frequently stress the desirability of continuous work surfaces, but where the storage requirement is considerably in excess of that afforded by cabinets above and below minimum-length work surfaces the saving in floor space resulting from the use of the floor-to-ceiling storage cabinets indicates the desirability of this method of caring for the excess.

Built-ins were assumed to be made of wood. Minimum amounts were allowed for the thickness of materials.

Cooperators all prefer closed cabinets, and this standard was accepted. The chief reasons given for this preference were that the contents of cabinets are not usually decorative, and that there is considerable dust in the air in the summertime.

Cabinet shelves were planned to be removable and adjustable as to distances apart. Sliding shelves were planned for lower cabinets, to increase the utility of these storage spaces. Drawers for small utensils were sectioned. Deep drawers were planned for use as bins; provision for the smaller bins was made by means of two to four removable metal insets in a single drawer.

Tables and chairs

Where kitchen functions included meal service, it was assumed that the meal table would also be used as a child's play center, as the place for the homemaker to sit while consulting recipes or doing such work as shell-

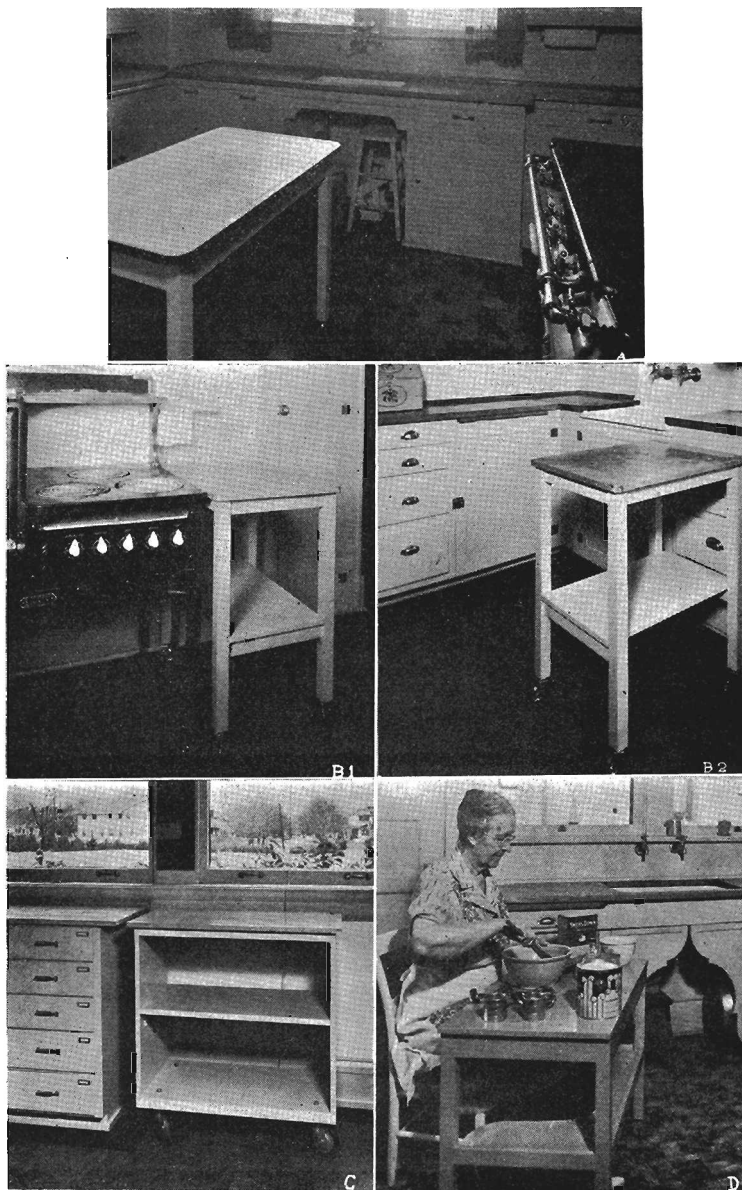


Figure 1. (A) Movable work table for the center of a large kitchen, or for use as a planning desk. (B) and (C) Wheeled tables used to supplement work surfaces and to move materials about the kitchen. (D) Table suitable for work done while seated.

ing peas, and as the place where ironed clothes were piled. Where meals were not served in the kitchen, a table of the minimum dimensions suitable for the other uses enumerated was included in kitchen equipment.

In devising plans for the economical use of kitchen space it was sometimes found wise to provide an easily moved work table to supplement the work space provided by built-in cabinets. Figure 1 illustrates four kinds of movable work tables.

ARRANGEMENT

Objectives

The chief objectives in planning the arrangement of a kitchen are:

- (1) To make it possible to organize kitchen work so as to use time and energy most efficiently.
- (2) To provide sufficient space for workers to move about freely and to prevent interference from other persons coming into the kitchen.
- (3) To provide natural light for work surfaces and views of the children's outdoor play area and the farm buildings.
- (4) To minimize the cost of building and maintenance.

Travel estimates

A study was made to arrive at a basis for estimating the amount of travel that would be required in doing routine work in kitchens of various arrangements. The method used was to estimate the number of moves made by a worker between each two parts of a kitchen in the course of a year's time, and to multiply these numbers by the distances between the various parts of the kitchen in the arrangement under consideration.

The number of moves between each two parts of the kitchen was estimated in the following manner: A list was prepared of dishes in common use in Willamette Valley farm households, based on information obtained from cooperators in the Farm Home study. This list was presented to 50 farm homemakers, each of whom was asked to estimate the number of times during the year that each of the various dishes was prepared in her household. The moves required in the preparation of each dish were listed by the investigator to determine the total number of times that each part of the kitchen served as a starting point or as a destination, the moves for each dish being weighted by the average number of times in the course of a year that it is prepared in the Willamette Valley farmhouse. These data for the moves required for meal preparation were supplemented by similar data for the moves required in setting the table, serving meals, dishwashing, and tending the kitchen fire.

Obviously the estimated number of moves is influenced by what are considered "parts" of the kitchen. These are listed in Appendix D.

In Table 1 are listed the four most important connections for each work surface and for the cooler and refrigerator, and the estimated number of trips per year between each two parts. Detailed information concerning the number of trips is given in Table 4 (Appendix E).

From these data there were developed the following steps in planning a Willamette Valley farm kitchen:

1. Plan a sink unit with work counters on both sides, one of these to be used as a serving table, and the other as a food-preparation table. Both would be used in dishwashing.

2. Utilize the space above and below the sink work counters for the storage of frequently used dishes, the kettles and pans used at the sink, and silver, linen, and small utensils.

3. In connection with the mixing table, plan space for the storage of equipment and supplies used there.

4. Observe the following order in locating the various items of equipment.

- a. Sink unit near the meal table, with the dish cabinet and the silver and linen drawers next to the meal table.
- b. Stove near both meal table and sink.
- c. Wood box near stove and on same side as firebox.
- d. Mixing unit near sink.
- e. Draft cooler near stove and mixing table.
- f. Refrigerator near serving table.

Table 1. FOUR MOST IMPORTANT CONNECTIONS WITH EACH UNIT.

Compiled from data in Table 4 (Appendix E).

Connections between each of the working surfaces, the cooler, and the refrigerator, and the four areas with which connections are most frequently made.	Number of moves
<i>*Sink unit and—</i>	
Meal table	9,100
Stove and stove table	9,062
Serving storage, shelves	8,971
Sink equipment storage, shelves or hung	6,656
<i>Stove and stove table and—</i>	
Meal table	9,409
Sink unit*	9,062
Fuel storage	7,200
Stove equipment storage	6,104
<i>Mixing table and—</i>	
Mixing equipment storage	6,864
Sink unit*	5,047
Cooler	4,788
Mixing supplies kept in bins	3,452
<i>Serving table and—</i>	
Meal table	10,458
Sink unit*	6,302
Serving storage, shelves	6,234
Serving storage, drawers	6,190
<i>Meal table and—</i>	
Serving storage, shelves	11,335
Serving table	10,458
Stove and stove table	9,409
Sink unit*	9,100
<i>Draft cooler and—</i>	
Stove and stove table	4,794
Mixing table	4,788
Serving table	4,303
Sink unit*	3,762
<i>Refrigerator and—</i>	
Serving table	3,176
Sink unit*	1,553
Mixing equipment storage	1,094
Stove and stove table	1,085

*Includes sink bowl, and counters used in dishwashing and in handling foods requiring the use of water.

Freedom of movement

To insure freedom of movement for workers, it is necessary: (1) To allow enough floor space about each work surface to enable the worker to assume the postures required for the efficient use of her muscles. (2) To guard against overlapping of floor spaces likely to be used at the same time.

The dimensions of passages and floor spaces adequate for the movements required at the various centers are given in the subsequent section on space allowances. Following are some suggestions for arrangements that are useful in preventing interference of workers one with another, and interference from persons passing through the kitchen.

Avoid separation of the various pieces of equipment by major passages. In the section on kitchen floor plans the relative importance of avoiding the separation of each two centers by means of frequently used doors is expressed numerically, based on the frequency with which the worker makes trips between them.

If it is necessary to break the sequence of working equipment by passages, avoid placing the sink, stove, or mixing table so that the worker stands in a direct line between living room and outside kitchen door, between living room and meal table, or between outside door and meal table.

Locate the ironing board so that its use will not interfere with travel between frequently used doors, or between sink, stove, and mixing table.

Plan the widths of upper cabinet doors so that they do not extend beyond the front edges of lower cabinets, when fully open.

Locate room doors and full-length cabinet doors so that they may remain open without interfering with workers or persons passing through the kitchen.

Light and view

The goal in planning window space was natural light sufficient for all working surfaces. The determination of the relation between floor area and window area required for various combinations of exposure and wall color and texture has not been made for Willamette Valley climatic conditions, hence no basis for judgment as to when a room is adequately lighted is available. In judging whether a particular area will be well lighted, it is of course necessary to consider possible interference with light from cabinet or room doors.

The question of the evaluation of the various directions from which light may strike a work surface was submitted to a group of home-management specialists and homemakers. The majority prefer that the sink, range, and mixing table should receive light from the side, and that the ironing board should be lighted from the side front.

The matter of desirable views from the kitchen was also submitted to the group of home-management specialists and homemakers mentioned above. In their opinion the most important outlook is that from the dining area. Next in importance is that from the sink area; third is from the mixing table. No importance was attached to a view from the range. Relative values set by this group upon the direction of light for each working sur-

face and upon the desirability of views from various parts of the kitchen are included in Appendix C.

Position of range

Space at the back of a wood range, unless the range is of the built-in type, must be sufficient to prevent possible scorching of a wall by heat from the stove pipe. This space must be accessible for cleaning, which requires that a passage be provided at one end of the range wide enough for a person to enter. The open space at the end of the range also adds to the convenience of a worker in handling kettles at the back of the stove.

Space economy

To eliminate unnecessary expense for the building and maintenance of the kitchen, and unnecessary expenditures of time and energy in its use, passages and activity areas were made no larger than use-requirements demand.

SPACE ALLOWANCES FOR ACTIVITIES

Number of workers

Judging from observation of the way kitchen work in Willamette farm homes is managed, space for one worker at the mixing table and stove centers is sufficient. At the sink, however, room is needed for two persons to work side-by-side.

Bases for space allowances

The determination of a number of the standards for dimensions required experimentation. Workers and equipment to represent the farm-home situation were used.

The distances of work surfaces from the floor were made to suit the convenience of persons standing. Farm women interviewed on this point were of the opinion that this plan is better than that of placing surfaces so low that the worker would always have to sit to be comfortable. Often the intervals of time spent at the center are so short that sitting would be a "bother."

Whenever the method of doing the work was in question, the practice approved by home economists was used as a basis of decision. But if such practice ran counter to that commonly used by farm homemakers, dimensions were so planned that they would permit either practice to be followed.

Whenever the size of minor equipment was a point of consideration in determining the dimensions of a work surface, measurements were used for the number, types, and sizes of utensils which are representative of those found in the inventories of homemakers cooperating in this study.

Space allowances based upon measurements of users are those determined in a recent study which is reported in Oregon Station Bulletin 348, "Standards for Working Surface Heights and Other Space Units of the Dwelling."

STORAGE OF SUPPLIES AND MINOR EQUIPMENT

In deciding upon the grouping of articles in a given area and upon the margins about articles stored, the aim was the maximum economy of

space commensurate with the proper care of the articles stored and ease of access to them.

Methods of storing supplies and equipment

As noted previously, it was necessary to assume that the homemaker would use a specific storage area in a prescribed manner, in order to arrive at the dimensions of the space required for a given article or group of articles. Storage practices, also allowances for margins about stored articles, are included in Appendix A.

Amounts for which storage provision was made

Allowances for storage room for purchased supplies were based upon information from cooperators as to the amounts usually purchased at a time and the amount usually left on hand when a new purchase is made. Storage space for home-produced supplies was allowed according to the homemaker's estimate of the minimum quantities desirable to keep in the kitchen. Storage space for equipment was planned for articles now on hand, also for articles for which the homemaker expressed the need.

Widths of cabinets and distances between shelves

The widths of upper cabinets and of floor-to-ceiling cabinets were determined by the size of the largest article assigned to each type. Lower cabinets were made as wide as the work-surface above would permit.

The widths of shelves for packaged food supplies, and the distances between shelves, were based on information obtained by measuring packages of the various brands and sizes on sale in Willamette Valley grocery stores patronized by farmers, rather than upon the dimensions of the packages found in the homes of cooperators at the time of the interview. The

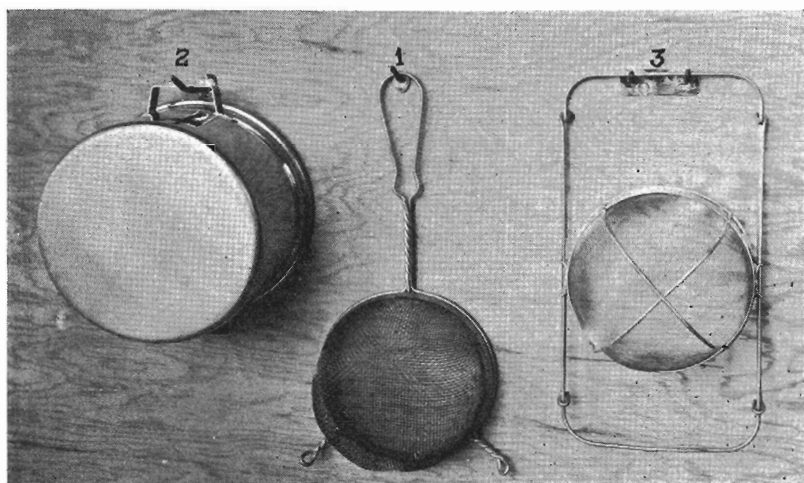


Figure 2. Hooks suitable for kitchen utensils.

Type 1. Suitable for most kitchen utensils. Type 2. For utensils with handles set well below the edge or with handles set vertically. Type 3. Utensils with grip handles.

inquiry was extended to include all brands for which there is considerable sale.

Construction standards

Minimum allowances for construction were made in arriving at the storage space available above and below working surfaces and in determining the outside dimensions of cabinets. The amounts approximate those commonly used in the construction of wooden kitchen cabinets. The specific amounts allowed for construction are given in Appendix A.

Hooks for kitchen utensils

An examination of hooks on the market indicated that the types needed for kitchen use were not available. The design of kitchen hooks was accordingly made the subject of a study in which all commonly used kitchen utensils that are equipped with a means of hanging were assembled and classified as to similarity of hook requirements.

The resulting designs are illustrated by Figure 2. The three hooks illustrated were found sufficient to accommodate all types of hanging utensils. Type one is suitable for most kitchen utensils; type two is needed for utensils with handles set well below the edge (as roasters), or for utensils with handles set vertically (as pitchers); while type three is required for utensils with grip handles (as Dover egg beater).

The average number needed for the kitchens of cooperators were 16 hooks of type one, 6 hooks of type two, and 3 hooks of type three.

SINK AND SERVING CENTERS

The sink center is considered jointly with the serving center because it is often advantageous to build a cabinet serving both functions. Activities centering about the sink require work surfaces on both sides, and in a well-managed farm kitchen one of these surfaces would usually be free to use as a serving table at the time it is needed for that purpose. Succeeding data include dimensions for cabinets serving these functions, both jointly and separately.

ARTICLES FOR WHICH STORAGE WAS PROVIDED

Sink center

- Vegetable cutting board
- Dried fruits, vegetables, and uncooked cereals requiring washing or soaking
- Stew kettles; saucepans; double boilers
- Colanders; strainers
- Ice-cream dipper
- Paring knives; slicing knives; scissors
- Vegetable brushes
- Dishpan; rinse pan; dish drainer
- Pot cleaners; cleaning brushes; bottle brushes
- Sink strainer; dish scraper
- Dish towels, dishcloths, and hand towels in use
- Supply of dish towels, dishcloths, and hand towels
- Soap container

- Garbage container
- Drinking glasses
- Flower containers
- Cloth for wiping spilled water from floor
- Drain cleaner; scouring powder; soap
- Empty fruit jars, till taken to storeroom
- Milk buckets and crocks
- Butter-making equipment
- Medicines and first-aid equipment
- Hand lotion

Serving center

- Bread; cake; cookies
- Ready-to-eat cereals, crackers, etc.
- Loaf sugar; honey; candies; dried fruits served without cooking and not requiring washing
- Relishes not requiring low temperatures
- Bread and cake knives; bread board; cake rack
- Ladles and serving spoons; serving forks; butcher knives
- Dishes, silver, and linen used for everyday meals
- Dishes used for company meals
- Seldom-used dishes
- Picnic supplies and equipment
- Keepsakes and decorative dishes
- Serving trays; mats for hot dishes

ARRANGEMENT AND EQUIPMENT OF CENTER

The combined sink-and-serving unit was planned on the assumption that it would be located near the dining area of the kitchen. It was also assumed that at its opposite end there might be located a wood box or wood lift, and that there would be space above the box or lift where utensils might be stored. It is assumed that the slope of the sink boards would not be such as to interfere with their use as tables.

The sink was placed at a height convenient for workers when standing. An open area below the sink, however, makes it possible to sit while at work, and provides a place for the stool.

The space above and below the work counters was utilized for storage cabinets. In some plans the space above the sink proper and part of the space below it were also so utilized.

Dishes were assigned to the upper cabinets. Where both company dishes and everyday dishes were stored in the combined sink-and-serving unit, the latter were allotted to the left-hand cabinet, as this is the more convenient location for dishes, and for that reason should be assigned to those most often used. Lower cabinets intended for the storage of utensils or food supplies were made into compartments with shelves.

Kettles, saucepans, etc., were allotted to the lower left cabinet. Food materials were stored in both upper and lower left cabinets.

Drawers were provided in the lower right-hand cabinet for kitchen textiles, silver, and small utensils that would not hang. Shelf space was also provided on this side for a bread-and-cake box.

Soap, scouring powder, vegetable and bottle brushes, etc., were stored either in a cabinet set between studding above the sink or in a pull-out rack below the sink.

STANDARDS FOR CABINET DIMENSIONS*

Minimum dimensions of work surfaces

The minimum dimensions of work surfaces needed for the sink and serving centers were determined by experimentation. Utensils of the types and sizes used in the homes of the cooperators in this study were assembled, and the kitchen processes for which each work surface is required were duplicated as far as was needed.

As it is usually desirable that adjacent surfaces should be the same width, width was considered first. Twenty-four inches is a desirable width for the sink unit, as upper cabinets are usually designed the required width for storing dishes, and the space in front of the upper cabinet should be wide enough for a kettle. This width is also desirable because it permits the use of a flat-rim stock sink of sufficient size for washing large utensils.

The length of the sink center was determined from the method of washing dishes and the sizes of articles washed. The method of dishwashing assumed consists of: (1) scraping, rinsing, and stacking soiled dishes; (2) washing by hand in a compartment or pan set in the sink; (3) rinsing by dipping into hot water or by pouring hot water over the dishes; (4) draining in a wire drainer; (5) wiping silver, glasses, and cooking utensils, but allowing china to dry in the wire drainer.

The length of space allotted to the sink proper was 30 inches. A one-compartment sink of this length permits the handling of utensils of the sizes used by the majority of cooperators, and both a dishpan and a rinse pan can be placed in it. This length also permits the installation of a two-compartment sink, which is a satisfactory type for the farm kitchen if there is a sink outside the kitchen to use for washing large articles, such as milk cans.

The length of the counter at the left of the sink was determined by the space required for the reception of soiled dishes from the table. Also it must be long enough to accommodate a dish drainer (in case rinsing is done by dipping) and at the same time provision for the dishes as they are stacked after drying. Thirty-two inches is sufficient for the length of this counter, assuming the width is 24 inches.

It was found by experimentation that the counter at the right of the sink should be 36 inches long in order to provide sufficient space for stacking soiled dishes used for the average meal.

The length of the serving table was determined from the space required for small salad plates laid out for filling. A length of 28 inches is enough for this purpose.†

Other measures

The dimensions of lower cabinets at the sink were worked out on the basis of a height of 34 inches for the cabinet proper. Allowing a minimum

* See Appendix A for methods of utilizing storage space.

† It is assumed that company meals would be served in the dining room. In that event the kitchen meal table could be used as an auxiliary serving table.

base of three inches, this permits the work-surface height to be 37 inches or more, and the height of the bottom of a sink 6 inches deep to be 31 inches or more.*

A space of 12 inches was allowed between the work-surface and the cabinet above it. This measurement permits unobstructed vision and sufficient room to avoid interference with hand action.†

The upper cabinets at either side of the sink were made 11 inches wide on the inside. This width permits the storage of all dishes in ordinary use. It was assumed that the shelves in upper cabinets were removable and that it would be possible to raise or lower them at 1-inch intervals.

Lower storage cabinets were made $22\frac{1}{2}$ inches wide, outside measure. The length of drawers was assumed to be the maximum possible. Allowing 2 inches for construction, this would make the inside length of the drawer $20\frac{1}{2}$ inches.

The cabinet directly above the sink needs to be 4 inches wide, inside measure. When it is set into the studding it need not extend over the sink proper.

Lengths of shelves and drawers were determined by assigning space to every article. No length in addition to that required for the articles themselves was allowed.

DIMENSIONS OF CABINETS PLANNED FOR COOPERATORS‡

One-unit installation

In the first set of plans for the sink and serving centers, a single cabinet was made to serve both functions. The variations in the design of this cabinet are illustrated by Figure 3.

Upper cabinets planned for the storage of everyday dishes varied in length from 36 inches to 48 inches, the average being 41 inches. Those planned for the storage of company dishes varied from 32 inches to 50 inches, with an average of 43 inches.

One lower cabinet contains drawers for silver, small utensils, and kitchen textiles. The space below a minimum-length counter (36 inches) was sufficient for these items for all cooperators. A longer cabinet can provide more drawers, however, permitting in some instances a more convenient classification of kitchen textiles as well as room to store articles not assigned to a specific center of the kitchen. A detailed drawing of this cabinet and its fittings is included in Appendix F.

The lower cabinet on the same side of the sink as that intended for everyday dishes was planned for the packaged food supplies allocated to the sink-and-serving center, and for the equipment used at the sink, except small articles for which a drawer affords the most convenient storage. Two plans were made for this cabinet. In the first, it was fitted with fixed shelves as wide as the compartment. In the second plan it was fitted with

* The number of individuals who chose sink heights of 31 inches or more in a recent study of working surface heights was 88.8 per cent of the 562 persons measured. See Bulletin 348, "Standards for Working Surface Heights and Other Space Units of the Dwelling," Oregon Agricultural Experiment Station, Table 3.

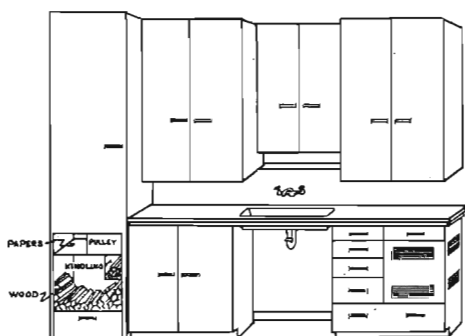
† Bulletin 348, Oregon Agricultural Experiment Station, Figure 7.

‡ Tables that include the dimensions of cabinets designed for the various cooperators are included in the complete report of this study. This report may be obtained from the Department of Home Economics, Agricultural Experiment Station, Oregon State College.

hooks on the doors and with sliding shelves that are narrower than the compartment itself by the depth of the largest article hung on the doors, as shown by Figure 4. The choice of articles to be hung depended on the width and length of the door and on the relative convenience, for each article, of hanging versus storing on a shelf.

The plan whereby part of the equipment was hung on doors was found to be more economical of space than that of storing everything on shelves,

- (A). PROVIDES FOR STORAGE OF ALL EQUIPMENT ALLOCATED TO THE SINK AND SERVING CENTERS. RIGHT AND LEFT SECTIONS MADE EQUAL IN LENGTH. CABINET DIRECTLY ABOVE SINK.



- (B). SINK-AND-SERVING CENTER WITH ADJACENT WOOD LIFT

- (C). RACKS ON BOTH SIDES OF SINK FOR TOWELS AND SINK SUPPLIES



Figure 3. Variations in the design of cabinets planned for the sink-and-serving center.

the average saving in the length of the compartment being 7 inches. In only one out of the 14 cases did the second method require as much space as the former. The lengths of the cabinets planned by the second method range from 32 inches to 60 inches, with an average of 44 inches. The maximum depth needed for articles hung on doors is 6 inches.

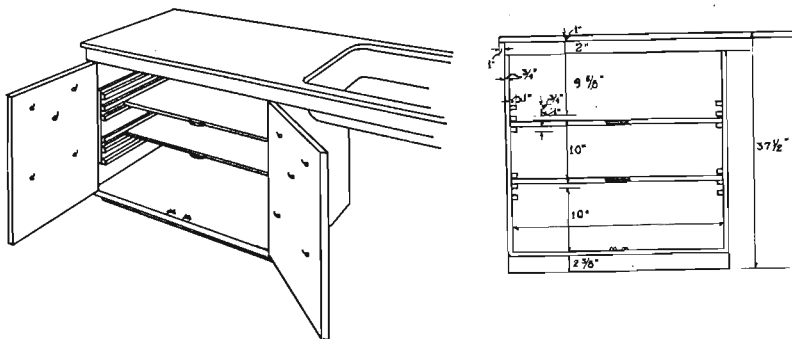


Figure 4. Lower cabinet at one side of sink. Designed for storage of kettles, saucepans, and other articles it is desirable to store near the sink. Cabinet has sliding shelves that can be adjusted as to distance apart. Shelves are made narrower than compartment, to provide room for utensils hung on doors.

In the kitchen arrangement that places the stove next to the sink center, it is often desirable to locate the wood box or wood lift between them. The space above the box or lift is suitable for storing cooking equipment and food supplies. This extra storage space makes it possible to limit the length of the lower cabinet to that of the upper cabinet needed for everyday dishes. In some cases this would make a substantial difference in the length of the cabinet, and consequently in the entire sink unit.

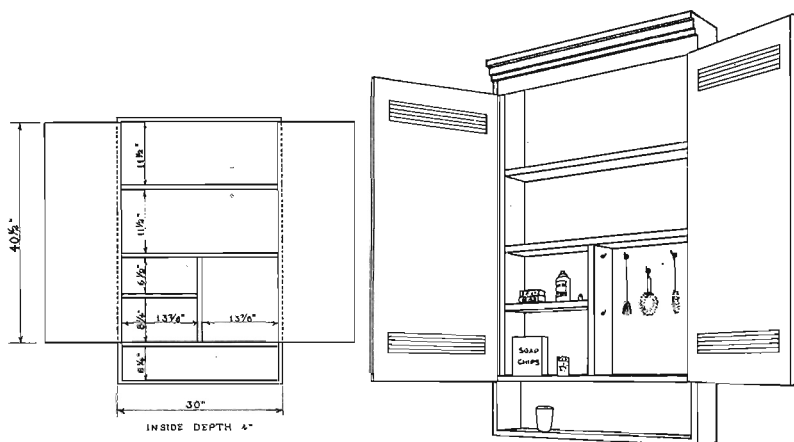


Figure 5. Cabinet above sink. For cleaning materials.

In planning the utilization of space in upper cabinets it was found that three movable full-width shelves would usually be needed in each one. Occasionally a half-width (six-inch) shelf was installed between two full-width ones, where there were an unusual number of low articles to store.

Soap, scouring powder, and brushes should be stored in a place by themselves. A shallow cabinet may be built for them above the sink proper, as shown in Figure 5. Another method of providing for these articles is by means of a sliding compartment built as a part of one of the lower cabinets. A dish-towel rack may be built that is identical in outside appearance with that planned for cleaning supplies and equipment. The two racks may ex-

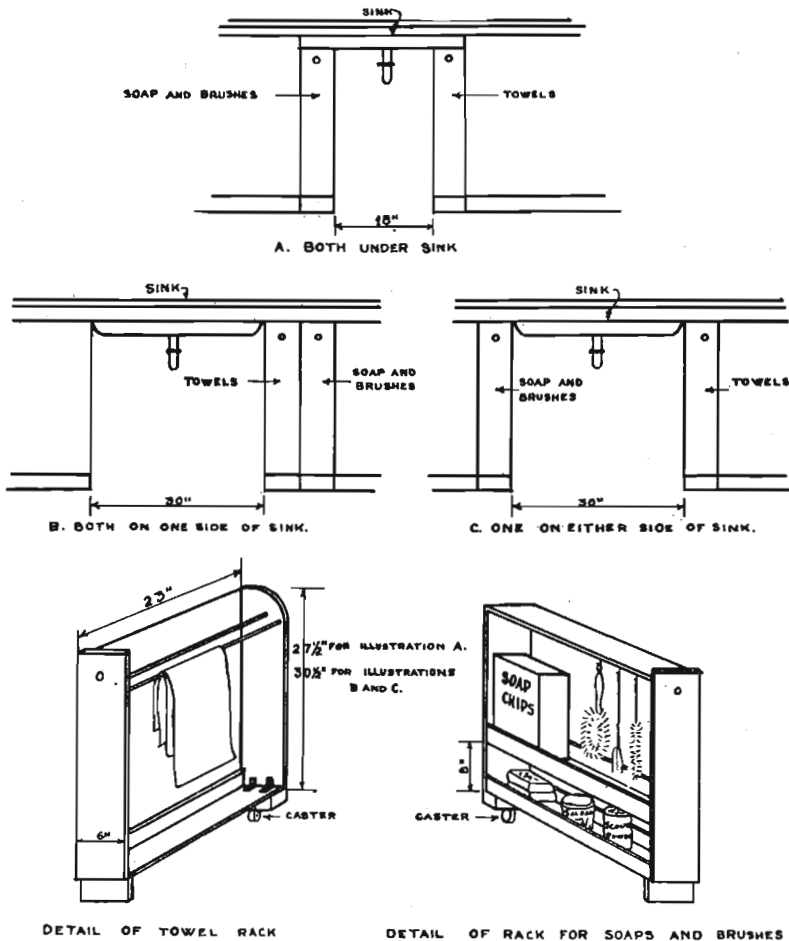


Figure 6. Racks for dish towels and cleaning materials.

(A) Both placed under the sink. (B) Both placed at one side of the sink. (C) One placed at either side of the sink.

tend under the sink itself, as in Figure 6A, or may be placed at one side of the sink, as in Figure 6B. The objection to the former arrangement is that the space left for sitting at the sink is narrow unless a sink more than thirty inches long is used.

From the standpoint of appearance and economy of room space, it is sometimes best to have upper and lower cabinets of the same length. Where the upper cabinet intended for everyday dishes is longer than the lower cabinet planned for utensils and supplies, the length of the section would be that of the upper cabinet, for the reason that it would not be desirable to store dishes in the lower cabinet. Where the lower cabinet is the longer, the lengths can be equalized by storing part or all of the packaged food supplies in the compartment with the dishes. Lengths of sections obtained by this method range from 36 inches to 54 inches with an average of 44 inches. For each of the 14 cooperators the length of the left section required for storage would be greater than that of the minimum counter space needed at the left of the sink, which is 32 inches.

It was not feasible to equalize the length of the cabinets on the other side of the sink by a transfer of contents, as the upper cabinet was assigned to company dishes and the cabinet below it to kitchen textiles and containers for baked goods. The length of the section, therefore, must usually be that of the upper cabinet.

Differences between the lengths of cabinets at the right and left of the sink were found to be slight. For the cabinets that do not include the racks for towels and brushes, only two cooperator plans show a difference of more than seven inches. Differences are greater for cabinets including these racks, but comparisons for half of the cooperators show differences of six inches or less.

These data suggest that the right and left sections may be made the same length without an undue amount of unused space. Wherever possible, lengths were equalized by transferring dishes and food materials. In some cases, however, no reduction was possible. The average length of the equalized cabinets was 45 inches when racks for towels and cleaning supplies were not included, and 47 inches when these were included.

When the combined lengths of the right and left cabinets are added to that of the sink proper, the result is the length of the space required for the sink-and-serving area when it is placed along one wall of the kitchen. These lengths are given in Table 2.

Type 1 is that of a sink unit that does not include built-in racks for towels, brushes, etc., and for which the right and left sections are not of equal length. These units vary from 8 feet 8 inches to 11 feet, with an average of 9 feet 9 inches. Plans for half of the cooperators differ from the average by not more than 6 inches:

When racks are added at either side (type 3) the unit varies in length from 9 feet 2 inches to 11 feet 5 inches, with an average of 10 feet. This does not assume the use of the space above a wood box or wood lift.

Types 4 and 5 are sink units whose right and left sections have been made equal in length. The unit that does not include the racks varies from 8 feet 10 inches to 11 feet 6 inches, with an average of 10 feet. When racks are included it varies from 9 feet 10 inches to 12 feet 4 inches, with an average of 10 feet 4 inches.

Table 2. LENGTHS OF SINK-AND-SERVING UNITS.

- Type 1. Length of left-hand* section is that required when all everyday dishes are stored in the upper left cabinet; all company dishes in the upper right; all cooking equipment in the lower left; food supplies stored in upper and lower left cabinets so as to equalize their length. Length of right-hand section is that of the upper cabinet required for the storage of company dishes except when this is less than the length of the minimum right-hand work center, 36 inches. No racks for towels, brushes, etc., are included.
- Type 2. As for type 1 except that the lower left cabinet is made only as long as is needed for the upper one when the latter is used for everyday dishes only, and the excess cooking equipment is stored above an adjoining wood lift or wood box. See footnote, Table 6.
- Type 3. As for type 1 except that a rack is added at either side of the sink. See page 27 for description of racks.
- Type 4. As for type 1 except that the lengths of the right and left sections have been equalized; in some cases this arrangement does not permit the allocation of the upper cabinets specifically to company dishes and everyday dishes respectively.
- Type 5. As for type 4 except that a rack is added at either side of the sink.

Cooperator	Length of sink unit (right and left cabinets plus sink)†									
	Type 1		Type 2		Type 3		Type 4		Type 5	
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
A	10	0	---	---	10	0	10	6	10	6
B	9	0	---	---	9	2	9	2	9	2
C	9	0	---	---	9	6	9	6	9	6
D	9	4	---	---	9	6	9	6	9	6
E	10	0	---	---	10	0	10	6	10	6
F	10	8	---	---	10	8	10	10	10	10
G	9	6	9	2	9	10	9	10	10	2
H	10	6	10	0	10	10	10	10	11	0
I	10	3	10	0	10	9	10	6	11	0
J	9	8	---	---	9	10	9	8	9	8
K	9	1	8	6	9	6	9	2	9	8
L	9	10	9	6	10	2	10	2	10	6
M	11	0	10	6	11	5	11	6	12	4
N	8	8	---	---	9	2	8	10	9	10
Average	9	9	---	---	10	0	10	0	10	4

*This assignment of "right" and "left" is for convenience in referring to specific cabinets.

†Assumes use of a 32-inch flat-rim sink, with an overlap of 1 inch on each side.

Two-unit installations

A cabinet planned for a combined sink-and-serving center would be difficult to incorporate in many kitchen arrangements because of its length. One possibility for shortening the unit is to store company dishes in a separate cabinet, or in a closet off the dining room. As company dishes are not frequently used in the average farm home, the extra travel required may be disregarded for the sake of a smaller kitchen, or for the sake of installations adaptable to a greater variety of arrangements.

For all except two cooperators it was found that the storage above and below minimum-length work counters (36 inches at the right and 32 inches at the left of the sink) would be sufficient for everyday dishes and for all other equipment and supplies assigned to the sink and the serving centers. This would shorten the sink unit to 8 feet 2 inches. In all but three cases, it would be necessary to use both upper cabinets for everyday dishes. One of the upper cabinets would also be used for packaged food materials. The lower left cabinet would be used for equipment only.

Separate floor-to-ceiling cabinets were planned for the company dishes listed in cooperator inventories. A length of 20 inches is sufficient for three-fourths of the cases, and 24 inches suffices for all but one of them. The lowest shelf utilized for dishes in frequent or occasional use was 24 inches from the floor and the highest shelf was 72 inches. The space above and be-

low these shelves was utilized for seldom-used dishes, flower containers, etc. Eight movable shelves would be required for each cabinet.

Another possibility for shortening the sink unit is to let a drop leaf serve as part of one work surface and to plan a serving unit independent of the sink unit. In the ensemble shown by Figure 7 the sink unit is 6 feet 8 inches long, which is sufficient for a minimum-length unit (32 inches) at one side of the sink and an 18-inch section with 18-inch drop leaf at the other side.

The storage space above and below the serving table provides for the materials remaining after the storage areas of the abbreviated sink unit have been assigned. A length of 32 inches suffices for the serving unit, in 10 of the 14 cases. The serving unit is planned as a single cabinet with a cut-back on a level with the sink rim. If a roller shade is used to close the upper part of the cabinet the uppermost wide shelf serves for work counter and storage as well.

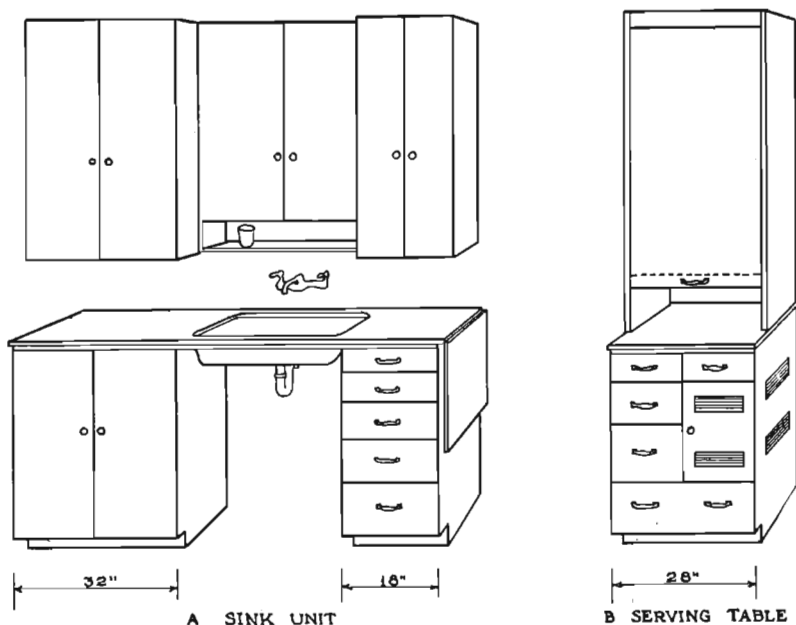


Figure 7. Separate cabinets provided for sink and serving centers.

(A) Minimum-length sink unit requiring a wall space 6 feet 8 inches long. (B) Serving table and storage cabinet. Upper section closed by roller shade.

MIXING CENTER

In addition to the working surfaces at either end of the sink, it is desirable that one surface shall be provided where processes requiring little or no water, such as beating, kneading, and rolling, may be carried on. These activities require a lower working surface than that of the sink table.*

* Oregon Station Bulletin 348, "Standards for Working Surface Heights and Other Space Units of the Dwelling." Table 3.

ARTICLES STORED AT MIXING CENTER

Storage for the following articles was planned at the mixing center:

Dried fruits used in cooking and not requiring washing or soaking; flour, meal, and other uncooked cereals used mainly in preparing made dishes; sugar; baking powder and soda; dry yeast; cornstarch, gelatin, junket; spices, flavorings, and colorings used in made dishes; cake decorations.

Mixing bowls; chopping bowl; measuring cups; grinders, choppers, graters, reamers, nutcrackers, scissors, egg beaters, egg whips, meat pounder and meat saw; spatulas, knives, mixing spoons, measuring spoons; dough cutters, sifters, rolling pins; cake decorators, cookie "guns"; molds; baking pans for bread, cake, pies, muffins and cookies; casseroles.

Lunch boxes; thermos bottles; freezer inset; pastry and meat boards; wax paper; paper napkins (for lunches); paper dishes; recipes; scales.

ARRANGEMENT AND EQUIPMENT OF CENTER

A working surface and adequate storage cabinets for the equipment and supplies used there comprise the mixing-table unit. Two plans were made for the storage required by each cooperater, one consisting of a lower cabinet, upper cabinet, and floor-to-ceiling cabinet, the other consisting of lower cabinet and floor-to-ceiling cabinet only. A floor-to-ceiling cabinet was considered an essential part of the mixing-center ensemble, as an upper cabinet wide enough for the larger articles of equipment allocated to this center would interfere with vision and arm movement at the mixing table. These cabinets are illustrated by Figure 8.



Figure 8. Mixing-center ensembles.

Plan A. Consists of floor-to-ceiling storage cabinet, shallow upper cabinet, and long mixing table with drawers and bins below it. Plan B. Consists of floor-to-ceiling storage cabinet and minimum-length mixing table with bins below it.

A minimum length of 36 inches was determined for the mixing table. This working surface should be large enough for the pastry board, containers or supplies, and at least two pie or cake tins.

Mixing tables were made 25½ inches wide (front to back). This affords space back of the board for placing utensils and containers when being used. The lower cabinet was made 24 inches wide (outside measure). The cabinet proper was made 29 inches high. It is intended to be placed on a recessed base at least 3 inches high, making a minimum height of 32 inches.*

Where a cabinet 12 inches wide extends the entire length of the mixing table the distance between the upper and lower cabinets should be at least 14 inches. This is two inches more than the minimum distance between the work counters adjacent to the sink and the cabinets above them, the difference being due to the necessity for avoiding interference with arm movement while rolling or kneading, as well as interference with vision.

DIMENSIONS OF CABINETS PLANNED FOR COOPERATORS

Two plans were made for each cooperator for cabinets which provide the working surfaces and storage areas needed at the mixing center. Plan A consists of a long work table with an upper cabinet extending across part of its length, and Plan B a minimum-length table with no cabinet above it. Both plans have floor-to-ceiling storage cabinets large enough to care for the excess.

In Plan A there was left above the mixing table a wall space free of upper cabinet that is long enough for the pastry board. The remaining space above the mixing table was utilized for a cabinet with shelves. This cabinet and the lower one were made long enough jointly to provide for the storage of all food supplies as well as other articles allocated to this center for which storage in drawers is desirable.

A 46-inch or a 48-inch lower cabinet met the requirements in all but one case. These lower cabinets consisted (with the one exception) of two tiers of drawer bins for bulk food materials and one tier of drawers intended for other uses, as illustrated in Figure 8A. The most common need was for a bin holding 100 pounds of sugar, one for 50 pounds of flour, and one sectioned drawer for 3 food materials stored in 10-pound lots. For utensils, recipes, and other nonedible materials, 4 drawers were required in 6 cases, and 3 drawers in 7 cases.

Provision for packaged foods and bulk foods stored in lots of less than 8 pounds was made in the shallow cabinets above the mixing table. Except in one instance these cabinets were from 20 to 24 inches long. Two movable shelves were usually required for them.

Eighteen inches was found to be the minimum practical inside length for the floor-to-ceiling cabinet planned to supplement the storage above and below the mixing table. A shelf width of 15 inches and a space of 3 inches between the edge of shelves and the door were found to be adequate, making the inside width of this cabinet 18 inches. The number of movable shelves required for this cabinet varied from 4 to 8, with 7 of the 13 plans requiring 6 shelves.

The storage space available at the long mixing table with upper cabinet, together with the 18-inch floor-to-ceiling cabinet, was sufficient to take care of the needs of 11 out of the 13 cases for which these dimensions were determined.

* This is the height recommended for the mixing table in Oregon Station Bulletin 348, "Standards for Working Surface Heights and Other Space Units of the Dwelling," Table 2.

The lower cabinet for Plan B is the same as that for Plan A except that the right-hand tier of drawers is omitted, and slots for the two small boards are placed at the side rather than the top. This cabinet needed to be 36 inches long except in one case. Plan B has no upper cabinet.

The Plan B floor-to-ceiling cabinet, which was planned to supplement the mixing table, varied in length from 18 inches to 32 inches, with the most common length as 24 inches. For this cabinet as well as that of Plan A, 6 movable shelves were required in 7 of the 13 plans.

In planning floor-to-ceiling cabinets for both Plan A and Plan B, it was found that except in one case the space between two fixed shelves was sufficient for the slots required for flat articles. It was usually found advantageous to divide this space into four parts, one of which was 4 inches wide, and the others approximately 3 inches. The height of this space was that required by the largest article assigned to it. This height was always at least 11 inches, but 13 inches was sufficient for 24 of the 28 installations planned.

Table 3 contrasts the two ensembles for the mixing center with respect to the combined lengths of the two cabinets that comprise each. The length of the wall space required by the installation that includes the minimum-length mixing table (Plan B) is usually the shorter by 4 to 6 inches. A wall space of 62 inches suffices for this installation in three-fourths of the cases.

Table 3. LENGTHS OF CABINETS REQUIRED FOR MIXING CENTER.

Combined lengths of lower cabinet and floor-to-ceiling cabinets for Plan A and Plan B, and differences in length.

Cooperator		Length of cabinet*					Difference in combined lengths	
		Plan A			Plan B			
		Lower cabinet	Floor-to-ceiling cabinet	Total	Lower cabinet	Floor-to-ceiling cabinet		Total
		(1) <i>Inches</i>	(2) <i>Inches</i>	(3) <i>Inches</i>	(4) <i>Inches</i>	(5) <i>Inches</i>	(6) <i>Inches</i>	(7) <i>Inches</i>
A	.....	46	20	66	36	26	62	4
B	.....	46	20	66	36	26	62	4
C	.....	48	20	68	36	20	56	12
D	.....	48	20	68	36	26	62	6
E	.....	48	20	68	36	26	62	6
F	.....	48	26	74	36	34	70	4
G	.....	60	20	80	48	26	74	6
H	.....	48	20	68	36	28	64	4
I	.....	46	20	66	36	26	62	4
J	.....	46	20	66	36	20	56	10
K	.....	48	20	68	36	28	64	4
L	.....	48	20	68	36	20	56	12
M	.....	48	20	68	36	26	62	6
N	.....	48	20	68	36	26	62	6

*Allowance of 2 inches for thickness of sides of cabinet.

STOVE CENTER

ARTICLES STORED AT STOVE CENTER

Storage for the following was planned at the stove center:

Uncooked cereals used for porridge; quick-cooking tapioca; coffee and tea; salt, pepper, other seasonings; flour in dredger.

Ladles, stirring spoons, masher, ricer; spatulas, turners, forks; wire toaster; skillets, griddles, broilers, roasters; coffeepot, teapot; utensil lids, pan holders, lifters; deep-fat kettle and basket; pressure cooker, steamer; thermometers.

Matches, stove polishes; fuel; kindling; papers for cleaning or for making fires.

ARRANGEMENT AND EQUIPMENT OF CENTER

Type of stove

The matter of type of stove was discussed with the 24 homemakers co-operating in the functional study of the farmhouse. The majority favor a combination stove, but are divided as to whether it should be (1) a 6-hole wood stove with a 2- or 3-hole electric plate, (2) a four-burner electric or gas stove with a 2-hole trash burner, or (3) a stove with both wood and electric ovens, four electric burners and at least four holes in the wood range.

There are several reasons for these differences of opinion. Those who prefer type one do not have many hired men to cook for, and desire the electric plate for getting the evening meal or other short-time processes. Those who prefer types two or three have more cooking to do in warm weather. In most cases the wood range is preferred as an economy measure, wood being commonly produced on farms in this area.

Arrangement for wood storage

The kitchen wood box should hold a day's supply of wood and kindling. As a basis for estimating the desired capacity, 17 Willamette Valley farm homemakers were asked to record the amount of wood used in the kitchen stove on a winter day when there was baking, washing, or some other reason for keeping up the fire between meals. A capacity of 12,000 cubic inches was judged to be desirable where wood was used for most of the cooking. For kindling storage, 1,000 cubic inches was thought to be sufficient.

The minimum width (front-to-back measure) for boxes intended for wood stored parallel to the front edge was determined from observations of a man in the act of putting in wood by the armload. Sixteen inches was judged to be minimum desirable width.

The inside depth (vertical measure) of the wood box was determined from observations of women in the act of reaching for wood. The floor of

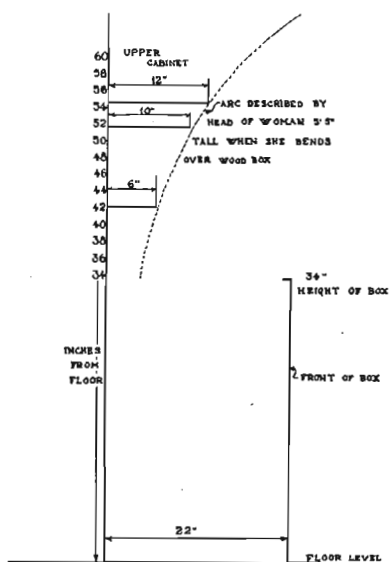


Figure 9. Arc described by head of woman 5'5" tall, in act of getting wood from the back corner of a box 22" wide whose front edge is 34" from the floor. Illustrates method used for determining distances from floor of room to bottom of upper cabinet.

a box 25 inches wide (front-to-back measure) should be not less than 12½ inches from the floor of the room, to enable a woman to reach all the wood in it.*

The distance between the wood box and a utensil cabinet above it was also determined from observations of women in the act of reaching

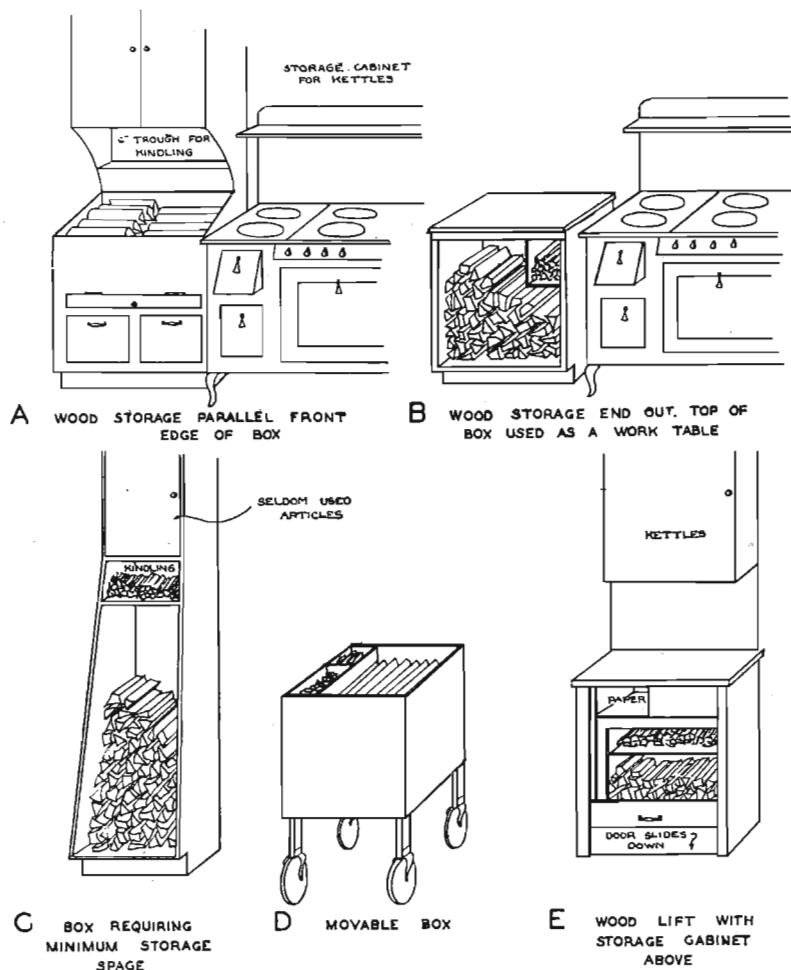


Figure 10. Wood-box designs.

(A) Box with upper cabinet for utensil storage. Space between wood and upper cabinet for kindling. (B) Box under work counter. (C) Wood box or closet. Suitable for use where wall space is limited. (D) Box equipped with rubber-tired wheels for convenience in moving through door for filling. (E) Wood lift. Door drops into basement. Top may be used for work table, and upper cabinet for utensils.

*Tables giving these data in relation to various widths are included in the complete report of this study.

for wood. Figure 9 shows the arc described by the head of a woman 5 feet 5 inches tall when bending over a box 34 inches high, and the minimum distances from the floor of cabinets above a wood box 22 inches wide. The bottom of a cabinet 12 inches wide placed above a box of this width needs to be at least 55 inches from the floor; if above a box 25 inches wide, 50 inches from the floor.

Figure 10 illustrates various types of wood boxes. A box holding a full day's supply and intended for wood stored parallel to the front edge needs to be long enough for two piles. This type is shown by Figure 10A. Figure 10B illustrates the storage of wood under a work counter, while Figure 10C is that of a box requiring only 17 inches of wall space; these two types may be built with or without doors.

Arrangement for utensils and supplies

Figure 11 illustrates the various methods used for storing the articles, other than fuel, that were assigned to the stove center.

In arranging for the storage of equipment and supplies allocated to the stove center, wood storage was planned first, then the unused space above and below the wood compartment was assigned. Where this space provided for all of the material to be stored, it was equipped with hooks for articles that can be hung, a lid rack on the door, and shelves for the rest. Where this space was insufficient for all articles, it was equipped with shelves, as in Figures 11A and 11D. In that case, heavy pieces of equipment and those that can be hung were allocated to a floor-to-ceiling cabinet of a type of construction permitting hooks to be placed anywhere on sides or back. The minimum inside length (side to side) measure of this cabinet is 15 inches and its front-to-back measure, 16 inches. It is illustrated by Figure 11B.

Where no wood storage was needed a single floor-to-ceiling cabinet was planned for supplies and utensils. This has a section for articles that will hang, as well as shelves (Figure 11E).

STOVE-CENTER PLANS FOR COOPERATORS

Plans made for the individual cooperator depended on whether or not she expressed a preference for a stove in which wood was the major fuel, the minor fuel, or was not used at all, and on whether or not the space above the wood lift or wood box was sufficient for the equipment and supplies allocated to the center.

The outside length of the lift was fixed at 24 inches. A box 40 inches long (outside measure) was planned for cooperators who specified that wood would be used for most of the cooking, while a 22-inch length was planned for those households in which electricity was the major fuel. The 40-inch box was dimensioned to approximate 12,000-cubic-inch capacity and the 22-inch box half as much. In some of the plans the space below the wood compartment was utilized for storage of equipment and food supplies.

Following is a summary of the various situations for which plans were made, and the length of cabinets found to be needed for the storage of supplies and equipment.

Situation 1: Wood for the kitchen stove is kept in the basement and a lift is provided.

In 7 out of 12 cases the space above a 24-inch lift provided sufficient storage for all utensils and supplies allocated to the stove center. In 4 cases a minimum length (17-inch) floor-to-ceiling cabinet provides sufficient space in addition to that above the lift, making a total wall-space requirement of 41 inches.

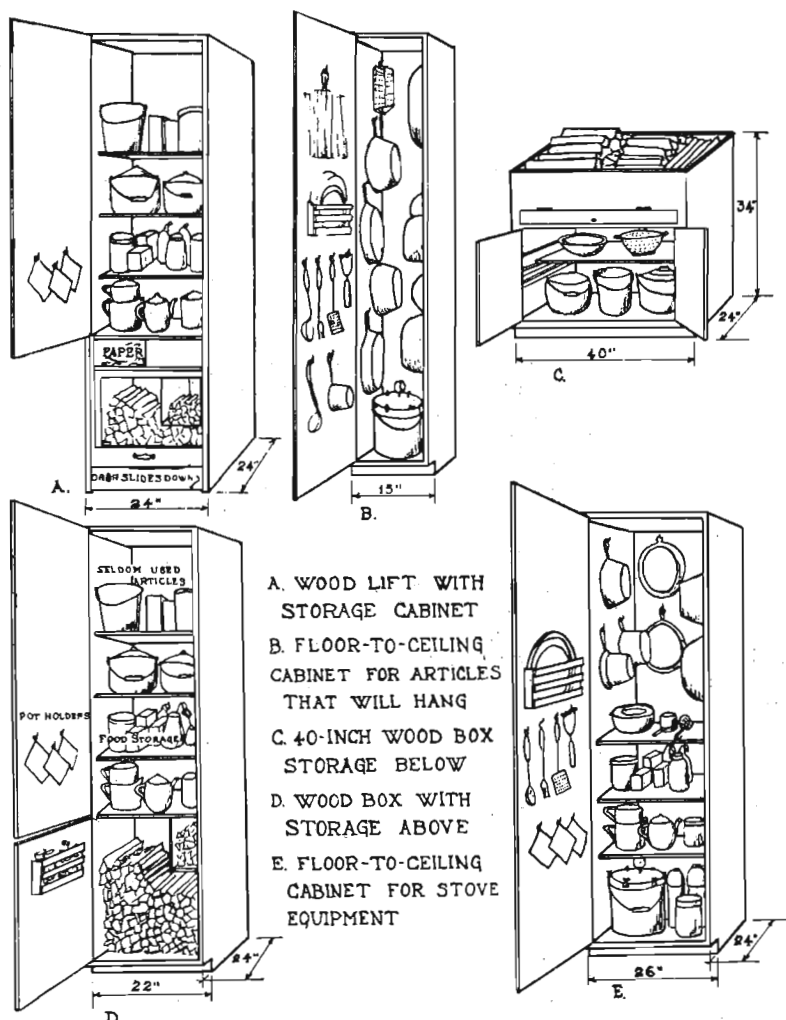


Figure 11. Cabinets used in stove-center plans.

(A) Wood lift with storage cabinet above it. (B) Floor-to-ceiling cabinet for articles that will hang. (C) 40" wood box with compartment below for kettles. (D) Cabinet for wood and for supplies and equipment requiring shelf room. (E) Cabinet for supplies and equipment requiring hanging space and shelf room.

Situation 2: Wood is kept in a box in the kitchen; wood is the minor fuel.

In all 3 cases the space above the wood box (22 inches long) is insufficient for the storage of utensils and supplies. In 2 cases minimum width (17-inch) floor-to-ceiling cabinets provide sufficient supplementary storage, making a total wall space of 39 inches.

Situation 3: Wood is kept in a box in the kitchen, and wood is the major fuel.

In 8 of the 9 cases the space above and below a wood box 40 inches long provides sufficient room for utensils and supplies. If a floor-to-ceiling cabinet is preferred to a cabinet above the wood box, it can be of minimum length (17 inches, outside measure). In the latter case the wall-space requirement is 57 inches.

Situation 4: No wood storage needed (two cases only).

Floor-to-ceiling cabinets were planned to care for all cooking supplies and equipment; these were 18 inches and 24 inches long respectively.

MIXING CENTER AND STOVE CENTER COMBINED

DESCRIPTION OF PLANS

For kitchen arrangements that place the mixing center and stove center close together, the storage of supplies and equipment allocated to both centers can often be planned advantageously as a unit. Plans of this type were made for cooperators in the kitchen study, utilizing first the space above and below the mixing table, and providing for the surplus in one or two floor-to-ceiling cabinets. The space above the wood lift or wood box was not utilized in planning combined storage facilities for these centers.

The characteristics of cabinets suited to the specific requirements for these centers have been described in the sections in which the stove center and mixing center have been planned independently. The various types of cabinets utilized in planning for these centers separately have also been used for them when they were combined. In addition, a plan has been made in which the cabinet above the mixing table was made as long as the table itself.

CABINETS PLANNED FOR COOPERATORS

Four plans combining stove and mixing centers were made for each cooperator. In Plan I there were used the mixing table with lower cabinet and the short upper cabinet included in Plan A when the mixing center was planned independently of the stove center (page 32). Plan II is like Plan I except that the cabinet above the mixing table was made as long as the lower cabinet. Plans III and IV include the minimum-length mixing table that was described on page 33. In Plan III no upper cabinet was included, and supplementary storage was provided by one or two floor-to-ceiling cabinets; whereas Plan IV includes a cabinet above the mixing table that is as long as the lower, and supplementary storage is provided by means of a single floor-to-ceiling cabinet.

The four ensembles planned for each cooperator vary considerably in length, the average difference between the shortest and the longest being

26 inches. In all cases the arrangement requiring the least wall space is Plan IV, which averaged 66 inches. Next in order of length was Plan II, which averaged 71 inches. The minimum-length arrangement that provides window space above the mixing table is that described in Plan III. For this arrangement 12 of the 14 cases required wall space of 89 inches or less.

Figure 12 illustrates various arrangements of the floor-to-ceiling cabinets required to supplement the storage space above and below the mixing table. Figure 12C illustrates the interior arrangement of cabinets developed in connection with Plan IV.

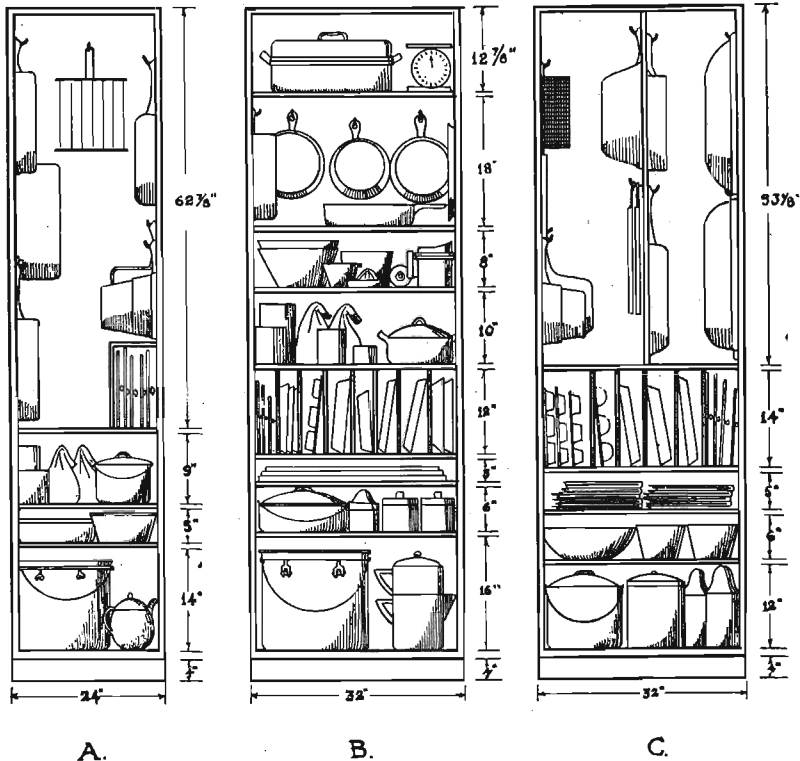


Figure 12. Floor to-ceiling cabinets used when stove center and mixing center are combined. Small articles are hung on the door of the cabinet, as shown by Figure 11.

STORAGE FACILITIES FOR PERISHABLE FOODS

Equipment for the storage of perishable foods consisted of a draft cooler large enough for all foods requiring less than room temperature, and a mechanical refrigerator of sufficient size for those foods requiring a temperature in summer less than that of the draft cooler, and for foods that are improved by chilling before use.

It was assumed that the cooler would at all times be used for fruits and vegetables, cured meats, sirup, vinegar, unopened canned foods, and opened jellies, jams, and relishes. Foods that were considered in determining the capacity of the refrigerator were fresh meat, milk and cream, eggs, butter and cooking fats, cheese, salad oil, peanut butter, shelled nuts, soft yeast, sauces and dressings, opened packages of perishable foods, leftovers, foods requiring chilling before use, and baby foods.

Decisions as to quantities to be stored were based on information from cooperating homemakers as to customary procedure. In all cases it was assumed that the food-storage room was located in the basement or near the kitchen door. Methods of utilizing space in the refrigerator and the cooler are stated in Appendix A.

The floor-to-ceiling draft coolers planned for cooperators varied little in size. The largest was 18 inches by 30 inches, but a cooler of this size would be used to at least four-fifths capacity by 13 of the 14 cooperators. Eight of the coolers planned required 7 movable shelves and 4 required 6 shelves.

Refrigerators required by cooperators approximate the commercial types on the market at the present time that are rated as 4- to 5-cubic-foot capacity. Since the introduction of mechanical refrigerators may possibly influence practices in the care and preparation of food in the direction of greater use of refrigeration, it seemed best to allow floor space for a larger one than was required at the time of the interviews. Accordingly space was allowed for a model of approximately 6-cubic-foot capacity.

FUNCTIONS OTHER THAN MEAL PREPARATION

ARRANGEMENTS NEEDED

Arrangements for the remaining functions of the kitchen can be planned in one area. They include food-preparation tasks that can be done while seated, meal service, child's play, ironing, and writing or consulting recipes.

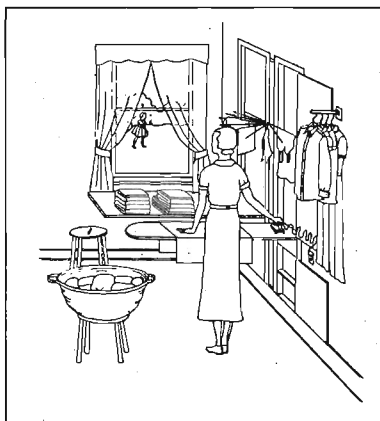


Figure 13. Convenient arrangement for ironing center.

For these uses there should be a table with washable surface, not easily marred. It should be placed in a position that will be as nearly permanent as possible, one that requires little or no moving for the family meal. It should have a light, well-ventilated location, preferably with a view of out of doors. An alcove is usually not so desirable as an open corner unless the location of the alcove permits the table to be extended into the kitchen when necessary. The table should be of such size that extension is not usually required.

Space allotted to this area should permit at least two chairs in

positions where they will not be in the way of kitchen work. It is preferable that the number of chairs be sufficient for all persons regularly seated at the meal table. If space-saving is a consideration, however, a bench may be used along the wall. Should a fixed bench and table be installed, the edge of the bench should be on a vertical line with the edge of the table, and the table support should be set in from the edge at least fifteen inches.

Near the table storage space should be provided for writing materials, recipes (unless stored at the mixing table), books on homemaking, and a drawer for children's "treasures."

The ironing board should be located near the table, in order that the latter may be used in sorting and piling garments. A hook should be placed conveniently near the board where newly ironed garments may be hung on hangers. There should also be a rack for drying folded articles. The wall rack with arms that spread fan-wise is a convenient type.

A convenient arrangement of table, built-in ironing board, garment hook, and drying rack is suggested by Figure 13.

DIMENSIONS OF DINING AREAS

Meal table

The dimensions of meal tables suitable for groups of various sizes were determined by measurements, first, of the leg and elbow room needed by people seated; second, of the space required for the dishes used in the service of a dinner served "family style." The dishes used were of the shapes and sizes most commonly found in the homes of cooperators in this study.

A man 6 feet tall was found to need 20 inches leg room. As men may sometimes be seated opposite one another, the width of the dining area should permit the use of a table at least 40 inches wide. Arm movement requires a seating allowance of 24 inches per person. It is desirable that the center of the first cover on a side should be at least 15 inches from the end of the table. For smaller groups the factor determining table size is the space required for covers and serving dishes, while for larger groups the requirements of persons seated determine table size.

In Table 6 (Appendix E) there are given the dimensions of rectangular tables planned to seat 4, 6, 8, and 10 persons. To meet the conditions outlined in foregoing paragraphs, a table seating six persons, with one person on each short side, needs to be 76 inches long when it is 40 inches wide.

Passageways about the meal table

Passage allowances depend on the heights of adjacent surfaces, and on the degree of convenience that is considered to be the desirable minimum. Following are allowances obtained by measuring adults in the various situations described:

- (1) Minimum passage to meal table between front of seat and edge of table when seat is drawn back: to permit person to take own seat, 9 inches; to permit person to pass to seat beyond, 12 inches.
- (2) Passage between corner of table and corner of adjacent articles of less than elbow height, 15 inches.

- (3) Passage between back of occupied seat and article of furniture of less than elbow height: for person passing to seat beyond, 15 inches; for person serving table, 21 inches.

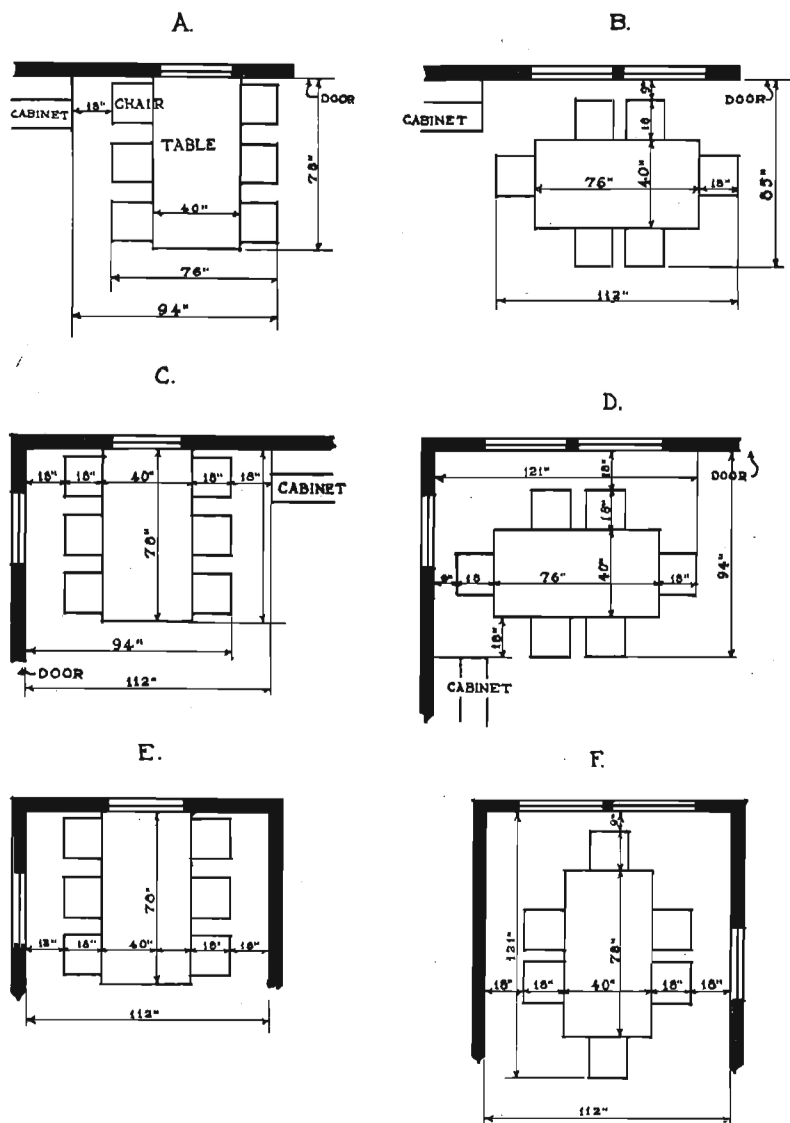


Figure 14. Dimensions of dining areas. Given for one-wall, two-wall, and three-wall areas, and for seating arrangements utilizing two opposite sides, and all four sides, of the table, respectively.

- (4) Passage between back of occupied seat and wall or article of furniture of more than elbow height: for person passing to seat beyond, 18 inches; for person serving table, 24 inches.

Total floor space

The total kitchen floor area required for the dining function is obtained by adding to meal-table dimensions the allowances required by occupied chairs and by passageways for entering and leaving seats.

Table 5 (Appendix E) gives the dimensions of dining areas suited to various requirements. Section A gives the allowance needed when the dining area is open on three sides; section B, when the meal table is in a corner; and section C, when it is in an alcove. The floor allowances given in Table 6 do not include passage between table or chair and adjacent cabinet, but they do include passage between back of chair and wall. Some of the situations are illustrated by Figure 14, which gives dimensions (in sketches A, B, C, and D) not only for table, chairs, and passage between them and the wall, but also for the distance to an adjacent cabinet.

The selection of the dimension for a particular situation depends on whether the dining area is limited in width or in length, on the height of adjacent surfaces, and on the degree of convenience that is considered the desirable minimum. Ideally the area will be large enough to permit any person to reach his seat without disturbing others.

OTHER DIMENSIONS

Utility table

If no meals are served in the kitchen, a table 24 inches by 30 inches in size will suffice for the other uses of the area—child's play, reading and writing, and sorting and piling clothes while ironing.

Ironing center

A board 14 inches by 60 inches is satisfactory for ironing most types of articles. This length includes an allowance of 8 inches at the end of the board for the iron to rest, a section 36 inches long whose sides are parallel, and a tapered section 16 inches long. Minimum space allowances about the ironing board include 6 inches at the back, 12 inches at the end.

KITCHEN-PLANNING PROBLEM ONE: WOOD RANGE USED; DINING AREA INCLUDED

DESCRIPTION OF PROBLEM

After the various center plans were made, as described in foregoing sections, plans were developed that provided the wall and floor space required for the kitchen of the average cooperator. The aim in making these plans was to determine kitchen arrangements having the lowest possible area and requiring the least possible travel in doing routine work. These arrangements were developed in sufficient variety to afford a choice of plans for the home builder.

The first problem chosen was that of planning for the situation where wood is used as the chief kitchen fuel, where electricity is available for light, power, and supplementary cooking heat, where the kitchen is used for din-

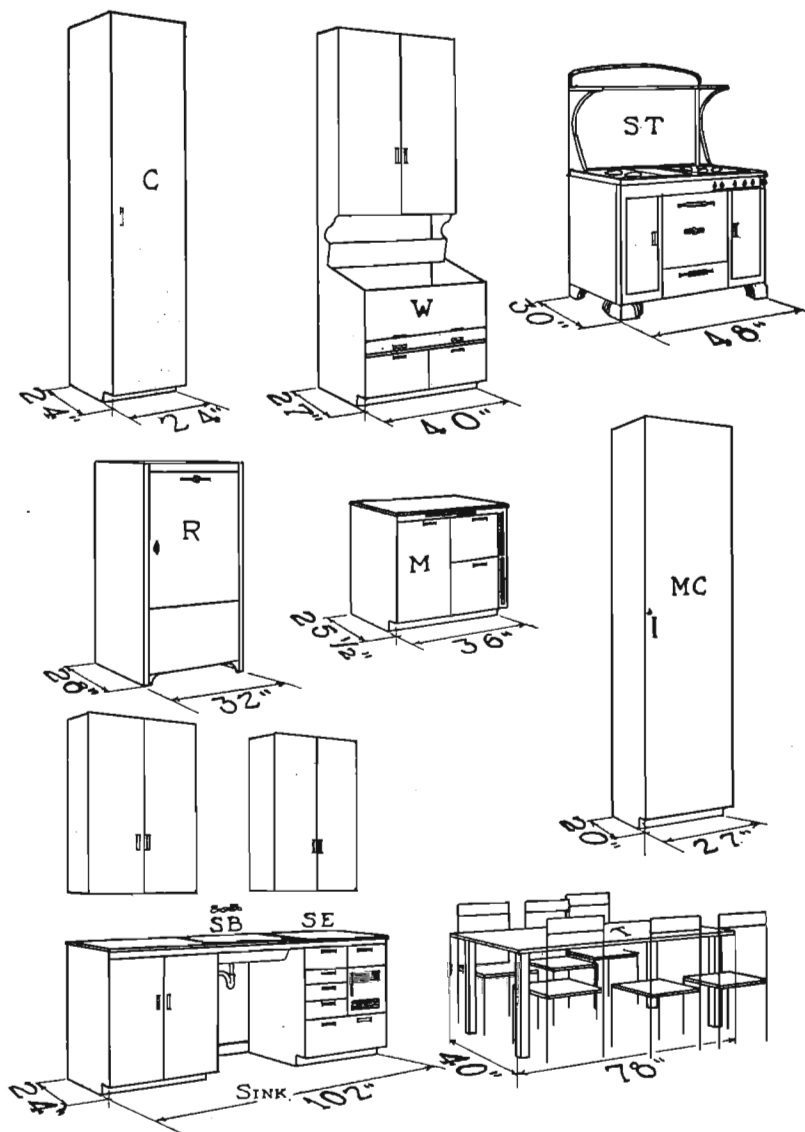


Figure 15. Equipment used in kitchens planned for Problem One, and shown in Figures 16 to 20 inclusive.

C—draft cooler. W—wood box with cabinet above it for equipment and supplies used at the stove. ST—combination cook stove, using wood or coal, and electricity or gas. R—mechanical refrigerator. M—mixing table with bins below it. MC—storage cabinet for utensils and packaged supplies used at the mixing table. SB—sink bowl. SE—serving end of sink unit. T—meal table.

ing, and where provision for the storage of dishes used only in serving company meals is made outside the kitchen. The specific units for which provision was made in these floor plans are illustrated by Figure 15. The sink and the serving centers are combined in one unit; the mixing-center units consist of a mixing table with no upper cabinet, and a floor-to-ceiling storage cabinet; the stove-center equipment includes a combination wood-and-electric range, a wood box holding fuel enough for a winter day's supply, and a utensil cabinet above the wood box; food-storage needs are provided for by a draft cooler and a refrigerator of 6-cubic-foot capacity; the meal table is large enough to accommodate 6 persons. Detailed information concerning dimensions and space allowances are included in Appendix B.

The specific aims in Problem One were:

1. The dimensions and arrangement of kitchens having two doors, both outside the sequence of working equipment. For this part of the study the meal table intended for three chairs on each long side was used.
2. The effect on the dimensions of these kitchens when—
 - a. The working sequence is broken by a door.
 - b. The meal table is planned to have seats at both ends as well as both sides.
 - c. A bench placed against the wall is planned for one side of the meal table.
3. The relative convenience of arrangements in which the working sequences are broken by doors.
4. Estimates of the travel that would be required in these kitchens.

PROCEDURE

Methods used for developing arrangements

In order to insure a thorough-going consideration of the kitchen arrangements possible with the equipment enumerated, each arrangement described in the following paragraphs was tested by means of templets (cutouts). The tests for each arrangement began with the least possible measure for one dimension, and continued until the least possible measure for the other dimension had been reached. Whenever an arrangement was developed that appeared to represent good use of space it was drawn to scale. In this process the various uses of the corners of the room were considered, also the possible positions of the meal table and of the two doors. Economy in area was given precedence over economy in construction of built-ins.

The number of arrangements to be tested was restricted because of the fact that in no case were the two articles of equipment that make up the mixing center separated by another article. Certain other limitations were placed on the arrangements, as follows:

The meal table was always placed outside the sequence of working equipment.

The wood box was always placed at the left of the stove and adjacent to it.

It was assumed that the meal table would be left in one position during and between meals, and that the six chairs would be pushed under the table between periods of use.

One end of the meal table was assumed to be against the wall.

The cooler and the storage cabinet (mixing center) were assumed to be equipped with single doors. These articles of equipment were always placed where cabinet doors might be opened at least 90 degrees.

In a case where a room door was located at the side of the meal table it was placed so that it might be opened to a 90-degree angle behind an occupied chair.

In a case where a room door was next to the stove, it was always swung away from the stove.

Where a room door opened against a sink cabinet or mixing table, it was placed far enough away so that its end would not have to swing in front of the built-in in order to allow a 30-inch passage between the end of the door and the piece of equipment on the other side of the passage.

The draft cooler and the mixing-center storage cabinet were always placed adjacent to other built-ins. An exception was made where the refrigerator intervened between two cabinets, with the expectation that they would be united by means of a cabinet above the refrigerator.

In planning corners, preference was given to the arrangement that brought two low or two high cabinets together. Examples: mixing table and sink; mixing table and wood box; wood box and sink; mixing cabinet and cooler.

Only those plans were considered acceptable in which it would be possible to place windows at least 2 feet 6 inches wide on at least two adjacent sides of the room.

Placement of working equipment with reference to wall spaces available for windows was not used as a limiting factor in making kitchen plans, for the reason that in a house equipped with electricity it is simpler to supplement light from windows than to attempt to provide natural illumination for all parts of the room. Furthermore, as much kitchen work in farm-houses is done before sunrise and after daylight has faded, artificial lights for work surfaces and cabinet interiors are required anyway, and their occasional use in the daytime adds little to bills for electric current.

Arrangements tested numbered 240. The number of arrangements may be accounted for in this way: There are three possible arrangements of sink, stove, mixing table, and meal table with reference to one another. There is a clockwise and a counter clockwise order for each arrangement, because the wood box was placed only at the left of the stove. There are twenty possible placements of cooler and refrigerator with reference to sink, stove, mixing table, and meal table. Finally, the storage cabinet for the mixing center may be placed at either the right or the left of the mixing table.

Method used for estimating kitchen travel

Kitchen travel was estimated for each proposed arrangement by multiplying the distance between each two parts of the equipment by the number of times during a year that the worker was expected to make the trip between them, and totaling the results. The procedure followed in estimating

the number of trips between each two parts of a kitchen has been described on page 16. In Table 7 (Appendix E) the data for kitchen trips contained in Table 4 have been adapted for use in estimating the travel that would be required in kitchens equipped as specified for this problem.

In measuring the distances between each two parts of a kitchen the following procedure was used: Measurements were taken between center fronts of units, except in case of left (firebox) end of stove; measurements to the meal table were made to the center of the nearest side; measurements were recorded as the nearest one-half foot; if passage to the unit was not straight, distance was measured as a person would walk to avoid the obstruction.

DESCRIPTION AND EVALUATION OF PLANS DRAWN

Types of arrangements

Differences in the areas of the kitchen floor plans developed by the method previously described were found to be associated with differences in the relative position of meal table and working area. The smallest kitchens are those in which the meal table occupies the center of the open space enclosed by the pieces of working equipment when they form a "U." The largest are those in which the dining space is entirely separate from the working space.

The points of difference that were used as the basis of classification of the kitchen floor plans drawn were the position of the meal table with reference to the working area, and the placement of doors. Five types of arrangement were distinguished; these are illustrated by Figures 16-A, -B, -C, -D, and -E. In type A the meal table occupies the space between pieces of working equipment. In type B the dining area is separate from the working area on one side, while in types C, D, and E, it is completely separate from the working area. In types A, B, and E both doors are at one side of the meal table, while in types C and D passage between doors crosses the passage between working and dining areas.

For the kitchen that is much used by other members of the family while cooking or dishwashing is in progress, it is evident that, generally speaking, the convenience and comfort of the "family" center is in inverse proportion to the area of the kitchen. In a minimum-area kitchen of type A neither side of the table can be used between meals without interfering with the kitchen worker. In one of type B or C one side only can be so used, while in a kitchen of type D or E both sides might be occupied without disturbing the kitchen worker.

A distinct advantage to types C, D, and E is that they permit the location of the meal table in an outside corner, an arrangement that is desirable for the sake of light, air, and view.

The chief advantage of type A is the convenience of the meal table for use as an auxiliary work area, but in some arrangements of this type the meal table would be uncomfortably near the stove in warm weather.

Least-area plans of each type

The floor plans included in Figure 16 are those of the smallest kitchens that resulted from the selective procedure previously described. The area in square feet of the least-area kitchen of type A is 178.7; type B, 188.4; type C, 200.0; type D, 206.0; and type E, 209.4.

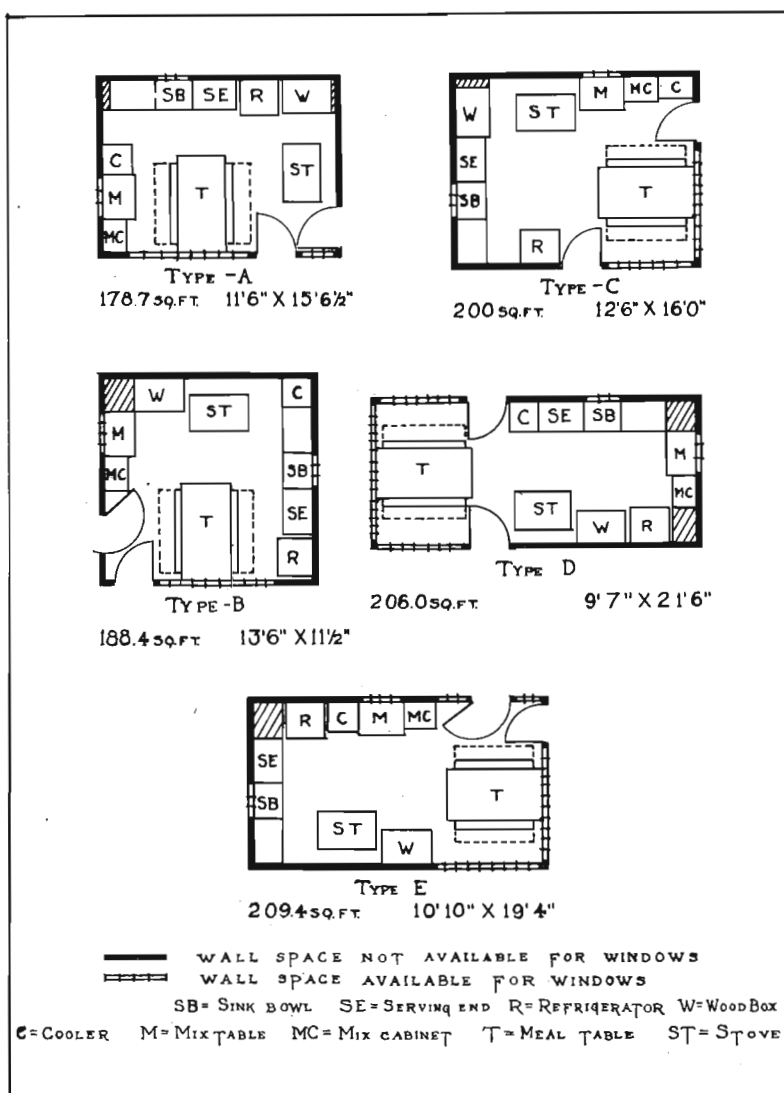


Figure 16. Dimensions and arrangement of least-area kitchens of each arrangement type, with equipment shown in Figure 15, and with sequence of working equipment unbroken by doors. Shading indicates areas that might be used for built-ins or equipment in addition to or as an extension of those used as the basis for planning the kitchens, or they indicate where change from the rectangular form of the room might be made. Double lines indicate wall space available for windows.

(A) Meal table occupies space between pieces of working equipment. Area, 178.7 square feet; travel estimate, 161.7 miles per year. (B) Meal table separate from working area on one side; both doors on one side of meal table. Area, 188.4 square feet; travel estimate, 166.6 miles. (C) Meal table in corner; passage between meal table and working area. Area 200.0 square feet; travel estimate, 173.4 miles. (D) Meal table occupies one end of kitchen; passage between meal table and working area. Area, 206.0 square feet; travel estimate, 178.1 miles. (E) Meal table occupies one end of kitchen; both doors on one side of meal table. Area, 209.4 square feet; travel estimate, 172.6 miles.

There was found to be no one arrangement for any of the types that required an appreciably smaller area than the rest. It was found possible in drawing kitchens of the various types to set a limit of 200 square feet for type A, 210 for type B, 215 for type C, and 225 for types D and E, and yet develop low-mileage floor plans in sufficient variety as to dimensions and possible positions for doors, windows, and chimney, to provide a considerable range of choice.

The ten least-area kitchens of each type are described in Table 8 of Appendix E. Least dimensions among each set of ten plans are 11'0" for type A; 11'6" for type B; 11'0" for type C; 9'4" for type D; and 9'8" for type E.

Types A and B more often approximate a square than the other types. Among the 20 plans of types A and B that are included in Table 8 are seven for which the difference between length and width is less than a foot. The average difference is 3'0" for type A and 2'3" for type B. Of the five groups of plans, type D varies most from the square, the average difference between length and width being 12'2½" for the ten plans. Types C and E are intermediate, type C having an average difference of 6'2" and type E, 8'0".

Travel estimates for plans developed

The routine procedure followed in attempting to develop low-mileage plans is that suggested by the data in Table 7 of Appendix E. The travel required of the kitchen worker during a year's time would be comparatively small in any of the kitchens coming within the area limits (200 square feet for type A, etc.), by reason of the fact that in all cases the wood box was placed next to the stove and the mixing-center storage cabinet next to the mixing center, and because the form of the sink unit places work areas immediately adjacent to the sink bowl. These three sets of connections account for 44 per cent of all the kitchen connections listed in Table 7.

The variation in kitchen arrangements that is responsible for the greatest difference in travel estimates is the position of the sink with reference to the meal table. The number of trips between these two pieces of equipment constitute 19 per cent of the total. Next in order of importance are the relative placement of sink and stove (6 per cent of the trips); sink and cooler (5 per cent); and stove and meal table (5 per cent). Distances to the mixing center and to the refrigerator are of small consequence because the number of trips made by the kitchen worker to these units is relatively small.

In one respect the goal of convenience is in conflict with the goals of low area and low mileage, and that is the position of refrigerator, cooler, and mixing-center storage cabinet in relation to passages. It was possible in all cases to contrive a "dead end" position for at least one of these pieces of equipment. This position is most advantageous for the mixing-center storage cabinet because it is a convenience to have the door of the cabinet open when work is going on in the kitchen.

The plans made that represent the lowest mileage for each of the various types would require 161.7 miles of travel in the type A kitchen; 166.6 miles, type B; 173.4 miles, type C; 178.1 miles, type D; and 172.6 miles, type E, respectively.

A variety of arrangements of each type were developed that came within the area limits set, and that would not require much more travel for the kitchen worker than the least-mileage plan of that type. The number of arrangements of each type that would require less than 10 per cent more travel than the least-mileage plan of the group are as follows:

Type A—23 plans, or 66 per cent of the 35 plans drawn that had less than 200 square feet area.

Type B—17 plans, or 65 per cent of the 26 plans with less than 210 square feet area.

Type C—10 plans, or 50 per cent of the 20 plans with less than 215 square feet area.

Type D—14 plans, or 82 per cent of the 17 plans with less than 225 square feet area.

Type E—6 plans, or 50 per cent of the 12 plans with less than 225 square feet area.

In rectangular kitchens in which the meal table is placed at one end of the room, the lower mileage plans are those in which the sink unit is placed on one of the long walls, with no piece of equipment placed between it and the meal table. The advantage in this arrangement is pronounced, as is indicated by the following comparisons of the travel estimates of low-mileage kitchens of types C, D, and E.

	<i>Type C</i>	<i>Type D</i>	<i>Type E</i>
Lowest travel estimate of any arrangement having sink on long wall.....	173.4	178.1	172.6
Lowest travel estimate of any arrangement having sink on wall opposite table.....	196.9	215.9	187.5
Difference, as per cent of smaller.....	13.5	21.2	8.6

Objection may be made to the use, as measures of relative convenience, of travel estimates that include trips made to and from the meal table, for the reason that in many households the work of setting, serving, and clearing away the table is not done by the same person who does the cooking. Travel to and from the meal table was lowest in type A and highest in type D. Following is the range, for each type, in the estimated amount of travel between the working area and the meal table:

Type A—lowest 25.5 miles, highest 42.0 miles.

Type B—lowest 32.7 miles, highest 65.2 miles.

Type C—lowest 37.2 miles, highest 88.9 miles.

Type D—lowest 50.2 miles, highest 104.6 miles.

Type E—lowest 42.3 miles, highest 101.6 miles.

When trips to the meal table are excluded, travel estimates are lower for type D than for the other types of arrangement; next in order is type E.

Selected plans illustrating good arrangement

It would appear from the foregoing analysis that there is no one "best" plan for the Willamette Valley farm kitchen equipped as described on page 44. Rather, there are various low-area and low-millage arrangements, differing principally in the convenience of the meal table or "family center." Thirty-two of these plans are illustrated in Figures 17, 18, 19, and 20. These plans were selected with the idea that they would be helpful in planning kitchens varying in shape, position of outer door, position of door to living or dining room, and position of chimney.

The points on which the selection of the 32 plans was based, in order of weight given them, are: (1) area low, (2) travel estimate low, (3) attractive design possible, (4) simplicity of construction possible, (5) unassigned space usable.

The sketches show wall space occupied by high objects, also that available for windows. Adjoining walls are not shown, for the reason that each sketch may be fitted into various floor arrangements.

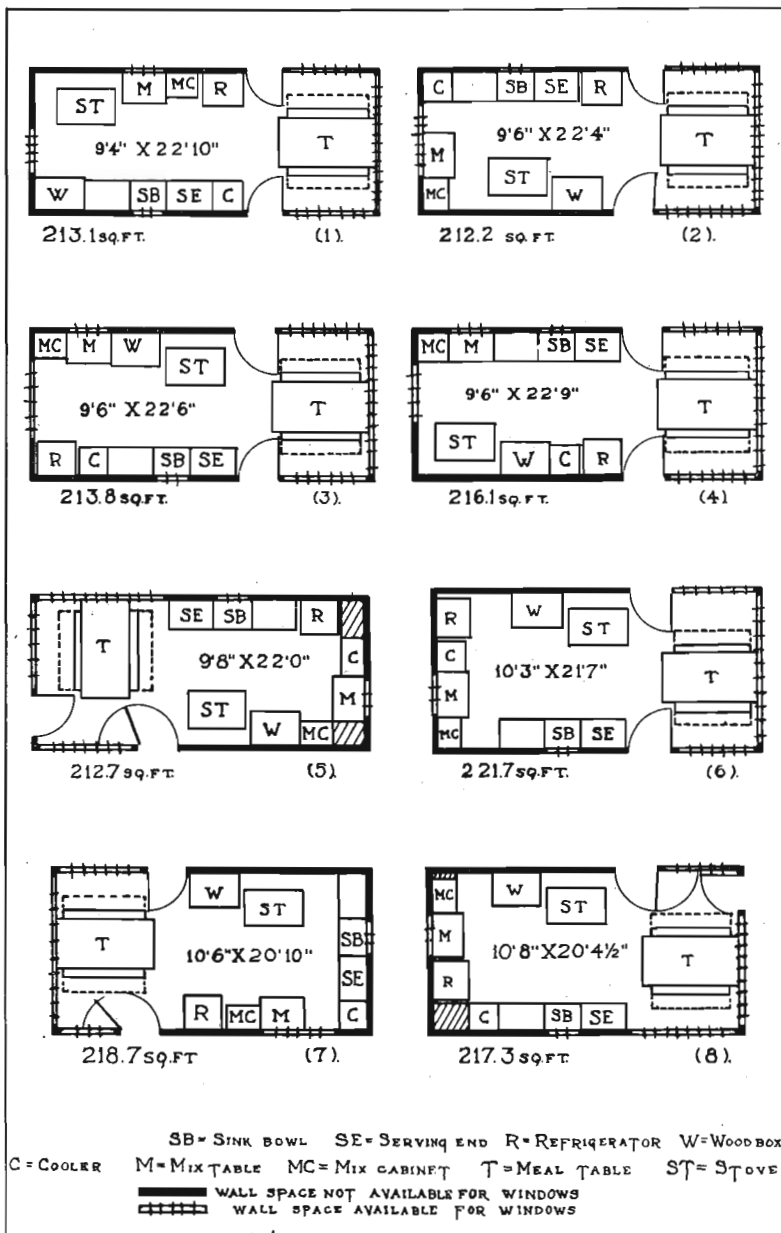


Figure 17. Selected kitchen plans representing further solutions of Problem One, arranged in order of shortest dimension. See Figure 15 for description of equipment.

Travel estimates are as follows:

- | | | | |
|---------------|---------------|---------------|---------------|
| (1) 189.7 mi. | (2) 183.8 mi. | (3) 181.0 mi. | (4) 185.6 mi. |
| (5) 172.8 mi. | (6) 182.8 mi. | (7) 215.9 mi. | (8) 172.6 mi. |

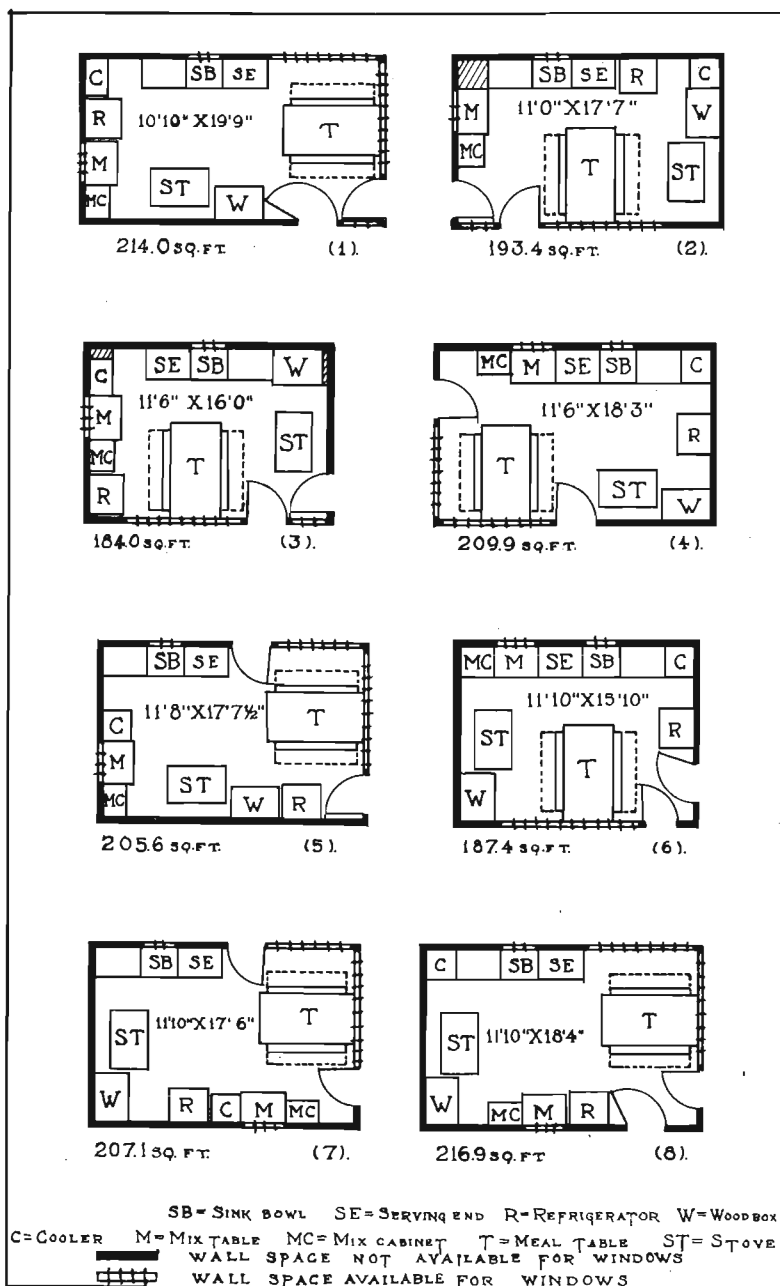
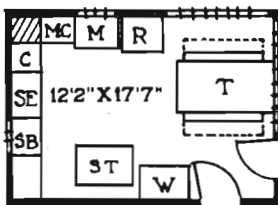


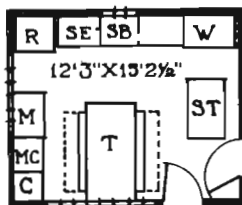
Figure 18. Continuation of Figure 17. For description of equipment see Figure 15. Travel estimates are as follows:

(1) 176.2 mi.	(2) 170.3 mi.	(3) 161.7 mi.	(4) 186.2 mi.
(5) 173.4 mi.	(6) 173.5 mi.	(7) 182.6 mi.	(8) 177.4 mi.



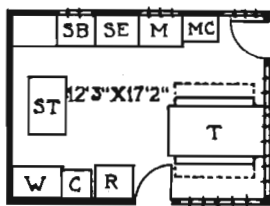
213.9 sq. ft.

(1).



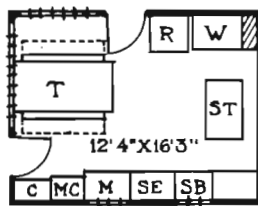
186.3 sq. ft.

(2).



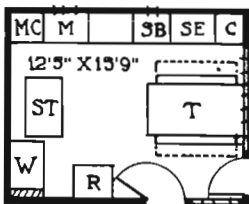
210.3 sq. ft.

(3).



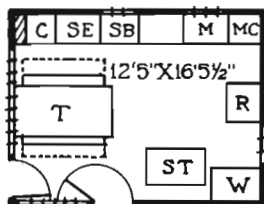
200.4 sq. ft.

(4).



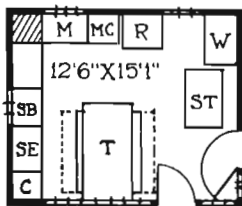
195.6 sq. ft.

(5).



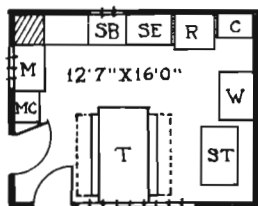
204.4 sq. ft.

(6).



188.5 sq. ft.

(7).



201.3 sq. ft.

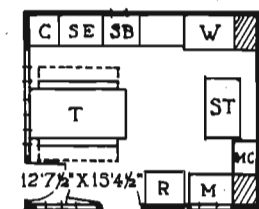
(8).

SB = Sink bowl SE = Serving end R = Refrigerator W = Wood box
C = Cooler M = Mix table MC = Mix cabinet T = Meal table ST = Stove
===== WALL SPACE NOT AVAILABLE FOR WINDOWS
===== WALL SPACE AVAILABLE FOR WINDOWS

Figure 19. Continuation of Figure 17. For description of equipment see Figure 15.

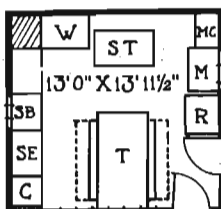
Travel estimates are as follows:

- | | | | |
|---------------|---------------|---------------|---------------|
| (1) 187.5 mi. | (2) 175.1 mi. | (3) 190.4 mi. | (4) 181.5 mi. |
| (5) 168.4 mi. | (6) 172.5 mi. | (7) 176.8 mi. | (8) 179.7 mi. |



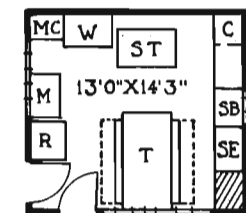
194.1 sq. ft.

(1).



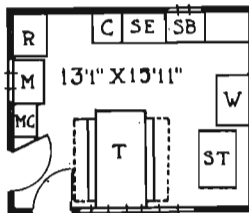
181.3 sq. ft.

(2).



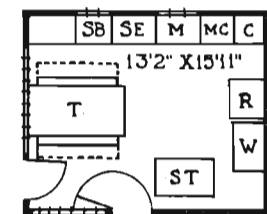
185.3 sq. ft.

(3).



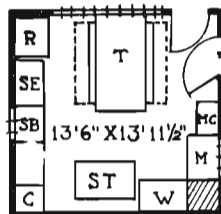
208.2 sq. ft.

(4).



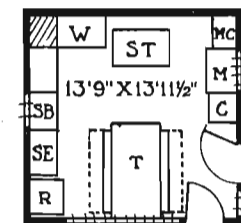
209.6 sq. ft.

(5).



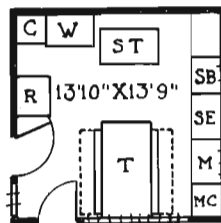
188.4 sq. ft.

(6).



191.9 sq. ft.

(7).



190.2 sq. ft.

(8).

SB= SINK BOWL SE= SERVING END R= REFRIGERATOR W= WOODBOX
C= COOLER M= MIX TABLE MC= MIX CABINET T= MEAL TABLE ST= STOVE
—— WALL SPACE NOT AVAILABLE FOR WINDOWS
===== WALL SPACE AVAILABLE FOR WINDOWS

Figure 20. Continuation of Figure 17. For description of equipment see Figure 15.

Travel estimates are as follows:

(1) 168.7 mi. (2) 169.4 mi. (3) 168.4 mi. (4) 182.8 mi.
(5) 178.5 mi. (6) 167.2 mi. (7) 170.9 mi. (8) 183.3 mi.

Variations in size of kitchen

The effect on floor area of three changes in standards was studied; namely, (1) inserting room doors in the working sequence, (2) using a different form of table, and (3) replacing chairs with a fixed bench, at the meal table. Twenty floor plans were selected at random from among the plans developed as described in the foregoing section, and the arrangement of each one altered as required for each of the three changes in standards.

The first test was made to determine the effect on floor area of inserting doors in the sequence of working equipment. For the convenience of the kitchen worker it is, of course, desirable that doors should be placed so that the main part of the kitchen does not serve the purpose of a hall, but in designs for small houses the factor of space economy usually outweighs the factor of convenience.*

For each of 15 plans the area was determined when one of the doors is between the stove center and the mixing center; for each of 5 plans, the area when the door was changed to a position between the sink center and the stove center; and for all 20 plans the area when there was a door between the sink center and the mixing center. In 30, or three-fourths of the tests, the area was increased by the change. The average area of the 20 original plans was 199.7 square feet; the average of the 40 altered plans was 207.9, or an average increase of 8.2 square feet.

A basis for the relative desirability of various kitchen arrangements with respect to placement of doors was determined from the data for the estimated number of trips made between kitchen centers in a year's time (Table 7 in Appendix E). The assumption was made that the more frequently the kitchen worker is required to make a trip between each two centers, the more inconvenient it is to cross a passage used by other members of the family. Following are the values from which credits for door placement were figured.

	<i>Credits</i>
No door separating meal table, sink unit, mixing center, dish-towel rack, stove, wood box, cooler, and refrigerator.....	1,000
Where travel between two parts of the kitchen crosses a passage to a door, subtract as follows:	
Door between meal table and sink unit.....	280
Door between stove and wood box with upper cabinet.....	150
Door between stove and sink unit.....	95
Door between cooler and sink unit.....	80
Door between meal table and stove.....	75
Door between mixing center and sink unit.....	75
Door between cooler and mixing center.....	40

* Apparently it is difficult to design a kitchen where a solid fuel is used (hence a chimney) in which the sequence of working equipment is not broken by doors. An examination of 122 recently published farmhouse plans showed that less than one in five is so arranged. Almost half of the 122 plans are of one type of arrangement, having two exposures on adjacent walls, a door on each interior wall, and the chimney between the doors. The plans examined were those in Farmers Bulletin 1738, "Farmhouse Plans;" "Subsistence Homesteads," a mimeographed publication of the Division of Subsistence Homesteads of the U. S. Department of the Interior; Washington Extension Bulletin 91, "Convenient Farm Homes;" Montana Extension Bulletin 102, "Suggestions for Rural House Planning;" Arkansas Experiment Station Bulletin 306, "Arkansas Farmhouse Planning;" and Kansas State Engineering Bulletin, "Designs for Kansas Farm Homes." They also included a set of 25 plans issued by the Department of Agricultural Engineering of the University of Wisconsin, and 12 plans clipped from newspapers and magazines. The examination was limited to plans for houses having at least four rooms, with kitchens of two or three exposures and two or three doors.

Door between cooler and stove.....	40
Door between refrigerator and sink unit.....	40
Door between mixing center and stove.....	35
Door between dish-towel rack and sink unit.....	30
Door between meal table and refrigerator.....	20
Door between sink unit and wood box with upper cabinet.....	20
Door between mixing center and refrigerator.....	10
Door between refrigerator and stove.....	10

This calculation was made for 30 of the floor plans in which doors were placed in the sequence of working equipment. The resulting values varied from 345 to 695 credits.

The second test was made to determine the effect on kitchen floor area of the form chosen for seating at the meal table, that of three persons seated on each long side in contrast to that planned for one person at each end and two on each long side. The former method of grouping the family about a table is customary in small alcoves, but the latter is usually used in dining rooms. The meal table of the farm kitchen is often used for all meals except when there are invited guests, and in many families there exists a pronounced preference for a dining area that permits the father a place at the head of the table and the mother at the foot.

Fifteen of the 20 selected plans were modified to include the table with seats at the ends. The modification in each case was made for two of the alterations providing doors at positions within the sequence of working equipment, as well as in the original. In 5 of the 45 modified plans the form of the table seating made no difference in floor area. In the other 40 cases the floor area needed to be increased to provide adequately for the table with chairs at the ends. The average increase in area was 14.2 square feet.

The third test was made to determine the extent to which the floor area is decreased when a fixed bench is used along a wall at one side of a table, eliminating the space allotted to the passage behind the chair. The average amount of decrease for 60 floor plans altered to make use of a bench was 6.3 square feet.

The results of these tests suggest three ways of producing low-area kitchen plans: (1) by dimensioning the dining area with the expectation that a table will be provided that is designed to seat persons on long sides only, when used at its maximum capacity; (2) by using a bench, rather than chairs, at one side of the table, in situations where the table is placed in the corner (the use of a bench precludes the use of a table having legs near the corners); (3) by placing room doors outside the sequence of working equipment.

KITCHEN-PLANNING PROBLEM TWO: ELECTRIC RANGE USED; DINING AREA INCLUDED

DESCRIPTION OF PROBLEM, AND PROCEDURE

The second problem chosen for study was that of a kitchen equipped with an electric range as the only cooking device. The problem of planning a kitchen equipped with a wood range was given first consideration in this study for the reason that stovewood is a home-grown commodity on the majority of farms in the area. The use of electricity as the major source of

heat for cooking, however, is by no means rare, and it is likely to increase with the extension of power lines in rural districts, with the reduction of the cost (in relation to farm incomes) of power and of electric ranges, with the increased use of central heating systems, and with the development of electric ranges suited to the needs of the farm family. The problem of making plans to fit this situation is handled as a specific one for these rea-

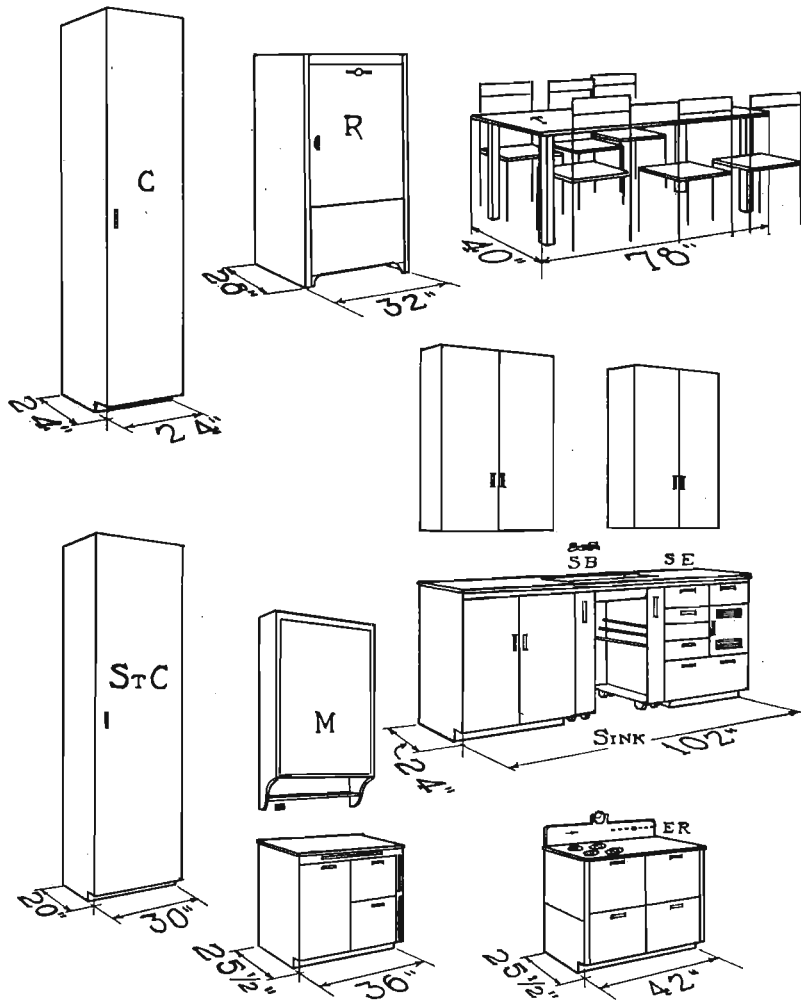


Figure 21. Equipment used in kitchens planned for Problem Two, and shown in Figure 22.

C—draft cooler. R—mechanical refrigerator. T—meal table. SB—sink bowl. StC—storage cabinet for utensils and packaged supplies used at the mixing and stove centers. M—mixing table with bins below it and with a storage cabinet above it. Upper cabinet closed by roller shade. ER—electric or gas range.

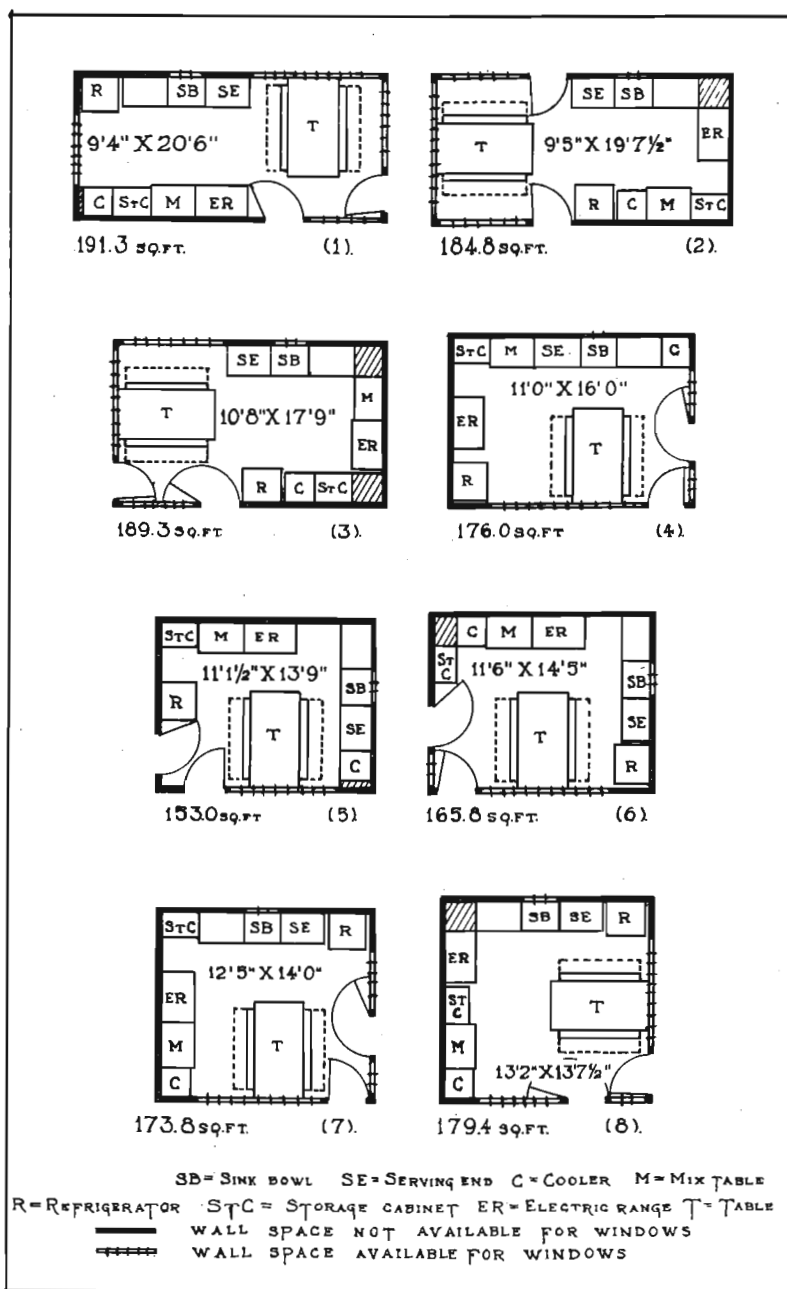


Figure 22. Selected kitchen plans representing solutions of Problem Two. For description of equipment see Figure 21. Shading indicates areas that might be used for built-ins or equipment in addition to or as an extension of those used as the basis for planning the kitchens, or they indicate where change from the rectangular form of the room might be made. Double lines indicate wall space available for windows.

Travel estimates for the various kitchen plans are as follows:

- | | | | |
|---------------|---------------|---------------|---------------|
| (1) 163.9 mi. | (2) 158.5 mi. | (3) 152.3 mi. | (4) 167.2 mi. |
| (5) 152.4 mi. | (6) 155.4 mi. | (7) 162.5 mi. | (8) 157.0 mi. |

sons: (1) the range can be set in the sequence of working equipment without open space at sides or back, (2) no chimney is required, (3) no wood box is needed.

The aim in Problem Two was to develop low-area and low-mileage floor plans of arrangement types A, B, C, D, and E (see Figure 16). Obviously these can be expected to be smaller in area than floor plans of corresponding types that provide for a wood stove. As no attempt was made to test all possible arrangements, as was done for Problem One, it cannot be claimed that the plans developed are "least-area" plans.

The problem was further limited in that a single floor-to-ceiling storage cabinet provides storage for the stove center and also in part for the mixing center, hence in all of the arrangements the stove and mixing centers were placed close together unless there was a good reason for separating them.

The arrangements tested were restricted to those in which the two doors of the kitchen are both outside the sequence of working equipment.

The equipment specified for Problem Two is illustrated by Figure 21. Dimensions are listed in Appendix B.

Estimates of the travel that would be required of a worker by the proposed kitchen arrangements were made in the manner described on page 49. The data for trips per year as adapted for Problem Two are given in Table 9 of Appendix E.

DESCRIPTION AND EVALUATION OF PLANS DRAWN

The area, dimensions, and travel estimate for the smallest kitchen of each arrangement type is given in Table 10 of Appendix E. The smallest area of the five is that for type A, 153.0 square feet. The smallest kitchen of each arrangement type, where an electric range was used, was from 20 to 26 square feet smaller than was the smallest kitchen of the corresponding type that was equipped with a combination wood-and-electric range. Travel estimates for four of the five low-area kitchens (one of each type) were approximately 155 miles per year.

Eight of the 27 kitchen plans developed for Problem Two are shown in Figure 22. The points upon which selection was based have been described on page 51. In all of the plans selected, working sequence is unbroken by doors.

KITCHEN-PLANNING PROBLEM THREE: WOOD RANGE USED; DINING AREA NOT INCLUDED

The third planning problem chosen was that of a kitchen equipped as for Problem One (Figure 15) except that a dining area was not included. To supply a place where tasks may be performed while sitting, space for a utility table 24 by 30 inches was allowed.

Space allowances for Problem Three are identical with those of Problem One (Appendix B). A position was assigned to the 24 by 30 inch table against a wall or in front of a window, where it might be used by one seated person without interfering with passage or the use of an adjacent article of equipment. Where the table was placed between two fixed objects, 2-inch spaces were allowed on both sides.

A minimum of 9 feet was placed on the width of the kitchen. This measure allows 42 inches between the front of the range and a built-in on the opposite wall.

Travel estimates were not made for these kitchens. They are, however, comparatively low in mileage, because in the main the arrangements are those suggested by the data in Table 7 (Appendix E).

Six plans selected from among those developed are shown in Figure 23. The first three are for long, narrow rooms in which the working se-

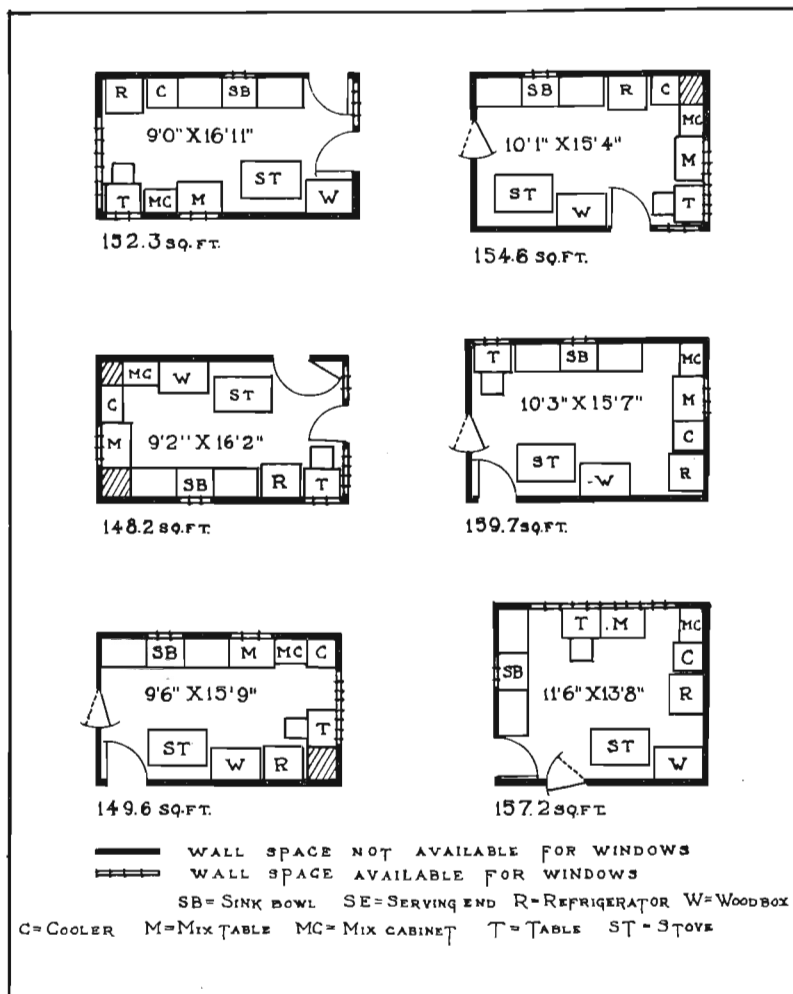


Figure 23. Selected kitchen plans representing solutions of Problem Three. Equipment is identical with that shown in Figure 15, except that the meal table is omitted, and a table 24" x 30", with one chair, is added.

quence is unbroken by doors; the smallest of the three has an area of 148.2 square feet. The fourth plan is suited to the kitchen having its chimney at the inside corner and a door on each inside wall. The last two plans represent attempts to develop kitchens with an inside corner location for the range and also with a working sequence unbroken by doors, a combination that was found to require more space than other arrangements.

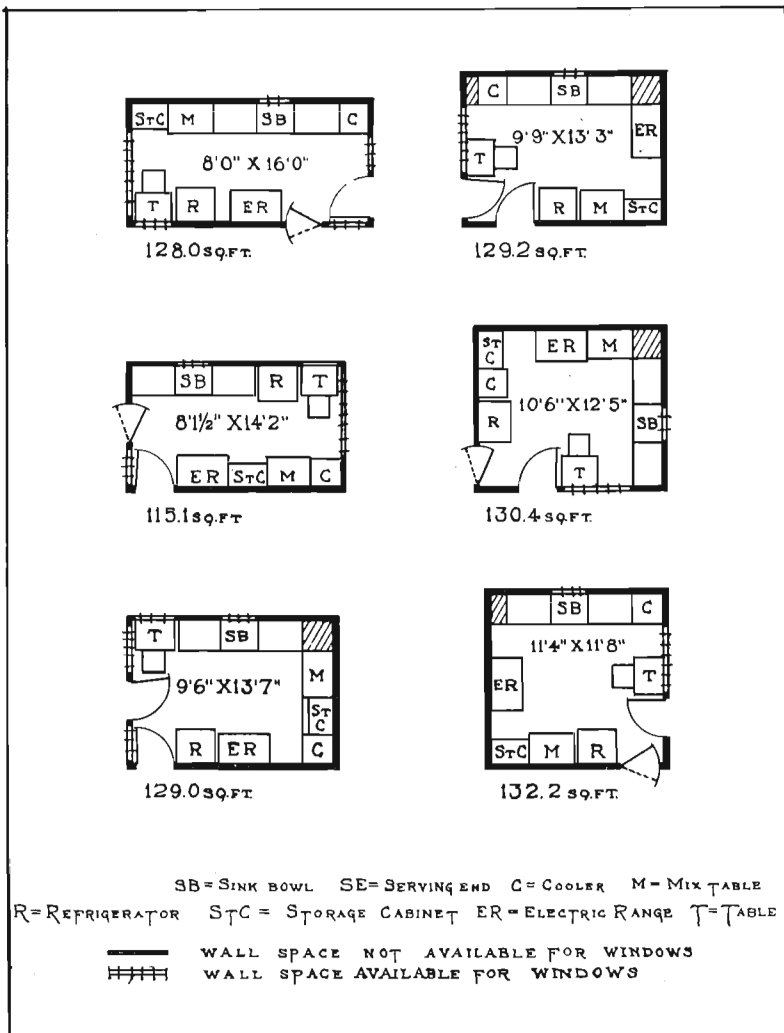


Figure 24. Selected kitchen plans representing solutions of Problem Four. Equipment used is identical with that shown in Figure 21, except that the meal table is omitted, and a table 24" x 30", with one chair, is added.

KITCHEN-PLANNING PROBLEM FOUR: ELECTRIC RANGE USED; DINING AREA NOT INCLUDED

The last of the problems chosen for study was that of a low-area kitchen without a dining area and without a wood or coal stove. Space allowances for Problem Four are identical with those listed for Problem Two, except for the omission of the meal table and the inclusion of a utility table. Travel estimates were not made for the kitchen plans developed as solutions to Problem Four.

The smallest kitchen developed contains 115.1 square feet. It was found that the narrowest kitchens were lowest in area. The narrowest kitchen planned in this series is 8 feet wide.

Six of the plans representing solutions to Problem Four are given in Figure 24. They vary in shape from the narrowest one planned to the one most nearly square. The average area for the six plans is 127.3 square feet.

CONCLUSIONS

From the results of the four kitchen-planning problems studied, it appears the Willamette Valley farm kitchen is a comparatively large room when it includes all features that are desirable from the functional standpoint. The results of the study emphasize the need for determining the relative importance of specific space allowances, a topic that is recommended for future study. For example, is it more important to have storage sufficient for all frequently used utensils that can be reached without crouching or climbing, or to have space enough about the meal table to permit any person to take or leave his seat without disturbing others? How important is it, compared with other uses of space, to place a door so that it can be left open all the time if desired? How desirable is freedom of movement for the kitchen worker?

Ways of minimizing floor area without compromising with standards for space allowances were suggested by the three tests cited on page 55. Another space-saving planning practice is to use doors that are as small as possible for their specific uses. Because a door must be considered in planning three spaces—the opening, door swing, and space for the door to remain when opened—even a slight variation (as two inches) in door width may have a marked influence on floor area.

Allowances for space at the back and side of a wood range assume that the wall back of the stove is inflammable. It would be desirable if there could be developed a fire-resistive wall panel with built-in pipe, together with a wood range that fits tightly against it. The saving in room area as well as in the cost of cleaning should materially offset the cost of manufacturing the built-in type of range.

TOPICS FOR FURTHER STUDY

Topics suggested for further study are:

Utensils needed for the work done in the Willamette Valley farmhouse, (based on research studies of utensils) and storage arrangements desirable for them.

Standards for natural illumination of kitchens in Willamette Valley farmhouses.

Cost of equipping kitchen in manner recommended in conclusions from this study.

Relative importance of specific space allowances.

Modification of center plans to conform to given cost levels for equipping farm kitchens.

Regional variations in foods used by farm families and in ways of preparing them.

Modification of recommendations for Willamette Valley farm kitchens in order that they may apply to the homes of (1) Southern Oregon fruit growers, (2) Central and Eastern Oregon wheat growers, (3) Central and Eastern Oregon livestock producers.

Variations in requirements for kitchen work space and storage space in a given area, in relation to farm incomes.

Appendix A

STANDARDS FOR UTILIZING STORAGE SPACE

1. Standards applying to all work centers

Packaged supplies were stored in single rows, except as follows: (A) When two or more packages of the same article are kept on hand. Unopened packages were then stored behind the opened ones, where width of shelf would permit. (B) Seldom-used supplies (as spices used only for preserving) were stored behind those used more frequently.

Containers for supplies were stored with the narrowest dimension parallel with the shelf.

Plates, kettles, bowls, etc., were nested if they were duplicates or used together, otherwise they were stored singly.

Articles of equipment consisting of several pieces, as grinders and pressure cookers, were assembled for storage.

Hooks were provided for articles that will hang, excepting certain small utensils, which it is sometimes desirable to store in drawers.

Drawers for small utensils were sectioned. Racks within drawers were provided for cooking knives, spatulas, and scissors.

Margins allowed for utensils:

2" in front of largest article stored on shelf.

2" between tallest article and shelf above.

3" between a hook and the lower edge of an article hung above it.

4" between utensils hung back-to-back.

Allowance for disorder was made above articles in drawers, the amount of space being determined by the nature of the articles stored therein.

2. Standards applying to the sink and the serving centers

In planning the storage of dishes the heavier or clumsier articles were placed on the lower shelves, while those lighter in weight or easier to grasp were placed on the higher ones. Dishes were grouped as to height, however, wherever this made for a better utilization of space between shelves than the grouping by weight.

In determining distances between shelves, a margin of 2 inches was allowed above the tallest articles on the shelf if they must be grasped from the top in removing them (as piles of plates). A margin of $\frac{1}{2}$ inch to 1 inch was allowed above those that are grasped from the side, as cups.

Duplicates (cups, goblets, etc.) were placed behind one another, when the width of the shelf permitted.

Whenever only small, individual pieces were allotted to a shelf, it was made only 6 inches wide. The use of the narrow shelf adds to the convenience of the one below it.

Articles of the same size and serving the same purpose were stacked together; plates, saucers, and saucedishes in piles of twelve or less; cups and glasses in piles of two. One platter and two vegetable dishes in daily use were piled together.

All of the "everyday" and "company" dishes were stored on shelves 72 inches or less from the floor. Most of the flower containers, keepsakes, and seldom-used dishes were stored above that height.

Silver and utensil drawers were sectioned. The problem of the dimensions of sections was made the subject of a special study in which utensils were assembled, grouped as to form and use, and the space required for each group was measured.

3. Standards applying to the mixing center

The space below the mixing table was utilized for drawers and bins intended for cereals and sugar, and for slots for pastry and cutting boards. Cabinets above the mixing table were designed for packaged goods and equipment requiring shelf room not more than 11 inches wide.

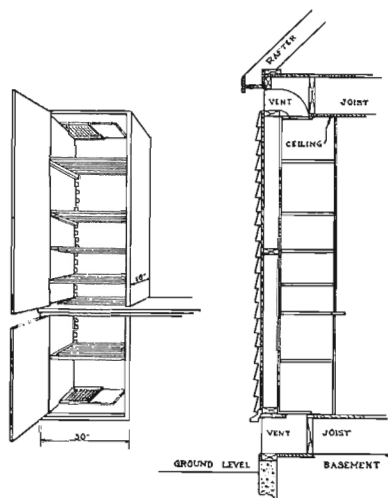


Figure 25. Draft cooler. (A) Perspective. (B) Cross section.

Two vents are essential. The lower one should be at or below the floor level, while the upper one should be at or above ceiling level. Large vents are more effective than small ones. Vents should be covered with fine-mesh copper screening which can be removed for cleaning. They should also be fitted with some arrangement for closing that can be operated from the inside.

Shelves should be removable and adjustable as to distances apart. The door should fit tightly, to prevent drafts in the kitchen. The interior finish of the cooler should be readily cleanable.

hung on the door. Shelves were spaced so that the heavier equipment may be stored in the lower part of the cabinet. A space between two fixed shelves is divided into slots for shallow equipment such as pie tins, layer-cake tins, and lids. All shelves, except those between which dividers are placed, were assumed to be movable and adjustable as to height at 1-inch intervals.

Separate bins were planned for cereals and sugar in lots of 25 pounds or more. Movable insets in sectioned drawers provided for 8- to 10-pound lots. Bins and sectioned drawers provide space for the amounts customarily purchased, plus an allowance for the amount on hand at the time of a new purchase, and space for scoop. The flour bin was made large enough for sifter and rolling pin also.

Bulk foods assigned to the shallow cabinet above the mixing table, or to the floor-to-ceiling cabinet, were assumed to be stored in metal or glass containers.

In estimating the capacity of the floor-to-ceiling cabinets required to supplement the storage above and below the mixing table, allowances were made of 4 inches for a base, and 1 inch for the thickness of shelves. The door was planned to extend the entire height of the cabinet, and to be of such construction that hooks for kitchen utensils can be placed anywhere upon it. Shelves are narrower in width than the cabinet itself by 3 inches or more to allow for articles

4. Allowances for construction

	<i>Inches</i>
Thickness of doors and sides of cabinets where hooks are placed above	1
Thickness of doors and back and sides of cabinet, other than above	$\frac{3}{4}$
Thickness of fronts of drawers.....	$\frac{3}{4}$
Thickness of sides and backs of drawers.....	$\frac{1}{2}$
Thickness of back of cabinet.....	$\frac{1}{4}$
Width of vertical strips at sides of cabinet doors, or between drawers	$1\frac{1}{2}$
Width of lateral strips between drawers.....	$\frac{3}{4}$
Thickness of counter top	$1\frac{1}{2}$
Width of piece below counter top.....	$\frac{1}{4}$
Thickness of dividers in sectioned drawers.....	$\frac{1}{4}$

5. Methods of utilizing space in cooler and refrigerator

The dimensions of both the cooler and the refrigerator allow for containers customarily used in farm households for the purpose of storing perishable foods. Containers are not usually purchased especially for this purpose, but use is made of glass fruit jars, sirup pails, berry boxes, and pans. Home-grown foods are usually stored in the containers in which they are brought into the house; purchased foods, in their original containers; and left-overs in table dishes.

Within the limits set by its type, the dimensions of the container chosen for each food were those that utilized shelf space as economically as possible. Milk was stored in quart or half-gallon jars, and cream in pint or quart jars. Potatoes were assumed to be stored in a two-gallon pail, and other vegetables in ten-pound pails.

Appendix B

EQUIPMENT AND SPACE ALLOWANCES USED IN KITCHEN PLANNING

PROBLEM ONE

Following are the dimensions of the floor areas for which provision was made in the kitchen plans developed as solutions for Problem One.

1. Articles of equipment (Figure 15) and spaces at back and sides

Stove center: Combination stove 30"x48". Free floor areas of 12" at back, to prevent scorching of wall from over-heated pipe, and at least 15" at one side, to provide access for cleaning. Minimum distance to adjoining equipment 3". Where refrigerator was placed at right of stove at least 12" was allowed between them.

Wood box with storage cabinet above it for supplies and equipment used at the stove, 27"x40".

Sink center: Unit 8'6" long. Side cabinets each 36" long. Sink bowl 30" long. Storage cabinets in a unit of this length do not provide space for all dishes possessed by the average cooperatator.

Mixing center: Table with bins below, 36" long. 24" wide if adjacent to sink unit; 25½" wide where not so placed.

Floor-to-ceiling cabinet, 20"x27": When placed between two wider cabinets this unit is made 24" wide.

Refrigerator, 28"x32"*: Minimum allowance of 2" at sides, for convenience in getting the refrigerator into place and for cleaning. Total floor area, if enclosed on three sides, 28"x36"; if on two sides, 28"x34".

Draft cooler: 24"x24" or 18"x30", depending upon which could be best fitted into the room arrangement.

Meal table: Seating six persons. Size 40"x78", where intended to be used with three chairs on each long side, or 40"x76", where ends are intended to be used. Floor allowance of 18"x18" for occupied chair and 6"x18" for chair pushed under table.

Room doors: Opening 32". Door jamb 2" wide.

2. Minimum dimensions of free floor areas

Width of major passage, as between doors or main work centers: 30."

Width of passage to wood box: 24."

Width of passage between occupied chair or corner of table and object of more than elbow height: 18." Of less than elbow height: 15."

Width of passage past a major activity area, as sink, stove, or mixing table: 36." This allows 21" for worker and 15" for person passing.

Depth of space for person to stand while working at sink, mixing center, or cooler: 27."

Depth of space before refrigerator: 32." This is required for door swing plus safety margin of 2."

* This space would permit the installation of the six-cubic-foot models shown in the stores at Corvallis, Oregon, in June, 1937, of the Westinghouse, General Electric, Montgomery Ward and Company, Frigidaire, Hot Point, Kelvinator and Sheldador makes.

Length of space at side of sink: To permit two persons to work side by side, the distance between either side of the sink and a turn in the work counter should be at least 18" at the counter level and 24" at elbow height.

Depth of space between two main centers (stove, sink bowl, mixing table) directly opposite each other: The minimum distance between front edges of working surfaces should be 48."

Depth of space in front of stove: 36." This allows passage in front of open oven door.

Depth of space in front of wood box, if adjacent to high article, as refrigerator: 24." If next to stove and at right angles to it, 15" space was allowed between them, if the one overlapped the other by less than 10," 18" space if they overlapped from 10" to 20," and 21" space if they overlapped 20" or more.

Minimum door swing: 90 degrees. Margin of safety beyond door width: 2."

PROBLEM TWO (Figure 21)

Equipment for stove and mixing centers combined:

Electric range 25½"x42".* Minimum allowance of 2" on each side when between built-ins.

Mixing table with bins below, 36" long.† Upper cabinet same length as lower.

Floor-to-ceiling storage cabinet 20"x30".‡

Other centers; free floor areas:

Space allowances for other equipment and for free floor areas are as outlined for Problem One and illustrated by Figure 15. The designs of the equipment are identical, with the exception of the sink unit, which has the dish-towel rack beneath the sink bowl as in Figure 6A.

* This space is sufficient for the 1938 table models with four surface units, of the Hot Point, Westinghouse, General Electric, and Montgomery Ward makes.

† In the section dealing with the planning of the combined stove and mixing centers it was shown (page 38) that the arrangement found to require the least wall space was the one in which the short-length (36") mixing cabinet with an upper cabinet of the same length was supplemented by a single floor-to-ceiling cabinet, the average length of which was 29 inches.

Appendix C

BASES FOR EVALUATING KITCHEN ARRANGEMENTS—LIGHT AND VIEW

Direction from which light should strike work surface

Average values set by home-management specialists and homemakers upon the direction of light for each working surface were as follows:

Mixing table—light from side	20
side front	15
front	10
side back	5
Sink—light from side	25
side front	20
front	15
side back	5
Range top—light from side	20
side front	15
side back	5
Ironing board—light from side front	20
side	10
side back	5

Views

Following is the numerical expression of the evaluation placed by home-management specialists and homemakers on desirable views from various places in the kitchen:

From meal table—two sides	30
From meal table—one side	20
From sink	18
From mixing table	12
From stove	0

Appendix D

DEFINITIONS

"Parts" of kitchen used in estimating kitchen travel

Following is the functional analysis of the kitchen used in estimating the number of moves made in routine operations (Table 1, 4, 7, and 9). Trips to bring supplies into the kitchen or to remove garbage or other materials from the room were not included. (See also page 11, Units of the Kitchen).

COOLER—a cabinet with two openings to the outer air and with provision for flow of air through or around shelves, where all foods requiring less than room temperature are kept during the cool months of the year, and where all except those requiring artificial refrigeration are kept during summer months.

DISH-TOWEL RACK—place where dish towels are hung to dry.

DISHWASHING TABLE—for receiving soiled dishes, stacking, draining.

MEAL TABLE—table where family meals are served, whether in kitchen or dining room.

MIXING EQUIPMENT STORAGE—where bowls, pans, etc., used mainly at the mixing table are kept.

MIXING SUPPLIES STORAGE, BINS—for flour, sugar, and other dry groceries usually purchased in lots of eight pounds or more.

MIXING SUPPLIES STORAGE, SHELVES—for packaged food supplies used at the mixing table.

MIXING SUPPLIES AND EQUIPMENT STORAGE, DRAWERS—recipes; small utensils not equipped for hanging; supplies kept in small boxes.

MIXING TABLE—a cabinet top where bread, pastries, etc., are made.

REFRIGERATOR—assumed to be used only for foods that spoil quickly, as milk, butter, eggs, fresh meat, and left-overs, and for those for which chilling is desirable.

REST CENTER—table at which worker can sit with feet on floor while doing such work as shelling peas.

SERVING TABLE—where bread is cut, dishes filled for the table, left-overs transferred to smaller dishes, etc.

SERVING STORAGE, COMPARTMENTS—for bread and cake.

SERVING STORAGE, DRAWERS—silver, linen, and small utensils used at the serving table.

SERVING STORAGE, SHELVES—for dishes and ready-to-serve foods.

SINK-CLEANING MATERIALS STORAGE—for reagents and tools used in dishwashing.

SINK EQUIPMENT STORAGE, DRAWERS—for towels, and for small articles that cannot be hung.

SINK EQUIPMENT STORAGE, SHELVES—for kettles, colander, etc.

SINK FOOD SUPPLIES STORAGE—for foods that require washing or soaking.

SINK PROPER—for preparation of foods requiring use of water, and for dishwashing; (sink is assumed to be equipped with hot and cold water and drain).

- SINK FOOD TABLE—where foods that require washing are handled.
- STOVE EQUIPMENT—storage for such articles as skillets, coffeepot, and utensils used in tending foods at the stove.
- STOVE PROPER—heated surface, baking oven, warming oven.
- STOVE SUPPLIES—storage for foods used in dishes made at stove.
- STOVE TABLE—unheated surface where short mixing processes can be done.
- WOODBBOX—box holding firewood and kindling for kitchen stove.

Other definitions

- AUXILIARY WORKROOM—a room in the basement or on the first floor where clothes washing is done, also such tasks as preparation of foods for preservation or market.
- BUILT-INS—cabinets that are fastened to floor or wall.
- CENTER—a functional unit of the kitchen.
- COOPERATORS—farm women who assisted in the study by expressing opinions concerning desirable housing arrangements for their respective families, by giving information concerning family living habits, and by supplying inventories of materials to be stored in the dwelling.
- ENSEMBLE—two or more articles of equipment that taken together serve a specific function.
- FOOD-STORAGE ROOM—for storage of home-canned products, cured meats, long-keeping fruits and vegetables, etc.
- KITCHEN MILEAGE—see "Travel estimate."
- SPACE ALLOWANCE—a specific measure for floor area required for activity of person, or for convenience in moving equipment.
- TRAVEL ESTIMATE—the estimated number of miles per year that the worker would travel in doing routine work in a kitchen of specified design.
- USE REQUIREMENT—the specification as to space, light, or other condition that is based upon the use to be made of the kitchen unit in question.
- UTILITY TABLE—a small table used in the kitchen which does not have a meal table.
- WOOD LIFT—box equipped with hoist. For use where stovewood is stored in basement.
- WORKING AREA—the part of the kitchen that is occupied by stove, sink, and other working equipment and that which is needed for movement of workers in using this equipment.
- WORK-SURFACE—top of cabinet or other article of equipment that is intended for use in doing kitchen tasks.

Appendix E

SUPPLEMENTARY TABLES

Table 4. SUMMARY OF TRIPS BETWEEN EACH TWO PARTS OF KITCHEN.

	Cooler	Dining table	Dish-towel rack	Mixing center					Refrigerator	Serving center			
				Mixing table	Mixing equipment storage, shelves	Mixing supplies, bins	Mixing supplies, shelves	Mixing supplies and equipment, drawers		Table proper	Serving storage, shelves	Serving storage, drawers	Serving storage, compartments
1. Cooler and	365	....	4,788	76	92	....	....	95	4,303	139	1,095	....
2. Dining table and	2,722	10,458	11,335	3,285	565
3. Dish-towel rack and
4. Mixing center
a. mixing table and	6,864	3,452	3,358	722	1,094	372	179	21	359
b. mixing equipment storage, shelves, and	207	143	....	24	14	36	....	....
c. mixing supplies, bins, and	69	20	6	....	....	....	....
d. mixing supplies, shelves, and	126	48	71	....	....
e. mixing supplies and equipment, drawers, and
5. Refrigerator and	3,176	153	....	57
6. Serving center
a. table proper and	6,234	6,190	4,819
b. serving storage, shelves, and	2,655	318
c. serving storage, drawers, and	24
d. serving storage, compartments, and
7. Sink center
a. sink proper, and
b. sink table, food preparation, and
c. sink dishwashing table, and
d. sink equipment, shelves or hung, and
e. sink equipment, drawers, and
f. sink supplies, cleaning, and
g. sink supplies, foods and
8. Stove center
a. stove proper, and
b. stove table, and
c. stove equipment, and
d. stove supplies (other than fuel), and
e. wood box, and
9. Rest center, and
	365	....	4,788	6,940	3,751	3,570	742	4,067	18,371	18,147	13,246	6,142

* See Appendix D for definition of "parts."

Table 4. SUMMARY OF TRIPS BETWEEN EACH TWO PARTS OF KITCHEN.—Continued

	Sink center							Stove center					Rest center	Total
	Sink proper	Sink table, food preparation	Sink dish-washing table	Sink equipment, shelves or hung	Sink equipment, drawers	Sink supplies, cleaning	Sink supplies, foods	Stove proper	Stove table	Stove equipment	Stove supplies, (other than fuel)	Wood box		
1. Cooler and	2,395	1,098	269	204	78	....	....	3,395	1,399	....	104	....	....	19,895
2. Dining table and .....	....	....	9,100	....	....	565	....	9,409	....	....	....	....	....	47,439
3. Dish-towel rack and	1,601	....	1,860	80	....	....	....	....	3	....	....	....	....	3,544
4. Mixing center														
a. mixing table and	3,518	158	1,371	103	20	....	....	2,395	856	293	88	....	....	25,223
b. mixing equipment storage, shelves, and	449	116	2,399	....	....	....	....	637	158	....	19	....	....	4,202
c. mixing supplies, bins, and	13	13	....	131	....	....	....	143	23	....	....	....	....	418
d. mixing supplies, shelves, and	34	118	15	....	....	....	....	239	109	....	....	....	....	760
e. mixing supplies and equipment, drawers, and .....	....	56	....	....	....	....	....	....	....	....	....	....	....	56
5. Refrigerator and	268	1,212	73	308	....	....	....	801	284	47	272	....	....	6,651
6. Serving center														
a. table proper and	5,071	560	671	....	25	....	....	314	276	....	....	....	....	24,160
b. serving storage, shelves, and	1,537	563	6,871	....	....	....	....	1,311	190	10	22	....	....	13,477
c. serving storage, drawers, and	365	....	888	....	....	....	....	394	14	....	....	....	....	1,685
d. serving storage, compartments, and .....	....	122	565	....	....	....	....	53	....	....	51	....	....	791
7. Sink center														
a. sink proper, and .....	....	7,733	21,072	4,122	1,412	961	25	4,066	2,417	730	150	....	32	42,720
b. sink table, food preparation, and .....	....	....	400	1,008	247	....	125	1,182	71	365	36	....	50	3,484
c. sink dishwashing table, and .....	....	....	....	1,526	391	....	....	791	535	1,136	....	....	....	4,379
d. sink equipment, shelves or hung, and .....	....	....	....	....	20	365	....	35	36	....	....	....	82	538
e. sink equipment, drawers, and .....	....	....	....	....	....	....	....	21	....	....	....	....	....	21
f. sink supplies, cleaning, and .....	....	....	....	....	....	....	....	20	....	....	....	....	....	20
g. sink supplies, foods and .....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
8. Stove center														
a. stove proper, and .....	....	....	....	....	....	....	....	....	5,827	3,432	3,991	7,200	....	20,450
b. stove table, and .....	....	....	....	....	....	....	....	....	....	2,672	1,365	....	....	4,037
c. stove equipment, and .....	....	....	....	....	....	....	....	....	....	....	670	....	....	670
d. stove supplies (other than fuel), and .....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
e. wood box, and .....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
9. Rest center, and .....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	15,251	11,749	45,554	7,482	2,193	1,891	150	25,206	12,198	8,685	6,768	7,200	164	224,620

Table 5. SIZE OF KITCHEN DINING AREA.

Sizes of kitchen dining areas for 4 and for 6 persons, in relation to size of meal table and allowances for passages or for pulling back chairs. Space measuring 18 inches front to back allowed for occupied seat.

A. ONE-WALL AREAS

Conditions							Dimensions of area (first dimension is parallel to wall)	Illustration
Capacity of meal table	Seating arrangement*	Size of table		Position of table with reference to wall		Allowance between wall and occupied chair		
		Width	Length	Long side parallel to wall	Short side parallel to wall			
4.....	A	3'4"	4'6"	xx		9"	4'6"x7'1"	Figure 14A Figure 14B
4.....	A	3'4"	4'6"		xx	9"	6'4"x4'6"	
4.....	B	3'4"	4'4"	xx		9"	7'4"x7'1"	
4.....	B	3'4"	4'4"		xx	9"	6'4"x8'1"	
6.....	A	3'4"	6'6"	xx		18"	6'6"x7'10"	
6.....	A	3'4"	6'6"		xx	18"	6'4"x6'6"	
6.....	B	3'4"	6'4"	xx		9"	9'4"x7'1"	
6.....	B	3'4"	6'4"		xx	9"	6'4"x10'1"	

B. TWO-WALL AREAS

Conditions						Dimensions of area	Illustration
Capacity of meal table	Seating arrangement*	Size of table		Allowance for use or for passage			
				On long side	On short side		
4.....	A	3'4"	4'6"	18"	7'10"x4'6"	Figure 14C Figure 14D
4.....	A	3'4"	4'6"	.....	18"	6'4"x6'0"
4.....	B	3'4"	4'4"	9"	9"	7'1"x8'1"	
6.....	A	3'4"	6'6"	18"	.....	7'10"x6'6"
6.....	B	3'4"	6'4"	18"	9"	7'10"x10'1"	
6.....	B	3'4"	6'4"	9"	18"	7'1"x10'10"	

C. THREE-WALL AREAS

Conditions										Dimensions of area (first dimension is that of open side)	Illustration
Capacity of meal table	Seating arrangement*	Size of table		Position of table with reference to open side of area		Allowance for passage					
				Long side parallel to opening	Short side parallel to opening	Along one side wall	Along back wall	Along other side wall			
		Width	Length								
4.....	A	3'4"	4'6"	xx		18"	18"	6'0"x7'10"	Figure 14E	
4.....	A	3'4"	4'6"		xx	18"	....	18"	9'4"x4'6"	
4.....	B	3'4"	4'4"	xx		18"	9"	9"	9'7"x7'1"		
4.....	B	3'4"	4'4"		xx	18"	9"	9"	8'1"x8'7"		
6.....	A	3'4"	6'6"	xx		18"	18"	....	8'0"x7'10"	
6.....	A	3'4"	6'6"		xx	18"	....	18"	9'4"x6'6"	
6.....	B	3'4"	6'4"	xx		18"	9"	18"	12'4"x7'1"		
6.....	B	3'4"	6'4"		xx	18"	9"	18"	9'4"x10'1"		Figure 14F

*A. No one seated on short side of table.

B. One person seated on each short side.

Table 6. DIMENSIONS OF DINING TABLES SEATING 4, 6, 8, AND 10 PERSONS, WITH ONE PERSON SEATED ON EACH SHORT SIDE.*

Seating capacity	Dimensions of table	
	Width	Length
	<i>Inches</i>	<i>Inches</i>
4 persons	40	52
4 persons	44	50
4 persons	48	48
6 persons	40	76
6 persons	44	74
6 persons	48	72
8 persons	40	100
8 persons	44	98
8 persons	48	96
10 persons	40	124
10 persons	44	122
10 persons	48	120

* Two inches should be added to the length of the table if covers are placed only on the long sides.

Table 7. TRIPS MADE BETWEEN PARTS OF KITCHEN. PROBLEM ONE.

Estimated number of trips made by worker in a year's time between each two pieces of equipment in a kitchen equipped with combination range, wood box with upper cabinet, draft cooler, refrigerator, sink with adjacent cabinets on either side, mixing cabinet with storage below it, floor-to-ceiling storage cabinet for mixing center, and meal table. Computation based on study described on page 16 and on data in Table 4 (Appendix E).

Order of size	Parts of kitchen	Trips	
		Number	Proportion of total
			<i>Per cent</i>
1.	Sink bowl, and adjacent cabinets.....	42,298	22.3
2.	Meal table, and serving end of sink unit.....	25,643	13.5
3.	Stove, and cabinet above wood box.....	11,460	6.1
4.	Mixing table or cabinet below it, and floor-to-ceiling storage cabinet	11,240	5.9
5.	Cabinets at right and at left of sink.....	10,898	5.8
6.	Meal table, and nearest end of sink unit.....	9,665	5.1
7.	Meal table, and stove.....	9,409	5.0
8.	Stove (left end), and wood box	7,200	3.8
9.	Sink bowl, and stove	6,483	3.4
10.	Cooler, and serving end of sink unit.....	5,615	3.0
11.	Cooler, and mixing table or cabinet below it.....	4,880	2.6
12.	Cooler, and stove	4,794	2.5
13.	Mixing table or cabinet below it, and sink bowl.....	3,531	1.9
14.	Mixing table or cabinet below it, and stove.....	3,417	1.8
15.	Refrigerator, and serving end of sink unit.....	3,386	1.8
16.	Meal table, and refrigerator	2,722	1.4
17.	Mixing center floor-to-ceiling cabinet, and nearest end of sink unit	2,704	1.4
18.	Stove, and nearest end of sink unit.....	2,670	1.4
19.	Serving end of sink unit, and stove.....	2,573	1.4
20.	Cooler, and sink bowl	2,395	1.3
21.	Dish-towel rack, and nearest end of sink unit.....	1,940	1.0
22.	Mixing table or cabinet below it, and nearest end of sink unit.....	1,776	0.9
23.	Dish-towel rack, and sink bowl.....	1,601	0.8
24.	Refrigerator, and nearest end of sink unit.....	1,593	0.8
25.	Cooler, and nearest end of sink unit.....	1,571	0.8
26.	Cabinet above wood box, and nearest end of sink unit.....	1,537	0.8
27.	Mixing center floor-to-ceiling cabinet, and stove.....	1,143	0.6
28.	Mixing table or cabinet below it, and refrigerator.....	1,100	0.6
29.	Refrigerator, and stove	1,085	0.6
30.	Mixing table or cabinet below it, and serving end of sink unit.....	951	0.5
31.	Sink bowl, and cabinet above wood box.....	880	0.5
32.	Mixing center floor-to-ceiling cabinet, and sink bowl.....	483	0.3
33.	Mixing table or cabinet below it, and cabinet above wood box.....	381	0.2
34.	Cooler, and meal table.....	365	0.2
Total		189,389*	100.0

* The total of 224,620 trips (Table 4) is accounted for as follows:

Requiring no steps (reaching or stooping only).....	33,781 trips
Connections made less often than once a day (12 in all).....	1,450
Enumerated above	189,389
Total	224,620

Table 8. AREA, DIMENSIONS, AND TRAVEL ESTIMATE* OF THE TEN LEAST-AREA KITCHENS
DEVELOPED FOR EACH TYPE OF ARRANGEMENT. PROBLEM ONE.

Type† and number of plan	Area	Dimensions			Travel estimate	
		Length	Width	Difference	Including trips to meal table per year	Excluding trips to meal table per year
	<i>Square feet</i>				<i>Miles</i>	<i>Miles</i>
A 1	178.7	15'6½"	11'6"	4'0½"	163.4	133.4
A 2	179.8	13'10"	13'0"	0'10"	183.7	145.7
A 3	180.3	16'2½"	11'1½"	5'1"	189.2	147.2
A 4	181.5	13'11½"	13'0"	0'11½"	169.4	141.4
A 5	184.0	16'0"	11'6"	4'6"	161.7	128.9
A 6	185.2	16'10"	11'0"	5'10"	167.6	137.7
A 7	185.3	14'3"	13'0"	1'3"	168.4	140.4
A 8	186.3	15'2½"	12'3"	2'11½"	166.9	128.8
A 9	186.7	13'11"	13'5"	0'6"	180.2	140.0
A 10	187.4	15'10"	11'10"	4'0"	170.8	134.1
B 1	188.4	13'11½"	13'6"	0'5½"	168.6	132.1
B 2	190.2	13'10"	13'9"	0'1"	183.3	142.9
B 3	191.9	13'11½"	13'9"	0'2½"	170.9	134.9
B 4	194.1	15'4½"	12'7½"	2'9"	168.7	136.0
B 5	195.6	15'9"	12'5"	3'4"	168.4	134.8
B 6	198.3	14'4"	13'10"	0'6"	182.2	137.8
B 7	198.6	14'8½"	13'6"	1'2½"	177.8	134.8
B 8	201.3	16'0"	12'7"	3'5"	179.7	143.0
B 9	203.2	17'8"	11'6"	6'2"	183.2	145.9
B 10	204.4	16'5½"	12'5"	4'0½"	172.5	139.2
C 1	200.0	16'0"	12'6"	3'6"	206.0	140.0
C 2	200.4	16'3"	12'4"	3'11"	181.5	130.2
C 3	200.8	18'3"	11'0"	7'3"	180.1	142.9
C 4	201.2	17'0"	11'10"	5'2"	206.3	137.6
C 5	204.4	18'7"	11'0"	7'7"	218.9	139.6
C 6	205.1	16'1"	12'9"	3'4"	203.3	141.4
C 7	205.6	15'11"	12'11"	3'0"	174.7	127.3
C 8	205.6	17'7½"	11'8"	5'11½"	173.4	127.1
C 9	206.4	16'1"	12'10"	3'3"	216.1	149.9
C 10	208.0	17'4"	12'0"	5'4"	181.8	127.5
D 1	206.0	21'6"	9'7"	11'11"	178.1	119.2
D 2	211.7	21'8½"	9'9"	11'11½"	186.2	112.6
D 3	212.2	22'4"	9'6"	12'10"	183.8	116.7
D 4	213.1	22'10"	9'4"	13'6"	189.7	120.4
D 5	213.8	22'6"	9'6"	13'0"	181.0	129.2
D 6	216.1	22'9"	9'6"	13'3"	185.6	126.2
D 7	218.7	20'10"	10'6"	10'4"	215.9	114.6
D 8	219.3	23'1"	9'6"	13'7"	188.0	120.1
D 9	220.5	21'0"	10'6"	10'6"	224.5	119.9
D 10	221.2	21'7"	10'3"	11'4"	182.8	132.6
E 1	209.4	19'4"	10'10"	8'6"	208.3	117.3
E 2	209.9	19'1"	11'0"	8'1"	224.2	133.9
E 3	212.7	22'0"	9'8"	12'4"	172.8	126.6
E 4	213.0	17'9"	12'0"	5'9"	210.6	134.7
E 5	213.9	17'7"	12'2"	5'5"	187.5	113.9
E 6	214.0	19'9"	10'10"	8'11"	176.2	133.8
E 7	214.7	18'8"	11'6"	7'2"	223.9	136.9
E 8	216.9	18'4"	11'10"	6'6"	180.8	132.2
E 9	217.3	20'4½"	10'8"	9'8½"	172.6	130.3
E 10	219.5	19'1"	11'6"	7'7"	182.7	127.2

* See page 49 for definition.

† See page 47 for definition.

Table 9. TRIPS MADE BETWEEN PARTS OF KITCHEN. PROBLEM TWO.

Estimated number of trips made by worker in a year's time between each two pieces of equipment in a kitchen equipped with electric range, draft cooler, refrigerator, sink with adjacent cabinets on either side, mixing table with storage above and below it, floor-to-ceiling cabinet serving for both stove and mixing centers, and meal table. Computation based on study described on page 16 and on data in Table 4 of Appendix E.

Parts of kitchen	Trips	
	Number	Proportion of total <i>Per cent</i>
1. Sink bowl, and adjacent cabinets.....	42,298	24.1
2. Meal table, and serving end of sink unit.....	25,643	14.6
3. Stove, and floor-to-ceiling storage cabinet.....	12,255	7.0
4. Cabinets at right and left of sink.....	10,898	6.2
5. Meal table and nearest end of sink unit.....	9,665	5.5
6. Meal table and stove.....	9,409	5.4
7. Mixing cabinet, and floor-to-ceiling storage cabinet.....	8,337	4.7
8. Sink bowl and stove.....	6,483	3.7
9. Cooler, and serving end of sink unit.....	5,615	3.2
10. Cooler and mixing cabinet.....	4,880	2.8
11. Cooler and stove.....	4,794	2.7
12. Floor-to-ceiling storage cabinet, and nearest end of sink.....	4,108	2.3
13. Mixing cabinet and stove.....	3,765	2.1
14. Mixing cabinet and sink bowl.....	3,565	2.0
15. Refrigerator, and serving end of sink.....	3,386	1.9
16. Meal table and refrigerator.....	2,722	1.6
17. Stove and nearest end of sink unit.....	2,670	1.5
18. Stove, and serving end of sink unit.....	2,573	1.5
19. Cooler and sink bowl.....	2,395	1.4
20. Mixing cabinet and nearest end of sink unit.....	1,909	1.1
21. Refrigerator and other end of sink.....	1,593	0.9
22. Cooler and nearest end of sink.....	1,571	0.9
23. Sink bowl and floor-to-ceiling storage.....	1,329	0.8
24. Mixing cabinet and refrigerator.....	1,226	0.7
25. Refrigerator and stove.....	1,085	0.6
26. Mixing cabinet and serving end of sink.....	1,070	0.6
27. Cooler and meal table.....	365	0.2
	175,609*	100.0

* The total of 224,620 trips (Table 4) is accounted for as follows:

Requiring no steps (reaching or stooping only).....	40,625
Connections made less often than once a day.....	1,186
Connections with wood box.....	7,200
	224,620

Table 10. AREA, DIMENSIONS, AND TRAVEL ESTIMATES* OF THE KITCHEN OF EACH TYPE† WHICH HAS THE LOWEST AREA. PROBLEM TWO.

Type†	Area	Dimensions		Travel estimates per year	Difference in area in comparison with least-area kitchen for Problem One‡
		Length	Width		
	<i>Square feet</i>			<i>Miles</i>	<i>Square feet</i>
A.....	153.0	13'9"	11'1½"	152.1	-25.7
B.....	165.8	14'5"	11'6"	155.4	-22.6
C.....	173.8	14'0"	12'5"	167.8	-26.2
D.....	183.2	19'7½"	9'4"	159.3	-22.8
E.....	189.0	15'9"	12'0"	156.5	-20.4

* See page 49 for definition.

† See page 47 for definition.

‡ Data given on page 49.

Appendix F

SUPPLEMENTARY ILLUSTRATIONS

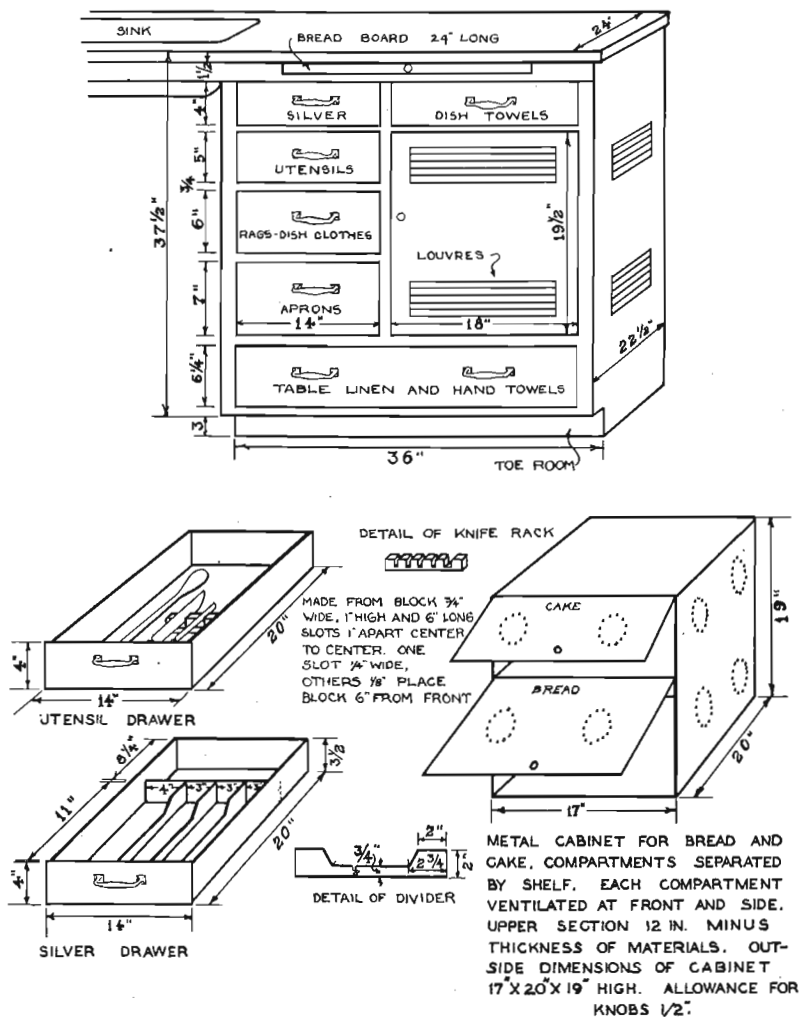


Figure 26. Dimensions of lower sink cabinet with drawers, illustrated by Figure 3, and allocation of available storage space.

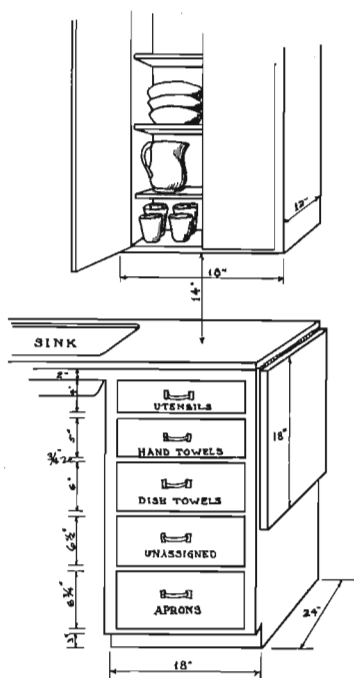


Figure 27. Dimensions of sink unit illustrated by Figure 7A, and allocation of available storage space.

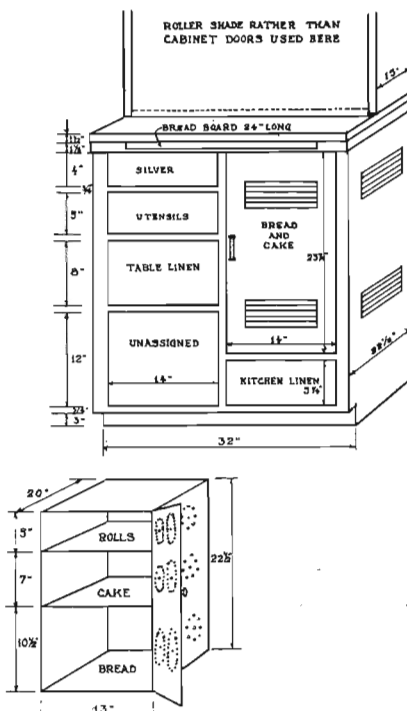


Figure 28. Dimensions of serving unit illustrated by Figure 7B, and allocation of available storage space.

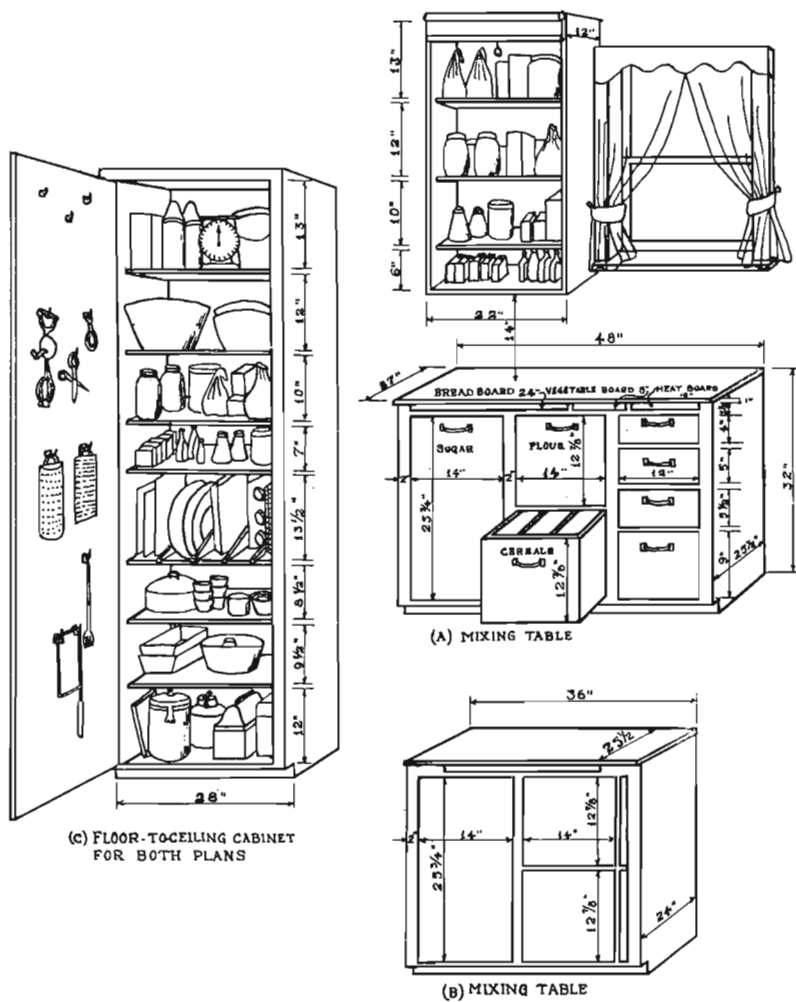


Figure 29. Dimensions and use of cabinets included in mixing-center plans. Detail of Figure 8.

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