

## THE ELECTRIC RANGE FOR THE HOME

## By Harriet C. Brigham



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## FOREWORD

The passing of domestic help has emphasized the need of improved equipment in the home. Manufacturers have been quick to sense this demand. As a result there is a bewildering number of models of household equipment on the market. The advantages of each kind are so well stated that the purchaser finds it difficult to make an intelligent selection. Furthermore, when a selection is made, she very often does not secure the services from it because of lack of knowledge as to the best way of caring for and operating the particular piece of equipment.

This bulletin has been prepared as a result of the many requests from housewives for information both as to the selection and operation of electric ranges.

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#### THE ELECTRIC RANGE FOR THE HOME

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A clean, safe, convenient method of cooking is afforded thru the use of an electric range. Electric heat is comfortable for the worker and is quickly and easily controlled giving a steady, reliable heat with no odors, fumes or soot.

The number of electric ranges in use has increased very rapidly in the last nine years. From 21,700 ranges sold in 1919 the number has increased to 147,000 in the year 1928. See figure 1. Consistently expanding electric lines bring the electric range to the rural home as well as to the urban home.

#### The Selection of an Electric Range

A prospective purchaser should consider the space in the kitchen allowed for the range. Direct light from the windows should fall on the cooking surface; for this reason the oven, if a high one, should be farthest from the windows, a left-hand or a right hand oven being selected accordingly. The size and type of range selected will be determined by the amount of cooking to be done and by the size of the space allowed for the range. Ranges may be purchased in many sizes and combinations, from a one or two unit plate or range attachment to a full sized range with water heater attached.

In small households where all the cooking is to be done, two plates and one oven are a minimum requirement, but for larger households more cooking space will be needed.

Ranges may be had in black, white, gray, and a variety of colors, plain or in combinations, but the color of the finish of a range is not a basis for wise buying. It should be remembered that it is possible to secure a black electric range at a cost from \$25 to \$50 less than a similar range in one or more of the various colors. While the colored ranges may be made to fit more easily into a charming color scheme which the present ideas of kitchen-planning emphasize, there is a question whether the additional cost is justified. A black range, skillfully handled, will fit into very delightful, subtle, and effective color schemes as well as do the colored ranges.

**Surface Units.** Surface units are used mainly for frying and boiling. Both open and closed types can be secured on most electric ranges. The open unit is composed of resistance wire laid in moulded high temperature refractores of special composition to resist sudden temperature changes. Some have an insulator covering behind the refractor to prevent downward heat radiation. The closed unit is composed of resistance wires enclosed within a metal

plate and the whole provided with an insulator on the bottom to prevent radiation downward as in the open unit. See figures 2 and 3. In either case nickel chromium is the resistance wire used. The closed plate may have a solid one piece top or may be divided having a small inner circle and an outer ring, either or both of which may be heated as desired. See left hand plate of figure 3.

Since an open type in most cases gives its heat more quickly and cools off more rapidly, it is advantageous for short time cooking



Fig. 2. Knife blade connections on units. Lower oven unit removed showing knifeblade connections, baffle or heat spreader is a part of the lower unit in this range.

processes. The closed-type unit heats somewhat more slowly but retains the heat for a longer time after the current is turned off. Consequently, it is adapted for long time processes or heavy service.

Units vary in the amount of heat they deliver, thereby allowing the user of the range to select the plate of the exact wattage best adapted to the particular work to be done. It is obviously wasteful to select a plate using 1500 watts for a job which a smaller unit could do just as well. East unit has a three-heat control. A unit turned to "medium" uses only one-half of the wattage used at "high" and then turned to "low" uses only one-quarter of the amount used at "high."

| Full heat  | Medium    | Low       |
|------------|-----------|-----------|
| 1800 watts | 900 watts | 450 watts |
| 1750       | 875       | 437       |
| 1500       | 750       | 375       |
| 1250       | 625       | 312       |
| 1000       | 500       | 250       |
| 990        | 495       | 247       |
| 800        | 400       | 200       |
| 750        | 375       | 187       |
| 660        | 330       | 165       |



Fig. 3. Range units: insulated cooker unit, inclosed unit, exposed or open unit. Vent, time clock and temperature control.

Having at least two sizes of units will tend toward fuel economy. If the range is equipped with two or more units, it will be worth while to have the larger plate back of the smaller ones where it will not be quite so convenient and hence will not be used when a smaller one might suffice. The usual unit, with the three-heat control when turned to high has the entire two elements on at a cherry red color. For medium one element or one-half the unit is on and at low both elements are on at one-quarter the heat.

In another type of unit the three heats are similarly controlled but the wires are so arranged that when turned to medium an inner circle only is heated. A smaller pan can be used with this heat.

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On nearly all ranges the units are removable which construction makes their cleaning easier. Available information indicates that the life of the open coil heating elements is approximately three to six years depending on the care and use to which they are subjected. Due to its construction, the life of the closed plate should be longer. Because it is a newer development, reliable life statistics are not available. The elements on most ranges are so constructed as to permit the heating coils to be easily replaced if damaged or worn out.

The switches controlling the units should be conveniently placed and marked so that a glance will tell whether the current is on or off. Those which may be turned in either direction are more convenient than switches turning in only one direction. Switches with three heats, high, medium and low, help to simplify manipulation of the heat during the cooking process.

In the majority of ranges the heating elements are connected to individual fuses (see definition of fuse page 20), within the range so that if the flow of electricity should be interrupted in one plate, the other plates will continue to function. Without such an arrangement, one burner having blown a fuse might stop the entire cooking process of the range until the blown fuse could be replaced. A master switch found on some ranges is used to disconnect the entire range from the circuit conveniently and safely.

Many ranges have a convenient outlet where such equipment as electric irons, percolators, waffle irons, washing machines, etc. may be plugged in and run on the same meter rate as the range. This circuit is fused separately and in some ranges its operation may be controlled by the automatic time clock attached to the oven.

The Oven. The oven should be considered as to location, size, lining, insulation and convenience. It is evident that the convenience of an oven at a good working height lies in the fact that the bending and stooping of the operator are eliminated. In some homes a large oven is desirable but the size of the oven purchased should depend on the amount and type of cooking to be done. The smaller oven is preferable for fuel economy.

Electrically heated ovens hold more moisture than do ovens heated by other fuels because of the nature of the heat and for that reason should be well protected from the corrosive action of heat and moisture. In the past, linings of ovens have been largely made of metals which have required special care to prevent rusting. The aluminum paint finish used on linings is not a permanent finish. In the cleaning process, the finish may be removed exposing the metal to rust. The older iron and steel linings have shown a decided tendency to rust. More recently a porcelain enamel has been used which is more permanent and is easier to clean. Zinc-coated rust-resisting steel, sheet aluminum and monel metal show little or no staining or rusting. Rounded corners, removable linings, shelves, units and racks in the oven facilitate the care of the oven.

Reduction of heat loss is particularly essential in electric oven construction. The door, top, floor and walls should be sufficiently insulated to retain the heat in the oven. The insulation is of a mineral fiber which withstands high temperatures and does not develop odors after using. Among the oven insulations in use are mineral or rock wool, diatomeceous or infusorial earth, bulk or cellular asbestos and others.

The oven door should fit closely. To prevent heat losses, the crack surrounding the door should be less than 1/16 inch. A door hinged at the bottom and supplied with good sturdy springs, is somewhat more convenient than the door that is hinged at the side.

Ranges of good construction have door hinges, springs, and latches made of durable material so that their life may be reasonably long as they are undergoing constant wear and tear in the use of the range. A comfortable handle on the oven door should fit well into the hand and should be made of material that will not warp, crack or heat.

The ovens of electric ranges are usually equipped with two heating elements, one at the top and one in the bottom. These should be removable so that they may be cleaned easily and in case of a burn-out, renewed easily. Ovens are made more convenient if they are supplied with removable baffle plates or heat deflectors. If the baffle plate is removed, care should be taken to see that it is placed directly above the lower unit when replaced. In some ranges the baffle is part of the lower oven unit.

The top heating unit of the oven is used for broiling, searing, toasting, browning, and to supplement the lower unit when a high temperature is needed quickly in browning or, in some ranges, for preheating. Seldom are both units used at the same time during the entire cooking process.

Thermostatically operated or manually operated vents are used on the oven to allow escape of excess steam. The electrically heated oven requires less ventilation than other ovens. Because no air needs to be brought into the electric oven to support combustion, no energy is required to heat excess air and there are no products of fuel combustion to be removed. Heat within an oven should be evenly distributed to insure good results. A considerable proportion of electric heat is diffused from the elements as radiant heat, passing to the food in straight lines unaffected by air currents. Convected heat is distributed by means of the air circulation within the oven.

The majority of range ovens are equipped with thermostatic regulators which maintain a uniform temperature at any degree for which they are set. They are used to obtain regulated oven temperatures. The operator has merely to turn on the electricity and to set the control dial on the outside of the oven at the desired temperature. The heating units stay on at full rating until the temperature is reached. Then by means of the thermostat the electricity is automatically cut off. This feature is a decided advantage for those who must be away during part or all of the cooking process.

The operator can maintain the desired temperature in the oven



Fig. 4. An even with thermostat.

without the thermostat by correct manipulation of the switches but in the long run it is probably worth the extra cost of \$14 to \$25 for the added convenience and economy of time, materials, foods and electricity. It is also important to remember that a thermostatic control will help to prevent too high temperatures which tend to warp and crack the oven and thus shorten its life.

A uniform product can be secured and consistent results assured by the absolute control of temperature made possible by the use of the thermostat.

"It has been estimated that automatic temperature control will lower the energy consumption of a range, as compared to one without, 25 per cent. Furthermore, it will remove many of the uncertainties of baking and is extremely valuable during the canning season."\*

With a thermostatically controlled oven, it is possible when one

is canning to place the containers of food on the racks in the oven as she would place a cake or pie, and heat the jars to the sterilization temperature cheaply and with little bother. In this case, the jars are prepared the same way as for the regular cold pack method (except that they are not filled so fully), put on the oven rack, and sterilized the required length of time.

Range ovens without temperature controls usually have a heat



Fig. 5. Use of range. Pressure cooker, triplicate pans and time control. Oven used to capacity conserves heat. Fuses beneath switches.

indicator or thermometer attached to them. This indicator is useful in telling whether the heat is on or off and gives some idea of the amount of heat present. The accuracy of an indicator is somewhat disturbed by the opening and closing of the door. It must be remembered that indicators do not control the oven temperature as do the thermostats.

A thermostat and a time clock connected to an electric oven make automatic cooking a possibility. See figures 3, 4 and 5. In one type of time control a pointer on the clock switches on the electricity at the time set and a second pointer functions at the time it is to shut off. Thus, the oven may be started and turned off at any predetermined time, the temperature control meanwhile func-

<sup>\*</sup> From Electricity on the Farm-Bul. IV, 1 p. IV. Jan. 1928. Committee on the Relation of Electricity to Agriculture.

tioning, and permitting accurate time and temperature cookery, even though the operator may be absent. Another type of time control is operated in a slightly different fashion. The time clock turns on the current as before. The thermostat turns off the current when the desired temperature is reached. The oven is constructed to retain cooking temperature long enough to finish the cooking operation without the current being turned on again.

The well insulated oven can be used in much the same way as a fireless cooker. Some ranges have a cooker-unit which may be substituted for a surface unit. This consists of a heating unit in a well-insulated compartment in which is placed the food or pans of food. This unit operating on the principle of maintained temperature may be used instead of the baking oven for certain long time cooking processes and can effect quite an appreciable saving.

As a summary under the selection of an electric range, let it be stated that one should not choose a range merely on its "good looks." Shelves, drawers, salt and pepper shakers, mirrors, and the like add materially to the good appearance of the range, but after all, they do not do the cooking. Consider the worth while parts of the range and the parts subject to the most wear, then look to the more unimportant accessories.

#### The Installation of an Electric Range

The consideration of the installation of electric ranges should begin when the kitchen is being planned in order that the purchaser may take advantage of the saving in wiring costs. The proper location of the outlet for an electric range is twelve inches from the floor. This makes possible the servicing of any range without difficult wiring.

The expense of installation of electric ranges varies from \$14 to \$75 per range in accordance with the code in effect and whether the feed wires have been installed at the time of wiring the building or after construction is completed. The usual wiring for electric ranges is three No. 6 copper wires when connected to a three-wire 110/220 or 115/230 volt circuit or two No. 4 wires when connected to a two-wire straight 110 or 115 volt line. The cost for the threewire connection is apt to be less than for the two-wire circuit because of the greater economy of copper in the smaller wires used in the three-wire circuit.

A range should not be connected to a circuit the voltage of which ever exceeds ten per cent above the normal voltage stamped on the heating unit. If the line voltage is below normal, the units will be slow in heating.

As a protection for the user against electrical shock, the range frame should be thoroly grounded by means of a No. 10 copper wire connected to the frame of the range with the other end connected to a convenient water pipe or any other metallic body embedded in the earth.

When connected to a properly grounded conduit system, the conduit will serve to ground the range frame. In some localities it is permissable to ground the range frame to the neutral wire.

A master switch which will disconnect the electricity from the range should be provided so that the current may be disconnected for repairs or cleaning, or as a safety precaution. This may be a part of the range or a separate switch near the range or meter box depending on the wiring of the kitchen. If one of the units fails to operate, it may be due to a blown fuse, a burned out unit, or a loose connection. After careful examination, if the trouble cannot be located, it is best to call a service man.

## The Operation of an Electric Range

A great deal of money could be saved in using an electric range if the operator would educate herself to apply the most economical methods. Each fuel and each cooking device requires a technique of its own, and unless this is understood and practiced, frequent disappointment is the result. The mere fact that a unit or an oven is electrically heated does not insure its successful operation. Electric heat must be conserved if cconomical operation is to be enjoyed.

Although books of instructions place emphasis on the special points to consider in the use of each range, there are a few general rules and suggestions that apply to electric range cookery which should be closely followed to obtain best results.

Use of the Surface Units. Most ranges have three or four units or burners on the cooking top. The selection and regulation of the plate for the particular job to be done is important. Each plate has three cooking speeds, high, medium, and low. A 1,000 watt unit turned to medium uses only half that wattage (500 watts) and on low, only one-fourth (250 watts). It is well to start the cooking on high and turn the switches to medium or low after the cooking is fairly started. Food will continue to cook after the switch is turned off until all the stored heat is used up. Rapidly boiling water does not cook food any more quickly than does slowly boiling water; in the open kettle the temperature is no higher than boiling regardless of the speed at which the liquid is boiling. Use the open unit for short time processes and the closed units for longer processes. With some units boiling will be maintained if the heat is turned off entirely for the last ten to fifteen minutes.

Though the time may be decreased somewhat by the use of a unit of higher wattage for a certain process, tests performed at Iowa State College show that the kilowatt-hour consumption increases correspondingly. The difference in cost in the use of smaller units for cooking is worth considering.

In the ordinary boiling process many persons use more water than is necessary. It is evident that the greater the amount of water used for the cooking process, the greater the amount of heat which will be required to accomplish that process. When a quart or pint of water is sufficient, do not heat a kettle full. From tests in the laboratory it was concluded that the nickled copper kettle heated most quickly on both open and closed units. Aluminum heated more slowly on an open unit than on a closed one; and enamel, on the other hand, heated more quickly on an open unit than a closed one. The aluminum kettle held the heat the shortest period on both units, the enamel and nickeled copper equally long on an open unit, enamel the most; aluminum cost the least on a closed one; enamel the most. Taking all these things into consideration, it may be concluded that in general the nickeled copper kettle would prove the most satisfactory teakettle to heat water on an electric unit.

By the use of flat-bottomed pans of the proper size and type, a saving in kilowatt-hours may be achieved. The principles given above relative to teakettles carry over to the use of pans on surface units. Be sure that the diameter of the pan at the cooking surface is equal to or a trifle larger than the heating unit so that there will be a minimum loss by radiation from the heating element.

Pans with slanting sides are relics of the days when ccal or wood stoves were used, at which time the pan was set down inside the holes in the cooking top. Slanting sides on pans are no longer required; in fact the straight sided pans present less surface for radiation and are therefore more desirable.

It is very necessary in purchasing pans for use on an electric range to secure a type heavy enough to prevent buckling. Tests have shown that the heavier pans heat as quickly as the lighter pans, and that they hold their contents at the boiling point longer than the lighter weight pans. A pan with a buckled or uneven bottom is very inefficient because so much heat can escape from under the pan. The utensil should have a close fitting cover for economy of time and fuel. Food in a closely covered utensil will reach the boiling point more quickly and will require less fuel to keep it boiling than will food in an uncovered pan.

Using a small amount of water with vegetables and using stored heat will help in the economical use of current.

Practically any vegetable may be cooked by putting it in a closely covered utensil and applying intense heat for a short period and completing the cooking on stored heat. The length of time the switch should be on high on a well insulated unit is approximately one-fourth of the cooking period, then the cooking is accomplished on stored heat. A large amount of product requires a longer period of applied heat in order to heat the substance through. It is unnecessary for vegetables to be even partially immersed in watervegetables in steam cook as quickly and as well. "Less water" cooking preserves soluble minerals, protein and sugar which are often thrown away in water. Green vegetables lose their color slightly if cooked in a tightly covered utensil unless steam is allowed to escape. With the exception of green vegetables do not open the container during the cooking period as heat is lost through escaping steam.

Duplicate and triplicate pans which fit together well can effect a saving of fuel. They can be used to the best advantage if they are used to cook more than one food with the heat from one unit.

A homemaker who has a pressure cooker will find that wherever it can be used in combination with an electric range it will be advantageous.

It has been found that a fireless cooker is used much less after the installation of an electric range on account of the fact that the insulated oven takes the place of the fireless cooker. In some ranges there is an insulated cooker unit combined with the range or inserted in place of a surface unit. This cooker can help materially to decrease the cost of operation of the range.

Care in the selection of pans to be used in baking to make them fit most advantageously into the oven space will enable one to use the oven to better advantage. Pans with flat covers are particularly good because they can be stacked one on top of the other in the oven.

**Use of the Oven.** As often as possible the oven should be filled to capacity. See figure 5. This is more easily accomplished if menus are planned in advance and foods cooked for several meals at one time. The oven can be used to better advantage if the pans selected for oven cookery have straight sides and flat, tight fitting covers. The flat covers make it possible to stack the pans one on another and the tight-fitting covers help to retain the moisture so that less water is used than was required with older methods. With pans of this kind, fresh fruits and vegetables may be cooked without water or with water to the depth of one-fourth inch in the pan. Dried fruits or vegetables should have sufficient water to cover but need no previous soaking.

For some processes the oven must be preheated. Preheat according to the directions which come with the range. Avoid over-heating the oven or preheating it before the food is ready to be put in the oven. The temperature continues to rise 25 to 50 degrees following the turning of the oven switch provided the oven door is kept closed. Allowance should be made for this when manipulating the switches. In ovens with time and temperature controls, the temperature is regulated automatically.

Do not open the door unnecessarily. Tests have shown that in an oven heated to 500 degrees F. when the door is open for one minute, 50 degrees of heat are lost. A properly regulated oven does not need watching.

After the oven is preheated to the desired temperature, the food is placed in it and the cooking temperature maintained either by th automatic controls or by regulating the switches. Practically all baking or roasting can be completed on stored heat at a slowly lowering temperature. Oven units may be off for the latter part of the cooking period, the time depending on the effectiveness of the oven construction and insulation.

When several foods requiring different temperatures are to be baked, start with the operation requiring the lowest temperature. As each food is removed from the oven, it requires but a few minutes to heat the oven to the higher temperature. This process gives better results and is more economical than when the process is reversed.

Preheating is unnecessary in some ranges with such foods as biscuits, muffins and cup cakes. By removing the baffle or by baking them on a rack directly over the baffle plate, foods can be baked in a shorter time and with less current than when baked in a preheated oven.

Meat may also be started without a cover in a cold oven and when the desired temperature is reached, cooked uncovered at a moderate temperature until done. No water should be used in the roaster pan. Tests at Iowa State College have shown that the meat is as juicy and full flavored as meat seared and cooked in a preheated oven. Less current is consumed when the roasting is begun in a cold oven than in a preheated one.

No better broiling can be done than in an electric range. The top unit or broiler may or may not be preheated on high before the meat is put in. The meat is seared quickly on each side and not turned again until done unless it is very thick. Piercing the meat with a fork will cause loss of juice.

For ordinary baking the manually operated vent should be half open; for broiling or roasting or for an operation releasing an excessive a mount of steam, the vent should be entirely open. When the oven is not in use, the vent should be left open to allow for the evaporation of any moisture.

After food is removed from the oven, dish water may be heated with the receding heat. The oven door should be left open after use until the oven is cool.

Follow the directions as set up by the manufacturer unless they prove unsatisfactory. All ranges work somewhat differently, and it is advisable to know your range thoroughly in order to obtain satisfactory results.

## The Care of the Electric Range

The time to begin taking care of an electric range is at the moment it enters the house. Not only will the range present a better appearance, with adequate care, but it will give less trouble and better results. With proper daily care, the life of a range can be prolonged and its good finish maintained. Some of the careless practices which impair the appearance or make replacements necessary are as follows:



Fig. 6. To clean open units. Burn spilled food from a surface unit by inverting a pie tin over the unit and turning the switch to high until food is charred. Straight sided pan which fits unit. Closed divided unit.

- 1. Spilling food on the elements and in the oven.
- 2. Use of sharp instruments in cleaning the elements.
- 3. Mechanical injury to open coils.
- 4. Setting vessels directly on open oven units.
- 5. Dirt and grease in wires.
- 6. Use of steel wool in cleaning the units.
- 7. The use of strong abrasives on the outside finish or on the oven lining.

Since these points are recognized as being paramount in the maluse of an electric range, some timely suggestions on proper care of the range may be presented.

**Outside Finish.** Since no smoke or soot are involved in the use of an electric range, the cleaning of the external part of it is a simple process. For cleaning the enamel, a soft cloth with soap and warm water are adequate. If an abrasive is necessary, a very fine one should be used (00 steel wool). Coarse abrasives remove or scratch the surface. If spots and stains are washed off while they are fresh, an abrasive is seldom necessary. Vinegar, sour milk, or lemon juice should not be allowed to remain on the enamel any length of time, because such acids will stain and remove the gloss even though they do not affect the wearing qualities of a good enamel.

Black japan finish may be washed with soap and water. If, after extended use, the finish wares off, it may be treated with a cloth SLIGHTLY dampened with oil, or the metal may be re-enameled. It is not advisable to use an oily blackening on an electric range.

An excellent cleaner for the nickel trimmings is a mixture of whiting and alcohol. The nickel may be washed first with soap and water.

**Surface Units.** Open units because of their general construction present a definite problem in the care of an electric range. The best method of removing food that has boiled over on an open unit is that of placing an ordinary pie tin, bottom-side up over the unit and turning the current on high to allow the food to burn out. See figure 6. Scrubbing or scraping open units with a sharp instrument is a sure means of damaging them. A soft brush may be used if manipulated carefully. A vacuum cleaner attachment is successful for removing crumbs.

Enclosed units may be cleaned by scraping and then polishing with steel wool.

It is advisable not to use asbestos mats on the top heating units. The heat is retained by them to such an extent that it is apt to melt the heating coils and in such a case replacement would be necessary. Use the low heat instead under a flat bottomed utensil of good weight.

**The Oven**. As yet there has not been developed a cleaner that works successfully on all types of ovens and for all types of stains. The majority of oven stains are burned food or carbon, which very often forms an insoluble compound with the metal of the oven lining. If burned food is removed as soon as the oven has cooled, it is somewhat more easily done.

From a steel or iron oven with an aluminum paint finish it is almost impossible to remove stains without removing the aluminum finish, which would expose the under metal to rust. With this sort of finish, soap and water are the only reagents that can be used which will not immediately remove the aluminum paint. Even continued use of soap and water will eventually take the finish off so that it will be necessary to repaint. Oven linings such as enamel, stainless steel and aluminum may be cleaned with soap and water or mild abrasives, steel wool, commercial cleaning powders, or sodium phosphate. All such cleaners require a great deal of "elbow grease" in order to be wholly efficacious with persistent stains; they are apt to remove the glazed finish of the lining material.

The door should be left open slightly after the oven is used to

allow the moist air to escape. If the oven lining is of a material that rusts, it should be rubbed over once or twice a month with a slightly oiled cloth. To prepare this cloth, sprinkle a few drops of oil on a cloth and shut it up in a tightly covered jar or can to allow the oil to diffuse throughout. A cloth prepared in this way does not carry enough oil to the oven lining to cause the oven to smoke when heated.

Ovens are often oiled at the factory for protection in shipping. Before using a new oven, turn both oven units on full until the temperature reaches about 400 degrees F. Then turn off both elements and allow the oven to cool; this will remove any odors that may be in a new oven. If metal comes in contact with the wire coils of the elements, there is a danger of short circuiting the coils, thereby causing them to burn out. For this reason, it is well to use kettles without legs or metallic accessories, which might touch the coils.

The oven should not be used as a storage space when the range is not in use. The moisture constantly evaporating from the stored food will tend to rust a metal oven or the metal racks in the oven.

Repair cost is definitely related to the care given to the range.

#### APPENDIX

#### DEFINITION OF ELECTRICAL TERMS

To obviate any misinterpretation of the material presented it might be well to clarify and define a few of the more technical terms used.

- 1. Watt: The unit of measure of electric power, or a rate of doing work.
- **2. Kilowatt:** A larger unit of electric power which is equal to 1,000 watts. Its symbol is kw.
- 3. Kilowatt-hour: The product of the time in hours and the watts used divided by 1000. Example: 500 watts used for two hours equals one kilowatt-hour. Its symbol is kw-hr.
- 4. Volt: A volt is the unit of electrical pressure or electromotive force. The lighting circuits are usually 115 volts, range circuits 115/230 volts.
- 5. Ampere: An ampere is the measure of the rate of flow or a unit of electric current strength.
- 6. Fuse: A wire, bar or strip of fusible metal inserted for protection in an electric circuit. When the current (ampere) increases beyond a certain allowable amount the metal melts breaking the circuit and thereby preventing the possibility of danger from fire or electrical shock.
- 7. Thermostat: A mechanical device for automatically regulating temperature. Where a continuous temperature is to be maintained, the thermostat functions to switch off the current when desired temperature is reached and to switch it on again when the temperature recedes. It may be constructed to turn off the current at a pre-determined temperature, when the desired temperature is reached, and to not turn it on again. The thermostat when properly set acts also as a safety factor by preventing excessive temperatures.
- 8. Electrical Heat: The resistance of a conductor (solid, liquid, or gas) to the flow of a current of electricity develops heat from electrical energy. Energy is a form of molecular vibration which increases in velocity as heat is added or decreases as heat is removed from a substance, thereby expanding or contracting the substance accordingly.
- 9. Heating element or unit: That part of the electric range

composed of fine wires through which the electricity flows and from which heat is liberated. The unit may be in the oven or on the top surface of the range. A heating element or unit is also called a hot-plate, heating-plate, surface-unit, or oven unit.

- 10. Baffle: A movable or stationary metal shelf in the oven placed directly above the heating unit to distribute the heat evenly.
- 11. Oven vent: An opening which allows the escape of excessive moisture from the oven. Some ranges are equipped with a thermostatically controlled vent which functions automatically when the range is in use.
- 12. Preheating: The process of securing the desirable initial temperature before food is placed into the oven.

#### Rate Schedules

There are several types of rate schedules in use but the three most common in Iowa are:

- 1. Separate meter rates
- 2. One meter rate
- 3. Demand form of rate

Under the separate meter schedule, there are two separate meters installed, one for the light circuit at one rate, the other for the cooking circuit at a lower rate, with a minimum monthly charge for each meter. A discount is allowed on the amount consumed if paid in a specified time. This discount does not affect the minimum charge.

Example:

(a) Lighting rate.

| · |                          |     |     |        |
|---|--------------------------|-----|-----|--------|
|   | First 20 kw-hr. or less  | 10e | per | kw-hr. |
|   | Next 80 kw-hr. or less   | 9e  | per | kw-hr. |
|   | Next 100 kw-hr. or less  | 7c  | per | kw-hr. |
|   | Over 200 kw-hr.          | 5e  | per | kw-hr  |
|   | Minimum charge per month |     |     | \$1.00 |

- (c) A cash discount of 10 per cent is allowed on amount consumed if bill is paid within ten days from the date of the bill. This discount does not affect the minimum charge.

| 2 | 2 |  |
|---|---|--|
|   |   |  |

Illustration:

| "A" uses 29 kw-hr. per mo. for lighting and  |        |
|--|--------|
| 123 kw-hr. per mo. for cooking and appliance | s .    |
| (a) Lighting                                 |        |
| First 20 kw-hr. @ 10c                        | \$2.00 |
| Next 9 kw-hr. @ 9c                           |        |
|  | \$2.81 |
| (b) Cooking                                  | φ=.03  |
| 123 kw-hr. @ 4c                              | 4.92   |
|  | ·      |
| Total  | \$7.73 |
| Discount of 10 per cent if paid in 10 days   |        |
| Net total paid                               | \$6.96 |

(Both the \$2.81 and \$4.92 are above the minimum for each meter.)

Under the one meter rate, one meter is installed with all electricity at a certain rate with a fixed charge. There is also an optional rate with a higher fixed minimum charge which charge includes a specified number of kilowatt-hours. All electricity in excess of this first number of kilowatt-hours is charged for at a low rate per kilowatt-hour. The charges and rates are net. Bills not paid within a specified time are increased by certain specified percentages.

#### Example:

| (a)   | Franchise rate. All electricity at 8c per kw-hr.  |          |
|-------|---|----------|
|       | Minimum charge per month\$1   | 1.1      |
| (b)   | Optional rate.  |          |
| . ,   | Minimum charge per month  | 1.8      |
|       | includes the first 60 kw-hr. of energy.   |          |
|       | All over the first 60 kw-hr. per kw-hr.   | 2.6      |
|       | All residence appliances, such as ranges, refrigerate   | ors      |
|       | lights and small appliances, included in this rate.   |          |
| (c)   | Charges and rates are net.  |          |
| (-)   | Bills not paid within ten days after rendition are<br>creased ten per cent on the first ten dollars and t<br>per cent on amounts in excess of the first ten dollars | in<br>wo |
| Illus | tration   |          |
| "B'   | ' uses 29 kw-hr, per month for lighting and   |          |
| 10    | 123 kw-hr, per month for cooking and appliances   |          |
| (a)   | Franchise residence rate  |          |
| (4)   | 152 kw-hr. @ 8c per kw-hr. \$12   | 16       |
|       | Minimum   | .15      |
| (b)   | Optional rate   |          |

| optional rate |        |      |       |    |       |      |
|---------------|--------|------|-------|----|-------|------|
| Minimum       | charge | plus | first | 60 | kw-hr | 4.85 |

| 152-60 = | 92 ] | kw-hr. | a | 2.6c 1 | per | kw-hr | 2.39 |
|----------|------|--------|---|--------|-----|-------|------|
|----------|------|--------|---|--------|-----|-------|------|

\$7.24

"C" uses 29 kw-hr. per month for lighting only.

(a) Franchise residence rate

| 29 kw-hr. | @ | 8c : | per | kw-hr | \$2. | .3 | 2 |  |
|-----------|---|------|-----|-------|------|----|---|--|
| Minimum   |   |      |     |       | 1    | 1  | 5 |  |

Evidently the Optional rate would be preferable for "B" while the Franchise residence rate would be most advantageous for "C."

With the demand form of rate in use, the customer pays a monthly service charge plus an energy charge. The service charge is proportional to the size of the transformer and constitutes the minimum monthly bill. The energy charge is based on a graduated scale.

#### Example:

| (a | ) Serv | vice cl | harge ( | or | minimum | monthl | y b | ill) | ) |
|----|--------|---------|---------|----|---------|--------|-----|------|---|
|----|--------|---------|---------|----|---------|--------|-----|------|---|

|   | Tran   | sforn  | ner c | apac  | ity red | quired | l not | more  | than 11/2 KVA  | \$3.00 |
|---|--------|--------|-------|-------|---------|--------|-------|-------|----------------|--------|
|   | Over   | 11/2   | and   | not   | more    | than   | 3     | KVA   |                | 4.00   |
|   | ,,     | 3      | "     | ,,    | ,,      | ,,     | 5     | "     |                | 5.00   |
|   | ,,     | 5      | ,,    | ,,    | ,,      | "      | 71/2  | "     |                | 6.00   |
|   | . ,,   | 71/2   | ,,    | ,,    | ,,      | ,,     | 10    | "     |                | 7.00   |
|   | (b)    | Ene    | rgy ( | char  | ge      |        |       |       |                |        |
|   | For t  | the fi | rst 5 | 0 kw  | -hr. u  | sed p  | er m  | onth  |                | 7.5c   |
|   | For a  | all in | exce  | ess o | f 50 k  | w-hr.  | per   | montl | 1              | 3.5c   |
| 1 | the on | arow   | ahar  | ero e | a dien  | ount   | of O  | 50 no | r bu hr is all | bown   |

On the energy charge a discount of 0.5c per kw-hr. is allowed if the bill is paid within 14 days from the date of the bill.

#### Illustration

| "D" has a 11/2 KVA transformer and uses 152 kw-hr. |         |
|--|---------|
| Service charge for 1½ KVA transformer              | \$ 3.00 |
| Energy charge for 50 kw-hr. @ 7.5c                 | 3.75    |
| Energy charge for 102 kw-hr. @ 3.5c                | 3.57    |
| Total bill   | \$10.32 |
| 152 kw-hr. @ 0.5c per kw-hr                        | 0.76    |
|  |         |

Net total paid .....\$ 9.56

Discount on energy charge if paid within 14 days 0.5c per kw-hr.

#### Consumption Costs for Ranges in Use

Ames Range Survey 1928. In order to determine some of the characteristics of electric range cooking, a survey was made at Ames, Iowa, covering the period July 1927 to June 1928. The energy consumption records were obtained from the City Clerk's office and such cooking data as could be obtained were received from the housewives operating electric ranges. This survey includes

165 electric ranges. Care was taken to eliminate those ranges used in commercial cooking, and the 165 records include only household cooking meter readings.

Under the rate plan used by the municipal plant at Ames, customers are allowed to operate certain household appliances, such as cleaners, irons, waffle irons, toasters, heating-pads, percolators, and fans from the same meter which measures the consumption of the electric range. Under the Ames rate plan, there are two meters, one which measures the energy used by the electric range and such appliances as the owner may operate from this circuit. The energy used through the cooking meter is paid for at a special-low rate.

The purpose of this survey was to show the consumption of the average household electric range, and to correlate this consumption with the number of persons in the family, and to show, if possible, the variation in this consumption due to special electric equipment.

Table 2 summarizes the main data received and is divided into groups by size of family. In Table 1 the energy consumption is summarized by months for the period covered. It should be understood, however, that the consumption as listed is not that actually used from the first to the last of the month, but covers the meter reading period which normally was 30 days. It is the practice of the meter reader to start work about the first of the month and work continuously until the city is completed, usually about the 25th day of the month. Since the meter reader began work about the first day of the month and concluded his readings the 25th, the average reading date would be near the 13th day of the month, which would give a consumption from the 13th of the preceding month to the 13th of the month indicated in Table 1. The months shown in Table 1 are approximate only and vary from about 26 to 33 days.

From figure 7 the relative consumption by approximate months may be obtained.

The curve for the cooking energy consumption indicates that there is considerably less energy used during the winter months than during the other seasons. This is no doubt due to the practice of heating water thru the furnace coil and of using coal or oil ranges during the winter season. The two lower curves, indicating the energy consumption for lighting follow the customary curve for the seasons, showing that considerably more energy is burned for light during the winter months than during the other months.

The bottom curve indicates the energy consumption for lighting in homes having a cooking rate meter. The comparison of this with the middle curve, where no cooking meter was installed, shows that the customers transfer some appliance load to the cooking meter as soon as they have the opportunity. See Tables 1 and 2 for further data.

It is interesting to note the lower energy consumption for light-

ing by those families having the special range meter. The middle curve is for those homes in which there was no special cooking meter installed and it shows almost 6 kw-hr. a month more con-





sumption than in the homes where there was a cooking meter installed. This indicates that the customers transfer some appliance load to the cooking meter as soon as they have the opportunity.

Figure 8 shows the variation in energy consumption for cooking and for lighting according to the number of people in the family. Both curves show a continual decrease per person as the number in the family increases.

How to read the chart: For a family of three persons, follow the

vertical line upward at the figure three until it is crossed by the curved lines, then follow the horizontal line to the left and note that the light meter for a family of three reads 10 kilowatt-hours consumed per person per month while the cooking meter indicates 40 kilowatt-hours per person per month. See Tables 1, 2, 3, for further data.

Table 3 summarizes the electrical appliances and range attach-





ments found in the 165 families. The most popular electric appliance was the iron, which was used by over 80 per cent of the families surveyed. The electric toaster, the vacuum cleaner, the percolator, the washing machine, the waffle iron, and the radio were other popular appliances. Sixty-three per cent of the families had an appliance outlet attached to the range, and 64 per cent used a temperature control, but only 22 per cent had a time control.

An attempt was made to correlate the energy consumption of the range with its age. The result, however, indicated that there was no difference in consumption.

The average family energy consumption for electric cooking was 120.4 kw-hr. a month. This average is slightly less than the average obtained at the City Clerk's office for all of the meters on this special rate. This is due to the elimination of meters which were used in commercial work. The average light energy consumption of the same families amounted to 29 kw-hr. a month, while the average for lighting consumption of families not having the special cooking rate meter was 34.9 kw-hr. a month.

Garner Rural Studies. A detailed study of electric range use was made in the eleven farm homes of the Iowa Project on Rural Electrification at Garner, Iowa, thru the cooperation of the Engineering Experiment Station and the Household Equipment Department of Iowa State College. Tables 4 and 5 and figures 9, 10 and 11 show the kilowatt-hour consumption for these ranges. The ranges were placed, separately metered, and instructions given for their use. Every attempt was made to have the home-makers use them as they would ordinarily use any other range, with the necessary precautions for their efficient use. The results show that there was a great difference in the methods used in cooking on these ranges as indicated in the wide variation of the amount of current consumed. Several installations are shown in figures 12, 13, 14 and 15. One family used one-fifth to one-half as much current for cooking on the same type range as another family of similar size. On all the farms there was an increase in kilowatt-hour consumption during the canning and harvesting seasons.

It was also true that during the winter months where the coal range was used for heating the kitchen, there was a decided drop in current consumption on the electric range.



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Fig. 9. This chart indicates the proportion of energy used for various cooking and heating requirements. The range was used in a typical farm home. The energy required for heating water on the range accounts for nearly half of the energy used by the range. For low energy consumption on the electric range, this chart indicates that some means other than the surface units of the range should be used for the heating of water. This chart also shows the proportion of energy used by the insulated cooker, the surface units, and the oven.



ig. 10. This graph indicates two special forms of electric range equipment which were well liked by the cooperators. The combination coal and electric range was used for all cooking. There was no coal or wood range used a part of the time as was the case with the other range cooperators. The two-plate range attachment was operated mainly during the hot summer weather in much the same way that kerosene equipment would be used.

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Fig. 11.

Fig. 12. Two-plate and oven range attachment. This type of electric cooking appliance has proven very satisfactory in the farm home.

Fig. 11. This chart shows three typical records obtained on the cooperators' farms. The equipment on the Ed Boehnke farm consisted of a two-plate and oven electric attachment for the coal range. Its use was mainly for cooking during hot weather, although it was used to some extent for quick service. The range on the Roy Lawhorn farm was used in conjunction with a 50gallon automatic electric hot water heater. The chart indicates that this heater keeps the entire energy consumption of the electric range at a minimum because of the fact that the range was used less for heating water. The range of the Louis Quintus farm was used for practically the same service as that of the coal range. Quantities of water were heated on the surface units during the warmer months when the furnace was not fired and warm way the fired in the surface was not fired.

The range of the Louis Quintus farm was used for practically the same service as that of the coal range. Quantities of water were heated on the surface units during the warmer months when the furnace was not fired and warm water was obtained in that way. To some extent the water front of the coal range was used during the warmer months for heating water. A part of the time it was the practice to get breakfasts on the coal range and use the electric range for dinners and suppers, the morning fire taking care of warming the water for a part of the day.

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Fig. 13. Combination coal and electric range with water heating front attached.
Fig. 14. Two-unit range attachment used with coal range. Notice handy sink, water supply, dish-drainer and utensils. Water heated by coal range.



Fig. 15. A specially metered range. Notice the five meters mounted under it. One plate used for all water heated on this range. Range equipped with an economy cooker,

| No.<br>in<br>fam-<br>ily  | No.<br>of<br>fam-<br>ilies   | July<br>1927   | Aug.  | Sept.   | Oct.  | Nov.   | Dec.   | Jan.<br>1928  | Feb.   | March  | April  | May  | June   | Total<br>Kw-hr.<br>for<br>year   | Month-<br>ly Ave.  | Kw-hr.<br>per<br>person<br>per<br>month   |
|---|--|--|---|---|---|--|--|---|--|--|--|--|--|--|--|---|
|   |  |  |   |   |   | Group 1  | . Speci  | al Cooki  | ing Rate   | e Meters   |  |  |  |  |  |   |
| $     \begin{array}{c}       1 \\       2 \\       3 \\       4 \\       5 \\       6 \\       7 \\     \end{array} $ | $     \begin{array}{r}       7 \\       48 \\       46 \\       34 \\       25 \\       2 \\       3       \end{array} $               | $ \begin{array}{r rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$ | $\begin{array}{r} 86.4 \\ 102.7 \\ 117.3 \\ 134.1 \\ 127.3 \\ 111.5 \\ 237.7 \end{array}$ | $\begin{array}{r} 87.4 \\ 111.2 \\ 128.2 \\ 151.4 \\ 136.6 \\ 167.0 \\ 168.0 \end{array}$ | $\begin{array}{r} 73.9 \\ 101.6 \\ 116.4 \\ 146.7 \\ 144.0 \\ 163.5 \\ 177.0 \end{array}$ | $\begin{array}{c} 80 \ 9 \\ 98.6 \\ 129.7 \\ 156 \ 8 \\ 155.5 \\ 169.5 \\ 202.0 \end{array}$ | $\begin{array}{r} 63.6\\87.1\\116.4\\139.0\\136.5\\147.5\\181.7\end{array}$  | $\begin{array}{r} 63.4\\ 89.4\\ 114.6\\ 138.2\\ 143.0\\ 117.5\\ 195.3\end{array}$ | $\begin{array}{r} 66.4\\ 91.3\\ 115.0\\ 144.5\\ 146.6\\ 132.5\\ 202.7\end{array}$    | $\begin{array}{r} 63.1 \\ 80.4 \\ 104.7 \\ 130.8 \\ 138.0 \\ 113.5 \\ 177.3 \end{array}$ | $\begin{array}{r} 61.1\\ 96.9\\ 118.8\\ 139.1\\ 167.3\\ 120.5\\ 198.3 \end{array}$ | $     \begin{array}{r}       103.6 \\       91.8 \\       113.3 \\       130.1 \\       139.7 \\       124.5 \\       187.7 \\     \end{array} $ | $\begin{array}{r} 126.7 \\ 102.7 \\ 127.4 \\ 139.0 \\ 146.4 \\ 160.5 \\ 238.3 \end{array}$ | $\begin{array}{r} 961.8\\1153.2\\1432.0\\1688.4\\1705.0\\1649.0\\2370.1\end{array}$    | $\begin{array}{r} 80.1 \\ 96.1 \\ 119.3 \\ 140.7 \\ 142.1 \\ 137.4 \\ 197.5 \end{array}$ | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$                                |
|   | 165  | Wt.<br>Ave. 121.4                                      | 118.8   | 128.8   | 122.8<br>Group  | 129.9<br>2. Lig  | 114 9<br>shting M  | 115.8<br>leters of  | 118.7<br>families  | 107.7<br>s in Gro  | 123.0<br>up 1.   | 115.6  | 127.9  | 1444.3   | 120.4  |   |
| $     \begin{array}{c}       1 \\       2 \\       3 \\       4 \\       5 \\       6 \\       7     \end{array} $    | $     \begin{array}{ c c }       7 \\       48 \\       45 \\       34 \\       24 \\       24 \\       2 \\       4     \end{array} $ | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | $\begin{array}{r} 28.7 \\ 13.5 \\ 18.6 \\ 17.5 \\ 15.5 \\ 15.0 \\ 17.5 \end{array}$       | $13.4 \\ 17.7 \\ 20.2 \\ 21.1 \\ 21.4 \\ 20.5 \\ 20.0$                                    | 38.5<br>27.2<br>29.6<br>30.7<br>37.1<br>33.0<br>35.5                                      | $51.2 \\ 29.5 \\ 37.3 \\ 36.7 \\ 46.0 \\ 50.0 \\ 46.7 $                                      | $\begin{array}{r} 40.2\\ 35.7\\ 39.5\\ 41.1\\ 46.6\\ 76.0\\ 48.5\end{array}$ | $\begin{array}{r} 36.0\\ 36.6\\ 40.5\\ 46.4\\ 48.1\\ 53.5\\ 47.8\end{array}$      | $     38.8 \\     33.7 \\     38.8 \\     50.1 \\     48.3 \\     47.0 \\     50.7 $ | $\begin{array}{r} 34.6\\ 25.8\\ 30.2\\ 32.2\\ 36.3\\ 27.0\\ 38.8 \end{array}$            | $\begin{array}{r} 30.2\\ 22.8\\ 30.0\\ 27.7\\ 41.9\\ 28.5\\ 37.2 \end{array}$      | $\begin{array}{r} 22.1 \\ 19.0 \\ 21.8 \\ 22.3 \\ 27.3 \\ 23.5 \\ 27.3 \end{array}$  | $\begin{array}{r} 28.7\\ 18.2\\ 20.3\\ 21.3\\ 24.6\\ 26.5\\ 23.0\\ \end{array}$            | $\begin{array}{r} 377.0\\ 292.9\\ 347.6\\ 353.5\\ 411.7\\ 428.5\\ 407.0\\ \end{array}$ | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$                                   | $ \begin{array}{c c} 31.4 \\ 12.2 \\ 9.7 \\ 7.6 \\ 6.9 \\ 5.9 \\ 4.8 \\ \end{array} $ |
|   | 164  | Wt.<br>Ave. 17.4                                       | 16.8<br>G   | 19.6<br>roup 3.   | 30.8<br>Lighti  | 37.1<br>ng Mete  | 405<br>rs of fa  | 41.8<br>milies N  | 41.4<br>IOT hav  | 30 6   | 29.3<br>cing rat   | 22.1<br>e meters   | 21.0   | 348.4  | 29.0   |   |
|   | 167  | Wt.<br>Ave. 23.9                                       | 24.5  | 26.1  | 34.1  | 44 6   | 46.5   | 47.0  | 46.3   | 36.1   | 34.5   | 27.6   | 27.5   | 418.6  | 34.9   | · · · · ·   |

TABLE 1. AVERAGE ELECTRIC METER READINGS IN KILOWATT-HOURS OF RESIDENTS IN AMES, IOWA.

1.1

Wt. Ave.-Weighted average.

|   |  |   | Ra   | nge F  | acts   |  | bers)   | ocrs)   |   |  | Ene   | ergy  |
|---|--|---|--|--|--|--|---|---|---|--|---|---|
|   | -  |   |  |  | its  | nits   | Imnu  | 1 miles   |   | Carlo Martin   | Kw  | -hr.  |
| Family Number   | Children Below High<br>School Age                        | Occupation of Head<br>of Family   | Cost New (Dollars)   | Years Used   | No. Open Surface Un  | No. Closed Surface U   | Range Attachments<br>(See table 3 for<br>corresponding 1  | Appliances Used<br>(See table 3 for<br>corresponding 7  | Amount<br>Baking<br>Done  | Amount<br>Water<br>Heated<br>Daily<br>Gallons                                  | Yearly Total  | Monthly Average   |
|   |  |   |  |  |  |  | Family  | of 1 Person   |   | cunons   |   |   |
| $     \begin{array}{r}       101 \\       102 \\       103 \\       104 \\       105 \\       106 \\       107 \\       \end{array} $ | 0<br>0<br>0<br>0<br>0<br>0<br>0                          | Professor<br>Professor<br>Dressmaker  | $ \begin{array}{c} 115\\ 106\\ 210\\ 160\\ 100\\ 87.50\\ \end{array} $ |  | $\begin{vmatrix} 3\\0\\3\\3\\3\\3\\2 \end{vmatrix}$                              |  | $ \begin{array}{r} 3-4 \\ 4 \\ 3-4-5 \\ 4 \\ 3-4 \\ 3.4 \\ 1 \end{array} $  | $ \begin{bmatrix} 10 \\ 10.15-13.7 \\ 6.8.10.15.24.20.17-13.21 \\ 10.15.24.20 \\ 0 \\ 10.14.15.20.21 \\ 10.20.21.7 \end{bmatrix} $  | Little<br>Little<br>0<br>Little<br>Little<br>Little                                 | Little<br>Little<br>Little<br>Little<br>Little                                 | $ \begin{array}{r} 399\\779\\1295\\683\\330\\2492\end{array} $  | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  |
| Ave.  |  |   |  |  | İ  |  |   |   |   |  | 961.8   | 80.1  |
|   |  |   |  |  |  |  | Family  | of 2 Persons  | 1.1   |  |   |   |
| 201<br>202<br>203<br>204<br>205<br>206<br>207<br>208<br>209<br>210<br>211   | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | Retired<br>Retired<br>Retired<br>Uerk<br>Jeweler<br>Professor<br>Merchant<br>Banker<br>Merchant | 35<br>69<br>140<br><br>39.50<br>65.00<br>325<br>225                    | 18     10     10     9     8     8     7     7     6     6 $     6     $ | $egin{array}{c} 2 \\ 3 \\ 2 \\ 4 \\ 0 \\ 3 \\ 4 \\ 2 \\ 0 \\ 6 \\ 4 \end{array}$ | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | $\begin{array}{c} 4 \\ 4 \\ 1 \\ 0 \\ 1 \cdot 3 \\ 4 \\ 1 \\ 0 \\ 1 \cdot 4 \cdot 5 \\ 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \end{array}$ | $\begin{smallmatrix} 0 \\ 10 \cdot 20 \cdot 21 \\ 10 \cdot 21 \\ 0 \\ 10 \cdot 15 \cdot 24 \cdot 3 \cdot 25 \\ 15 \cdot 24 \cdot 20 \cdot 3 \\ 10 \cdot 15 \cdot 20 \\ 15 \\ 4 \\ 10 \cdot 26 \cdot 20 \cdot 16 \cdot 21 \\ 10 \cdot 11 \cdot 15 \\ 17 \cdot 20 \cdot 4 \cdot 3 \cdot 4 \cdot 5 \cdot 23 \cdot 12 \cdot 28 \\ 17 \cdot 20 \cdot 24 \cdot 3 \cdot 4 \cdot 5 \cdot 23 \cdot 12 \cdot 28 \\ \end{smallmatrix}$ | Most<br>a.b.b.1<br>Little<br>Half<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>Little | Little<br>Little<br>Little<br>Little<br>Little<br>Little<br>Much<br>4.0<br>5.0 | $\begin{array}{c} 1236\\ 1473\\ 1264\\ 1327\\ 1563\\ 1385\\ 1442\\ 476\\ 383\\ 1286\\ 1039\\ \end{array}$ | $\begin{array}{c} 103.0\\ 122.7\\ 105.3\\ 110.6\\ 130.2\\ 115.4\\ 120.2\\ 39.7\\ 31.9\\ 107.2\\ 86.6 \end{array}$ |

TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28.

1 a.b.b. indicates "all but bread"

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3

|   |                                   |   | Rar   | nge Fa   | acts   |   | bers)  | bers)  |  |  | Enconsu  | ergy<br>mption  |
|---|-----------------------------------|---|---|--|--|---|--|--|--|--|--|---|
| Family Number   | Children Below High<br>School Age | Occupation of Head<br>of Family   | Cost New (Dollars)  | Years Used   | No. Open Surface Units                                 | No. Closed Surface Units  | Range Attachments<br>(See table 3 for<br>corresponding num   | Appliances Used<br>(See table 3 for<br>corresponding num   | Amount<br>Baking   | Amount<br>Water<br>Heated<br>Daily<br>Gallons  | Yearly Total   | Monthly Average   |
| $\begin{array}{c} 212\\ 213\\ 214\\ 215\\ 216\\ 217\\ 218\\ 220\\ 2221\\ 222\\ 223\\ 2224\\ 2225\\ 2226\\ 2227\\ 2228\\ 2226\\ 2227\\ 2228\\ 2230\\ 2312\\ 2332\\ 233\end{array}$ |                                   | Civil Engr.<br>Butcher<br>Professor<br>Retired<br>Merchant<br>Professor<br>Widow<br>Contractor<br>Professor<br>Retired<br>Gardener<br>Retired<br>Faeltor<br>Engineer<br>Professor<br>Bookkeeper | $\begin{array}{c} 220\\ 125\\ 124\\ \hline \\ 124\\ \hline \\ 119\\ 120\\ 135\\ 148\\ 190\\ \hline \\ 100\\ 100\\ \hline \\ 75\\ \hline \\ 160\\ \hline \\ 120\\ \end{array}$ | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$                 | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$ | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | $\begin{array}{c} 1 \cdot 4 \cdot 5 \\ 0 \\ 1 \cdot 3 \\ 1 \cdot 3 \\ 1 \cdot 3 \cdot 4 \\ 0 \\ 3 \\ 1 \cdot 3 \\ 1 \cdot 3 \\ 1 \cdot 3 \\ 1 \cdot 3 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$ | $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$  | a.b.b.<br>None<br>Little<br>Little<br>Little<br>a.b.b.<br>a.b.b.<br>Little<br>Most<br>Nearly all<br>Little<br>Some<br>Nearly all<br>Little<br>None<br>a.b.b.<br>A.b.b. | Little<br>None<br>4.5<br>1.5<br>4.5<br>Little<br>2.0<br>4.5<br>Little<br>4.5<br>Little<br>2.0<br>4.5<br>Little | $\begin{array}{c} 1436\\ 655\\ 586\\ 1271\\ 993\\ 1559\\ 1175\\ 1195\\ 1797\\ 1100\\ 1053\\ 1535\\ 598\\ 816\\ 816\\ 1357\\ 913\\ 1429\\ 1745\\ 1251\\ 1351\\ \end{array}$ | $ \begin{vmatrix} 119.7\\ 54.6\\ 48.8\\ 105.9\\ 82.7\\ 129.9\\ 99.6\\ 149.7\\ 99.7\\ 87.7\\ 127.9\\ 49.8\\ 68.0\\ 61.2\\ 113.1\\ 76.1\\ 145.4\\ 104.2\\ 112.6\\ \end{vmatrix} $ |
| $234 \\ 235 \\ 236 \\ 237 \\ 238 \\ 239 \\ 240$   |                                   | Bridgeman<br>Merchant<br>Bookkeeper<br>Professor  | $ \begin{array}{c c} 140 \\ 260 \\ 120 \\ 130 \\ 225 \\ 155 \\ 175 \\ \end{array} $   | $\begin{vmatrix} 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ 2\\ $ | 3<br>0<br>3<br>0<br>3<br>0<br>0                        | 030303  | $ \begin{array}{c c} 3-4 \\ 1-4-5 \\ 4-5 \\ 1-3-4 \\ 0 \\ 1-3-4 \\ 1-4-5 \end{array} $   | $ \begin{bmatrix} 28\\ 10\cdot20\cdot24\cdot16\cdot21\cdot3\\ 10\cdot15\cdot20\cdot24\\ 15\\ 10\cdot14\\ 10\cdot15\cdot20\cdot21\cdot24\\ 10\cdot15\cdot20\cdot21\cdot24\\ 10\cdot15\cdot20\cdot24 \end{bmatrix} $ | Little<br>Little<br>All<br>a.b.b.<br>a.b.b.<br>Little<br>a b b   | 4.5<br>5.0<br>1.5<br>3.0<br>5:0<br>None  | $\begin{array}{c c} 2282 \\ 1313 \\ 818 \\ 632 \\ 1151 \\ 1018 \\ 877 \end{array}$   | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  |

TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

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TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

|   |   |   | Ran   | ige Fa   | acts                                    |                       | bers)   | bers)   |  |  | Ener   | gy  |
|---|---|---|---|--|---|-----------------------|---|---|--|--|--|---|
|   |   | See Calles  |   |  | its                                     | nits                  | unn   | mn  |  |  | Kw-  | hr.   |
| Family Number   | Children Below High<br>School Age   | Occupation of Head<br>of Family   | Cost New (Dollars)  | Years Used   | No. Open Surface Un                     | No. Closed Surface U1 | Range Attachments<br>(See table 3 for<br>corresponding 1  | Appliances Used<br>(See table 3 for<br>corresponding 1  | Amount<br>Baking   | Amount<br>Water<br>Heated<br>Daily<br>Gallons                            | Yearly Total   | Monthly Average   |
| $241 \\ 242 \\ 243 \\ 244 \\ 245 \\ 246 \\ 247 \\ 248$  |   | Retired<br>Professor<br>Baker<br>Professor<br>Grocer<br>Professor<br>Dry Cleaner  | 225<br>120<br>120<br>240<br><br>130   |  | 0 |                       | $\begin{array}{ c c c } 0 \\ 3.4 \\ 1.4 \\ 1.3.4 \\ 1.2.4.5 \\ 3 \\ 0 \\ 1.3.4 \end{array}$   | $\begin{matrix} 0 \\ 0 \\ 10.26 \\ 10.17.28 \\ 10.15.17.20.21 \\ 0 \\ 10.26.20.16.21 \end{matrix}$  | Most<br>Little<br>Most<br>Little<br>25%<br>All<br>a.b.b.   | 4.0<br>Little<br>Little<br>None<br>Dishwater<br>3.0                      | $ \begin{array}{r} 1365 \\ 852 \\ 568 \\ 1279 \\ \hline 485 \\ 1814 \\ 1312 \\ \end{array} $ | $113.7 \\71.0 \\47.3 \\106.6 \\62.2 \\40.4 \\151.2 \\109.3$   |
| Ave.  | 1   |   |   | I  | 1                                       | 1                     | 1   |   |  |  | 1153.2   | 96.1  |
|   | -   |   |   |  |   |                       | Family  | of 3 Persons  |  |  | ISS I  | 1.14  |
| 301<br>302<br>303<br>304<br>305<br>306<br>307<br>308<br>309<br>310<br>311<br>312<br>313<br>314<br>315<br>316<br>317 | 0<br>0<br>0<br>1<br>1<br>1<br>0<br>0<br>1<br>0<br>0<br>1<br>0<br>0<br>1<br>0<br>0<br>1<br>0<br>0<br>1<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | Druggist<br>Doctor<br>City Clerk<br>Cleaner<br>Electrician<br>Realtor<br>Trav. Sales.<br>R. R. Trackman<br>Professor<br>Business<br>Retired<br>Elec. Dealer<br>Professor<br>Professor<br>Merchant | $\begin{array}{c} \hline & & \\ 175 \\ 175 \\ 165 \\ 275 \\ \hline & \\ 80 \\ 132 \\ 68 \\ \hline & \\ 140 \\ 180 \\ 165 \\ \hline \\ 160 \\ 165 \\ \hline \end{array}$ | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 2 - 3 4 3 3 4 2 3 2 3 3 4 - 3 3 4       |                       | $\begin{array}{c} -\\ 1 \\ 1\\ -\\ -\\ 3 \\ 2 \\ 4\\ 2 \\ -\\ 3 \\ 4\\ 2 \\ -\\ 4\\ 1 \\ -\\ 3 \\ 4\\ 1 \\ -\\ 3 \\ 4\\ -\\ 3 \\ -\\ 4\\ -\\ 3 \\ -\\ 4\\ -\\ 4\\ 1 \\ -\\ 4\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\ -\\$ | $\begin{array}{c} 10\text{-}15\text{-}20\\ 10\text{-}15\text{-}16\text{-}17\text{-}20\\ 10\text{-}26\text{-}20\text{-}16\text{-}21\\ 21\\ 11\text{-}10\text{-}15\text{-}26\text{-}24\text{-}20\text{-}17\text{-}13\text{-}21\\ 10\text{-}15\text{-}20\text{-}28\\ 10\text{-}20\text{-}21\\ 10\\ 10\text{-}20\text{-}21\\ 10\\ 10\text{-}15\text{-}26\text{-}20\text{-}17\text{-}16\text{-}21\\ 10\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}24\text{-}20\\ 10\text{-}15\text{-}26\text{-}20\text{-}16\text{-}21\\ \end{array}$ | a.b.b.<br>a.b.b.<br>Some<br>25%<br>50%<br>50%<br>Most<br>a.b.b.<br>a.b.b.<br>All<br>Little<br>Little<br>Most | 4.5<br>Little<br>4.5<br>Some<br>4<br>Little<br>4.5<br>1.5<br>4.5<br>Some | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$                                       | $\begin{array}{c} 67.7\\ 168.2\\ 115.7\\ 141.3\\ 58.3\\ 87.5\\ 119.1\\ 107.7\\ 53.9\\ 77.0\\ 122.1\\ 148.2\\ 148.0\\ 120.7\\ 77.6\\ 87.6\\ 87.6\\ 170.7\end{array}$ |

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|  |   |   | Rar  | nge Fa  | acts  |  | bers)   | bers)  |  |  | Ene<br>Consur<br>Kw  | nption<br>-hr.   |
|--|---|---|--|---|---|--|---|--|--|--|--|--|
| Family Number  | Children Below High<br>School Age   | Occupation of Head<br>of Family   | Cost New (Dollars)   | Years Used  | No. Open Surface Units  | No. Closed Surface Units   | Range Attachments<br>(See table 3 for<br>corresponding num  | Appliances Used<br>(See table 3 for<br>corresponding num | Amount<br>Baking   | Amount<br>Water<br>Heated<br>Daily<br>Gallons  | Yearly Total   | Monthly Average  |
| $\begin{array}{c} 318\\ 319\\ 320\\ 321\\ 322\\ 322\\ 322\\ 322\\ 322\\ 322\\ 322$ | 0<br>1<br>0<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>0<br>0<br>0<br>0<br>0<br>0<br>1<br>1<br>1<br>1<br>0<br>0<br>0<br>0<br>0<br>0<br>1<br>1<br>1<br>1<br>1<br>0<br>0<br>0<br>1<br>1<br>0<br>0<br>0<br>1<br>0<br>0<br>0<br>1<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | Grocer<br>Hwy. Comm.<br>College Bldg. Supt.<br>Professor<br>Retired<br>Banker<br>Trav. Sales.<br>Baker<br>Army Officer<br>Physician<br>Instructor<br>Col. Bookstore<br>Funeral Dir.<br>Retired Farmer<br>Hortičulturist<br>Electrician<br>Professor<br>Brickmason<br>Carpenter<br>Professor<br>Mail Carrier<br>Widow<br>Dairy<br>Supt. Const. | 165           145           115           115           125           155           150           144           120           127           106           120           157           120           132           80 | $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | $\begin{array}{c} -4 \\ 3 \\ - \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3$ | $ \begin{array}{c} 3 \\ - \\ - \\ 3 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$ | $\begin{array}{r} 1.3.4\\ 1.3.4\\ 3.4\\ 1.3.4.5\\ 1.3\\ 1.3\\ 1.3\\ 1.3\\ 1.3\\ 1.4.5\\ 1.4.5\\ 1.4.5\\ 1.4.5\\ 1.4.5\\ 1.3.4\\ 1.2.3.4\\ 3.4\\ 1.2.3.4.5\\ 1.3.4\\ 1.2.3.4.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.2.5\\ 1.3.4\\ 1.3.$ | $\begin{array}{llllllllllllllllllllllllllllllllllll$     | All<br>Little<br>a.b.b.<br>Most<br>a.b.b.<br>Little<br>Some<br>Little<br>Some<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>Little<br>Most<br>a.b.b.<br>A.b.b.<br>Little<br>Most<br>a.b.b.<br>A.b.b.<br>Little<br>Most<br>a.b.b.<br>A.b.b.<br>Little<br>Most<br>a.b.b.<br>A.b.b.<br>Little<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.b.<br>A.b.b.b.<br>A.b.b.<br>A.b.b.<br>A.b.b.b.<br>A.b.b.b.<br>A.b.b.b.<br>A.b.b.b.<br>A.b.b.A.b.b.<br>A.b.b.b.b | 4.5<br>Little<br>4<br>Little<br>5<br>3<br>6.5<br>Little<br>4<br>1.5<br>1.5<br>3.6<br><br>3.6<br><br>7<br>3<br> | $\begin{array}{r} 1498\\ 622\\ 622\\ 1442\\ 9994\\ 9994\\ 1986\\ 1189\\ 1673\\ 2278\\ 1673\\ 2278\\ 1622\\ 1801\\ 1711\\ 1622\\ 824\\ 1620\\ 1480\\ 2481\\ 1721\\ 1801\\ 1726\\ 1801\\ 1726\\ 1801\\ 1726\\ 840\\ 866\\ 840\\ 866\\ 866\\ 1906\\ \hline \end{array}$ | $\begin{array}{c} 124.8\\ 251.8\\ 251.8\\ 120.2\\ 162.8\\ 83.3\\ 165.5\\ 99.1\\ 139.4\\ 189.8\\ 142.6\\ 135.2\\ 68.7\\ 135.0\\ 123.3\\ 206.7\\ 143.4\\ 128.5\\ 150.1\\ 143.8\\ 106.2\\ 77.2\\ 150.1\\ 143.8\\ 106.2\\ 77.2\\ 158.8\\ 133.0\\ 179.8\\ 133.0\\ 179.8\\ 199.8\\ $ |
| Ave.   | 1   |   | 1  | 1   | 1   | 1  |   |  | 1  |  | 1432   | 119.3  |

TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

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TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

|               |                                   |                                 | Rang               | re Facts                             | nbers)   | nbers)   |                  |   | Ene<br>Consul<br>Kw | ergy<br>mption<br>-hr |
|---------------|-----------------------------------|---------------------------------|--------------------|--------------------------------------|--|--|------------------|---|---------------------|-----------------------|
| Family Number | Children Below High<br>School Age | Occupation of Head<br>of Family | Cost New (Dollars) | Years Used<br>No. Open Surface Units | AO. Closed Surface Units<br>Range Attachments<br>(See table 3 for<br>corresponding num | Appliances Used<br>(See table 3 for<br>corresponding nur | Amount<br>Baking | Amount<br>Water<br>Heated<br>Daily<br>Gallons | Yearly Total        | Monthly Average       |

| Family | of | 4 | Persons |
|--------|----|---|---------|
|--------|----|---|---------|

| 401 | 0 | Plumber     | 60  | 16 | 2 | 0 | 3-4       | 15-16-20-21               | Most       |               | 672  | 56.0  |
|-----|---|-------------|-----|----|---|---|-----------|---------------------------|------------|---------------|------|-------|
| 402 | 2 | Printer     | 75  | 15 | 4 | 2 | 0         | 10-21                     | 50%        | 4             | 1708 | 142.3 |
| 403 | 0 | Professor   |     | 10 | 3 | 0 | 1         | 10-20                     | a.b.b.     | 3             | 2206 | 183.8 |
| 404 | 1 | Professor   | 225 | 8  | 3 | 0 | 1-3-4-5   | 10-15-24-26-20-1-16-17-21 | V. little  |               | 2315 | 192.9 |
| 405 | 0 |             | 148 | 8  | 3 | 0 | 1         | 11                        | All        | All in summer | 3019 | 251.6 |
| 406 | 0 | Professor   | 225 | 7  | 3 | 0 | 4         | 5-20-21-24                | a.b.b.     |               | 1870 | 155.8 |
| 407 | 2 | Electrician |     | 7  | 3 | 0 | 0         | 10-15-26-16-20-21         | a.b.b.     | 1.5           | 1679 | 139.9 |
| 408 | 0 | Barber      | 225 | 7  | 3 | 0 | 0         | 10-15-24-16-21            | a.b.b.     |               | 1831 | 152.6 |
| 409 | 1 | Teacher     | 85  | 6  | 2 | 0 | 1         | 2-3-4-5-7-9-10-15-20      | a.b.b.     |               | 1195 | 99.6  |
| 410 | 1 | Widow       | 85  | 6  | 3 | 0 | 1         | 2-10-11-26                | a.b.b.     |               | 2094 | 174.5 |
| 411 | 0 | Physician   |     | 6  | 3 | 0 | 1         | 5-10-15-20-21-26          | V. little  | 3             | 2260 | 188.3 |
| 412 | 0 | Merchant    |     | 6  | 0 | 3 | 3         | 10-15-26-1-16-20-24       | a.b.b.     | 3             | 2017 | 168.1 |
| 413 | 1 | Plumber     | 68  | 6  | 2 | 0 | 1-4       | 2-10-20-21-26             | a.b.b.     | 3             | 1631 | 135.9 |
| 414 | 1 |             | 95  | 5  | 4 | 0 | 2-3       | 3-10-15-20-21             | a.b.b.     | 1.5           | 1192 | 99.3  |
| 415 | 2 | Professor   |     | 5  | 3 | 0 | 3-4       | 10-20                     |            | 3             | 1589 | 132.4 |
| 416 | 0 | Student     |     | 4  | 4 | 0 | -         | 15-20-21                  | a.b.b.     |               | 823  | 68.6  |
| 417 | 0 | Painter     | 80  | 4  | 0 | 2 | 3-4-5     | 10-15-20-24-5-18-26       | Nearly all | 3             | 1678 | 139.8 |
| 418 | 2 | Store       | 115 | 4  | 3 | 0 | 0         | 10-18-20-24               | Part       | Little        | 1475 | 122.9 |
| 419 | 0 | Plumber     |     | 4  | 4 | 0 | 1-3-4     | 1-20-21                   | a.b.b.     | 4.5           |      | 195.4 |
| 420 | 2 | Professor   | 75  | 3  | 2 | 0 | 1-4       | 10-18-20-26               | Little     | 7.5           | 1145 | 95.4  |
| 421 | 2 |             |     | 3  | 0 | 2 | 1-2-3-4-5 | 10-15-26                  | Little     |               | 1482 | 123.5 |
| 422 | 2 | Engineer    | 175 | 3  | 3 | 0 | 1-3-5     | 21                        | a.b.b.     |               | 1141 | 95.1  |
| 423 | 0 | Minister    | 140 | 2  | 3 | 0 | 1-3-4-5   | 15-20-21-24-26            | Little     | 4.5           | 1714 | 142.8 |
| 424 | 2 |             | 125 | 2  | 3 | 0 | 1-3-4     | 15-20-21-26               | Little     | 4.5           | 843  | 70.2  |
| 425 | 2 | Electrician |     | 2  | 3 | 0 | 1-2-3-4-5 | 10-15-20-24-26-5-7-16-21  | a.b.b.     | 3             | 1062 | 88.5  |
| 426 | 2 | Barber      | 120 | 2  | 3 | 0 | 0         | 10-21                     | a.b.b.     |               | 1087 | 90.6  |
| 427 | 2 | Professor   | 120 | 2  | 3 | 0 | 1-3-4     | 15-21-24-26               | a.b.b.     | V. Little     | 1409 | 117.4 |

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|  |   |   | Ra   | nge F   | acts                              |  | ers)  | Ders)   |   |  | Ene  | rgy   |
|--|---|---|--|---|-----------------------------------|--|---|---|---|--|--|---|
| Family Number  | Children Below High<br>School Age   | Occupation of Head<br>of Family   | Cost New (Dollars)   | Years Used  | No. Open Surface Units            | No. Closed Surface Units   | Range Attachments<br>(See table 3 for<br>corresponding num)   | Appliances Used<br>(See table 3 for<br>corresponding num  | Amount<br>Baking  | Amount<br>Water<br>Heated<br>Daily<br>Gallons  | Yearly Total   | Monthly Average   |
| $\begin{array}{c c c} 428 & \\ 429 & \\ 430 & \\ 431 & \\ 432 & \\ 433 & \\ 434 & \\ \end{array}$  | $     \begin{array}{c}       0 \\       0 \\       2 \\       2 \\       2     \end{array} $                    | Contractor<br>Professor<br>Professor<br>Electrician<br>Civil Engr.<br>Professor   | $\begin{array}{c c} 120\\ 180\\ 140\\ - 40\\ 172\\ 145\\ 145\\ 145\\ \end{array}$  | $\begin{vmatrix} 2\\ 1\\ 1\\ 1\\ 1\\ 1\\ 1 \end{vmatrix}$ | 3 3 4 3 3 3 3<br>3 3 3 3          | 0<br>0<br>0<br>0<br>0<br>0<br>0  | $\begin{array}{c} 1-4\\ 1-2-3-4-5\\ 1-3\\ 1\\ 1-2-3-4-5\\ 1-3-4-5\\ 1-3-4\end{array}$   | $\begin{array}{c} 10\text{-}21\text{-}26\\ 1\text{-}10\text{-}15\text{-}20\text{-}21\text{-}26\\ 11\\ 10\text{-}26\\ 10\text{-}15\text{-}20\text{-}21\text{-}24\text{-}26\\ 10\text{-}20\text{-}21\text{-}24\text{-}26\\ 10\text{-}15\text{-}20\text{-}21\\ \end{array}$  | a.b.b.<br>  a.b.b.<br>  a.b.b.<br>  a.b.b.<br>  a.b.b.<br>  a.b.b.<br>  a.b.b.  | $\begin{array}{c} 3 \\ 3.5 \\ 3.5 \\ 4.5 \\ 4.5 \\ 2 \\ 1.5 \end{array}$             | $\begin{array}{ } 2237 \\ 1364 \\ 1613 \\ 3661 \\ 1172 \\ 1369 \\ 2628 \end{array}$  | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  |
| Ave.   |   |   |  | Í   | 1                                 | İ  |   |   | 1   |  | 1688.4   | 140.7   |
|  |   |   |  |   |                                   |  | Family .  | of 5 Persons  | 0   |  |  |   |
| $\begin{array}{c} 501\\ 502\\ 503\\ 504\\ 505\\ 506\\ 507\\ 508\\ 509\\ 510\\ 511\\ 512\\ 513\\ 514\\ 515\\ 516\\ 517\\ 518\\ \end{array}$ | 0<br>3<br>1<br>3<br>2<br>0<br>0<br>0<br>3<br>3<br>0<br>0<br>0<br>3<br>1<br>3<br>1<br>3<br>1<br>3<br>1<br>3<br>1 | Civil Engr.<br>Seed Dealer<br>Auto Dealer<br>Professor<br>Extension<br>Janitor<br>Banker<br>Economist<br>Clerk<br>Professor<br>Painter<br>Mail. Car.<br>Auto Mechanic<br>Engineer<br>Exp. Station | $\begin{array}{c} \hline 250 \\ \hline 190 \\ 165 \\ 175 \\ \hline 80 \\ 150 \\ 120 \\ 105 \\ 125 \\ 92 \\ 150 \\ 100 \\ \hline 50 \\ \end{array}$ | $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | 3 3 0 - 3 4 3 4 4 3 0 3 3 3 0 3 1 | $ \begin{array}{c c} 0 \\ 0 \\ 2 \\ - \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$ | $\begin{array}{c} 0 \\ 0 \\ 1 \\ 4 \\ 4 \\ 5 \\ 1 \\ 3 \\ 3 \\ 4 \\ 1 \\ 2 \\ 3 \\ 3 \\ 4 \\ 1 \\ 2 \\ 3 \\ 4 \\ 0 \\ 1 \\ 0 \\ 1 \\ 2 \\ 2 \\ 4 \\ 5 \\ 3 \\ 4 \\ 0 \\ 1 \\ 0 \\ 1 \\ 2 \\ 2 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 3 \\ 4 \\ 5 \\ 5 \\ 5 \\ 6 \\ 5 \\ 6 \\ 5 \\ 5 \\ 5 \\ 5$ | $\begin{array}{c} 10\text{-}20\\ 10\text{-}11\text{-}21\text{-}26\\ 10\text{-}20\text{-}26\text{-}\\ 10\text{-}21\text{-}21\text{-}26\\ 10\text{-}21\text{-}21\text{-}26\\ 10\text{-}20\text{-}21\text{-}26\\ 10\text{-}15\\ 0\\ 10\\ 10\text{-}20\text{-}21\\ 10\text{-}16\text{-}21\text{-}26\\ 3\text{-}10\text{-}21\text{-}26\\ 3\text{-}10\text{-}21\text{-}26\\ 10\text{-}21\text{-}24\text{-}26\\ 10\text{-}15\text{-}17\text{-}20\\ 10\text{-}20\text{-}21\\ 10\text{-}15\text{-}20\text{-}26\\ 10\text{-}20\\ 10\text{-}20\text{-}26\text{-}13\text{-}16\text{-}21\\ 10\text{-}16\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}16 \text{-}10\\ 10\text{-}20\text{-}26\text{-}13\text{-}16\text{-}21\\ 10\text{-}16\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}16 \text{-}10\\ 10\text{-}10\text{-}20\text{-}26\text{-}13\text{-}16\text{-}21\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}8\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}17\text{-}21\text{-}26\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}11\text{-}21\text{-}26\text{-}6\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}11\text{-}21\text{-}26\text{-}6\text{-}18\text{-}10\\ 10\text{-}16\text{-}11\text{-}10\text{-}10\text{-}10\text{-}10\\ 10\text{-}16\text{-}11\text{-}10\text{-}10\text{-}10\text{-}10\\ 10\text{-}16\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\\ 10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\text{-}10\\ 10\text{-}$ | a.b.b.<br>a.b.b.<br>Most<br>a.b.b.<br>Little<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>a.b.b.<br>b.<br>a.b.b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b.<br>b | 3.6<br>4.5<br>5.5<br>Little<br>Little<br>4.5,<br>4.5<br>2<br>5<br>7<br>Little<br>4.5 | $\begin{array}{c} 2632\\ 2694\\ 1170\\ 1702\\ 1232\\ 1488\\ 2291\\ 1275\\ 1871\\ 1351\\ 2210\\ 2543\\ 950\\ 1115\\ 2016\\ 1596\\ 2094\\ 2095\end{array}$ | $ \begin{array}{c} 219.3\\ 224.5\\ 97.5\\ 141.8\\ 102.7\\ 124.0\\ 190.9\\ 106.2\\ 155.9\\ 112.6\\ 184.2\\ 211.9\\ 79.2\\ 92.9\\ 168.0\\ 133.0\\ 174.5\\ \end{array} $ |

TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

1.1

TABLE 2. SUMMARY OF ELECTRIC COOKING SURVEY, AMES, IOWA, 1927-28 (CONTINUED).

|   |  | 1. 4. The   | Ran   | ge F   | acts                                     |                          | bers)   | bers)  |   |   | Ener  | rgy<br>iption   |
|---|--|---|---|--|--|--------------------------|---|--|---|---|---|---|
| Family Number   | Children Below High  | Occupation of Head<br>of Family   | Cost New (Dollars)  | Years Used   | No. Open Surface Units                   | No  Closed Surface Units | Range Attachments<br>(See table 3 for<br>corresponding num  | Appliances Used<br>(See table 3 for<br>corresponding num   | Amount<br>Baking  | Amount<br>Water<br>Heated<br>Daily<br>Gallons | Yearly Total  | Monthly Average   |
| $\begin{array}{c c c} 519 \\ 520 \\ 521 \\ 522 \\ 523 \\ 524 \\ 525 \\ \end{array}$ | $     \begin{array}{c}       3 \\       2 \\       3 \\       1 \\       1 \\       3 \\       0     \end{array} $ | Professor<br>Insurance Agent<br>Instructor<br>Banker<br>Bookkeeper<br>Plumber | $\begin{array}{ c c c c } & 77.50 \\ 175 \\ 111 \\ \hline \\ \hline \\ 165 \\ 172 \\ \hline \\ \hline \\ \\ \hline \end{array}$ | $     \begin{array}{c}       2 \\       2 \\       1 \\       1 \\       -     \end{array} $ |  |                          | $ \begin{vmatrix} 0 \\ 1 \cdot 3 \cdot 4 \cdot 5 \\ 1 \cdot 2 \cdot 4 \\ 4 \\ 1 \cdot 2 \cdot 3 \cdot 4 \\ 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \\ 0 \end{vmatrix} $ | $\begin{array}{c} 10\text{-}16\text{-}20\text{-}21\\ 10\text{-}20\text{-}24\text{-}1\text{-}17\text{-}21\\ 10\text{-}20\text{-}21\text{-}26\\ 11\\ 10\text{-}15\text{-}21\text{-}24\text{-}23\text{-}27\\ 11\text{-}21\text{-}24\text{-}26\\ 10\text{-}21\\ \end{array}$ | Nearly all<br>  a.b.b.<br>  a.b.b.<br>  All<br>  Nearly all<br>  a.b.b. | 3<br>1.5<br>3<br>5<br>5<br>5                  | $\begin{array}{c} 1361 \\ 1947 \\ 1294 \\ 1085 \\ 1822 \\ 1225 \\ 1566 \end{array}$ | $\begin{array}{c} 113.4 \\ 162.2 \\ 107.8 \\ 90.4 \\ 151.8 \\ 102.1 \\ 130.5 \end{array}$ |
| Ave.  |  |   |   |  | 1  |                          |   |  |   |   | 1705  | 142.1   |
|   |  |   |   |  |  |                          | Family  | of 6 Persons   |   |   |   |   |
| $\begin{array}{c c} 601 &   \\ 602 &   \end{array}$                                 | 0<br>3   | Barber<br>Police  | 165   | 5<br>2   | 3  | 03                       | $1 \cdot 2 \cdot 4$<br>3.4  | 6-8-10-24<br>10-26   | a.b.b.<br>  a.b.b.  | 3   | 2128<br>11170   | 177.3<br>975  |
| Ave.  |  |   | 1 1 1 1 1   | 1  |  | 1                        | 1   | 1  |   |   | 1649  | 137.4   |
|   |  |   |   |  | 1  |                          | Family  | of 7 Persons   |   |   |   |   |
| 701<br>702<br>703   | 3<br>4<br>4  | Contractor<br>Professor<br>Plumber  | $\begin{vmatrix} 5\\75\\145\end{vmatrix}$   | $\begin{vmatrix} 5\\3\\2 \end{vmatrix}$  | $\begin{vmatrix} 4\\ 2\\ 2\end{vmatrix}$ | 0<br>1<br>0              | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  | $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   | None<br>Most  | 3   | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$                              | 205.3<br>191.8<br>195.6   |
| Ave.  |  |   |   |  |  |                          |   |  |   |   | 2370.1  | 197.5   |
|   |  |   |   |  |  |                          |   |  |   | a program                                     | N. C.   |   |

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| Appliance<br>or Item<br>Number | Appliances or Item            | Number of<br>Families<br>Having<br>Appliances | Per Cent of<br>Total<br>Families |
|--------------------------------|-------------------------------|---|----------------------------------|
|                                | Household Electric Appliances |   | 1                                |
| 1                              | Battery charger               | 15  | 9.1                              |
| 2                              | Corn popper                   | 6   | 3.6                              |
| 3                              | Curling iron                  | 11  | 6.7                              |
| 4                              | Egg boiler                    | 4   | 2.4                              |
| 5                              | Cooling fan                   | 8   | 4.8                              |
|                                |                               |   | 1.0                              |
| 6                              | Floor waxer                   | 4   | 2.4                              |
| 7                              | Glow heater                   | 6   | 3.6                              |
| . 8                            | Grill                         | 3   | 1.8                              |
| 9                              | Heating pad                   | 3   | 1.0                              |
| 10                             | Iron                          | 133   | 80.6                             |
|                                |                               |   |                                  |
| 11                             | Ironing machine               | 10  | 6.0                              |
| 12                             | Malted milk mixer             | 1   | 0.6                              |
| 13                             | Motors                        | 7   | 4.2                              |
| 14                             | Oil burner                    | 3   | 1.8                              |
| 15                             | Percolator                    | 65  | 39.4                             |
| 16                             | Radio (electric)              | 24  | 14.5                             |
| 17                             | Refrigerator (electric)       | 18  | 10.0                             |
| 18                             | Sewing machine                | 10  | 10.9                             |
| 19                             | Soldering iron                | 1   | 4.0                              |
| 20                             | Toaster                       | 98  | 59.4                             |
| 21                             | Vacuum alaanan                |   |                                  |
| 22                             | Violet Ber Mechine            | 91  | 55.1                             |
| 22                             | Vibrot Ray Machine            | 1   | 0.6                              |
| 20                             | Vibrator<br>Weffle ince       | 2   | 1.2                              |
| 24                             | Wanie iron                    | 43  | 26.0                             |
| 20                             | waterless cooker              | 4   | 2.4                              |
| - · · · · · ·                  | Range Attachments             | Contract of the                               |                                  |
| 1                              | Appliance outlet              | 104   | 63.0                             |
| 2                              | Cooker unit                   | 21  | 12.7                             |
| 3                              | Oven vent                     | 93  | 56.3                             |
| 4                              | Temperature control           | 106   | 64.9                             |
| 5                              | Time control                  | 27  | 09.4                             |

TABLE 3.SUMMARY OF APPLIANCES AND ATTACHMENTS INCLUDED IN<br/>TABLE 2. (165 Families Surveyed)

# TABLE 4. KILOWATT-HOUR CONSUMPTION OF RANGES IN RURAL HOMES. IOWA PROJECT ON RURAL ELECTRIFICATION AT GARNER, IOWA.

|                |                       | 1            | Kilowati     | t-hours p    | er month      | in margaret      |
|----------------|-----------------------|--------------|--------------|--------------|---------------|------------------|
| Family<br>Size | Type of range         | Mini-<br>mum | Maxi-<br>mum | Aver-<br>age | Per<br>Person | Farm             |
| 6              | 2-plate range         | 1            |              |              | 1             | 1                |
|                | attachment            | 2            | 107          | 27.5         | 4.5           | A. Abele         |
| 5              | 2-plate and over      | [            |              |              |               |                  |
|                | range attachment      | 12           | 143          | 41.6         | 8.3           | Ed Boehnke       |
| School         | Wall outlet range     | 1            |              |              |               |                  |
| <b>CI</b> 1    | single plate and oven | 20           | 32           | 25.01        |               | Weaver School    |
| Church         | Hot plate and oven    | 9            | 95           | 32.0         |               | St. Johns Church |
| 7              | Range                 | 20           | 293          | 119.6        | 17.0          | L. Weaver        |
| 6-7            | Range                 | 27           | 315          | 193.0        | 27.6-32.1     | I. Rasmus        |
| 6              | Range                 | 17           | 230          | 130.0        | 21.7          | C. Lawhorn       |
| 5              | Range                 | 37           | 132          | 70.5         | 14.1          | R. Lawhorn       |
| 5              | Range                 | 61           | 225          | 137.4        | 27.5          | H. Greiman       |
| 4              | Range                 | 2            | 273          | 74.7         | 18.7          | F. Wetterling    |
| 2-6            | Range                 | 85           | 347          | 162.0        | 27.0          | L. Quintus       |
| 3              | Wall-mounted range    | 15           | 120          | 49.42        | 16.42         | W. Boehnke       |
| 5-6            | Combination coal and  | 1            | 1 1          |              |               | J Docimike       |
|                | electric range        | 208          | 390          | 253.23       | 42.2-50.6     | M Sprole         |
| 5              | Combination coal and  | 1            |              |              |               | and options      |
|                | electric range        | 150          | 244          | 185.3        | 37.0          | F. Greiman       |

13 months' record. 26 months' record. 39 months' record.

RURAL A NI USED AND COOKER ECONOMY WITH EQUIPPED REPORT OF SPECIAL RANGE METERING, RANGE HOME AT GARNER, IOWA. ú. TABLE

|  |             |      |      |      | R     | Gilowatt- | hours us | sed  |              |      |      |      | Per cent            |
|--|-------------|------|------|------|-------|-----------|----------|------|--------------|------|------|------|---------------------|
| Units                                    | May<br>1927 | June | July | Aug. | Sept. | Oct.      | Nov.     | Dec. | Jan.<br>1928 | Feb. | Mar. | Apr. | of total<br>consump |
| 100 Watt plate for water<br>heating only | 114         | 66   | 103  | 153  | 132   | 129       | 102      | 81   | 91           | 16   | 19   | 111  | 47.4%               |
| 00 Watt plates                           | 5           | 30   | 69   | 73   | 105   | 19.9      | 80       | 20   | 60           | 50   | 67   | 88   | 29 601              |
| 50 Watt economy                          | -           | 20   | 3    | 2    | 201   |           | 2        | ~    | 8            | 3    | 5    | 8    | 0/-0-20             |
| cooker<br>Oven Use                       | 13          | eo   | 2    | 2    | 6     | e0        | 11       | 12   | 8            | 2    | 9    | 6    | 3.6%                |
| 00 Units                                 | 24          | 16   | 31   | 42   | 35    | 54        | 43       | 43   | 37           | 39   | 36   | 34   | 16.4%               |
| Total                                    | 202         | 124  | 203  | 275  | 281   | 308       | 236      | 195  | 196          | 202  | 188  | 242  | 100.0%              |



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