7-1930

Selection and Management of Kerosene Cook Stoves

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Circular 41 July, 1930

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The buyer of household equipment is often bewildered by the array of suggestive advertising by which she is surrounded. It becomes difficult to judge whether price is an indication of superior performance or merely covers the cost of frequent changes in style. Most persons have no opportunity to learn the comparative merits of various products, but buy because of colorful advertisements, clever sales argument, suggestions of friends, or because the local dealer has only one product of a kind to offer.

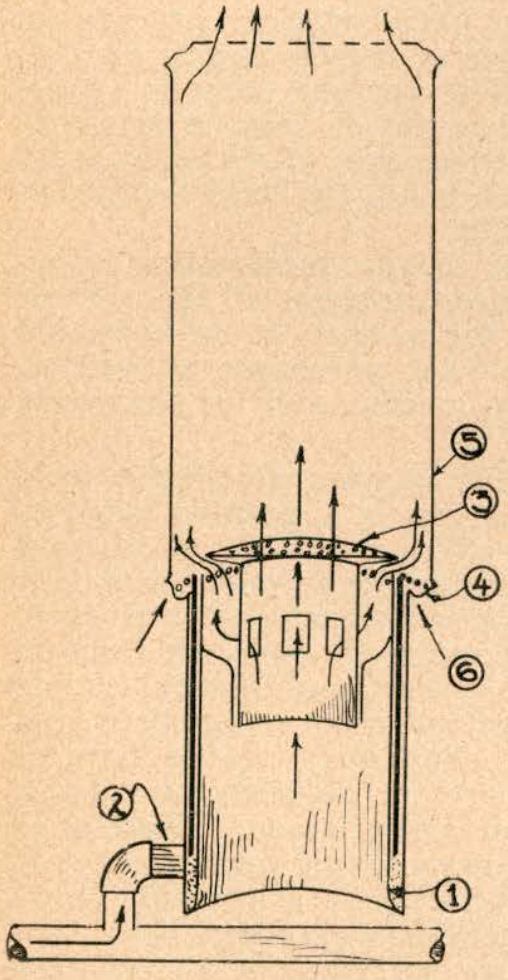
The purpose of this circular is to give information in regard to the advantages and disadvantages of the various types of kerosene cook stoves on the market, in the hope that such information will be useful to the purchaser in deciding the type best suited to individual needs, and in managing whatever type is selected.

In homes where gas or electricity is not available for cooking purposes, kerosene used as a fuel is a genuine blessing. Compared with coal or wood it offers a number of features which add to convenience and comfort, and which materially reduce labor. Since the heat from a kerosene stove is available almost at once, it is unnecessary to keep the stove in operation when not in use, and as less heat is radiated into the room, much of the discomfort from excessively hot kitchens during the summer is eliminated. Little time or effort is required to refuel or care for kerosene stoves and they are much more efficient than coal or wood. The cost of operation is reasonably low, and any cooking process done on a coal stove may be done satisfactorily on a kerosene stove. In addition to the advantages mentioned, kerosene is a comparatively safe fuel, as it does not vaporize at ordinary temperatures. It is said that there are around eight million kerosene stoves in use. If this be a fact, it demonstrates that manufacturers have met a real need.

THE FOUR KINDS OF STOVES

Kerosene cook stoves fall into four groups, which are known by the type of burner on the stove. The four types are:

1. The long-chimney wick type,
2. The short-chimney wick type,
3. The short-chimney lighting-ring type,
4. The wickless type.



The purpose of the burner is to vaporize kerosene so that it may be burned. In the long-chimney type, the wick draws the oil upward and breaks it into small particles, so that the heat from a lighted match is sufficient to vaporize some of these and cause the vapor to burn. The flame, in this type, is enclosed by a chimney, and is about ten inches below the cooking utensil. The flame is visible thru a window in the front of the chimney. Figure 1 shows details of the long-chimney burner.

FIGURE 1.—Long-chimney wick burner

1. Double-walled wick tube.
2. Feed pipe.
3. Flame spreader.
4. Collar on which chimney rests.
5. Chimney.
6. Arrows showing direction of air currents.

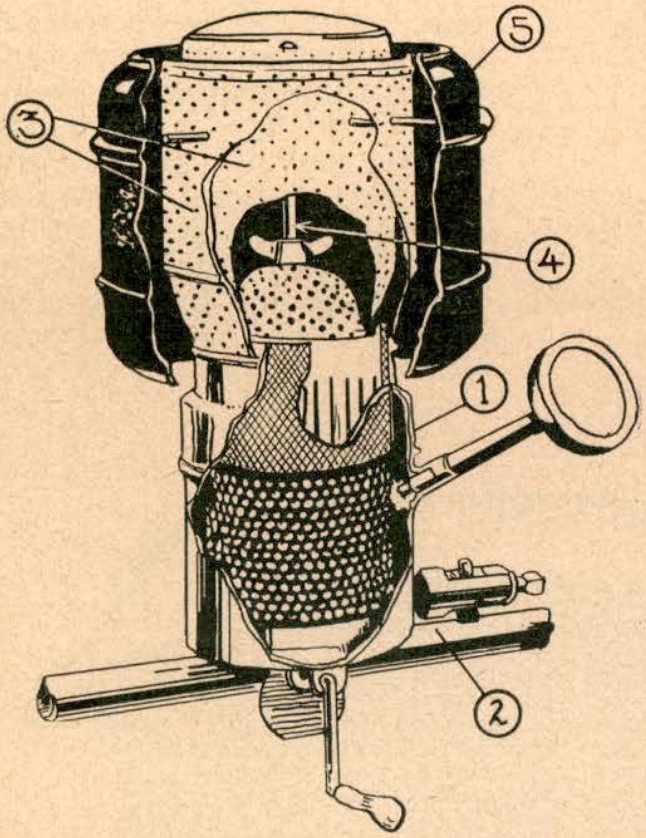


FIGURE 2.—Short-chimney burner with wick
1. Double-walled wick tube.
2. Feed pipe.
3. Outer and inner combustion tubes.
4. Inner support.
5. Chimney.

In the short-chimney wick burner, the wick serves as in the long-chimney type, but in the former there are outer and inner combustion chambers inside the chimney. As the combustion chambers become heated, the flame rises to the top so that it comes in contact with the cooking utensil, and is only partially visible. Figure 2 shows details of the short-chimney wick burner.

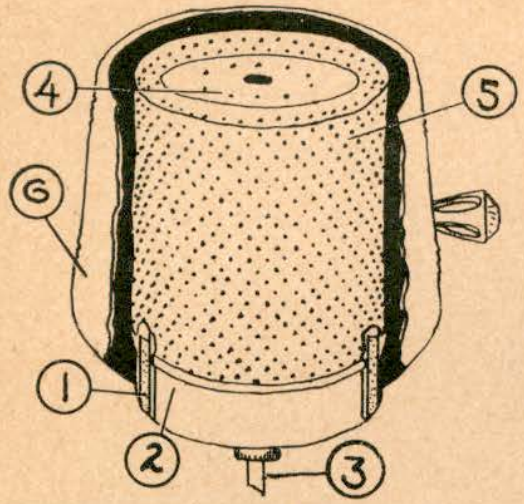


FIGURE 3.—Short-chimney burner using asbestos kindler or lighting ring.

1. Asbestos lighting ring or kindler.
2. Oil trough or burner bowl.
3. Feed pipe.
4. Inner combustion tube.
5. Outer combustion tube.
6. Drum or chimney.

The short-chimney lighting-ring type is similar to the short-chimney wick type, but instead of a wick, an asbestos kindler or lighting ring is used. The oil flows into a shallow burner bowl and surrounds the kindler. The flame rises to the top of the chimney and comes in contact with the cooking utensil, so that it is only partially visible. Figure 3 shows details of the short-chimney lighting-ring burner.

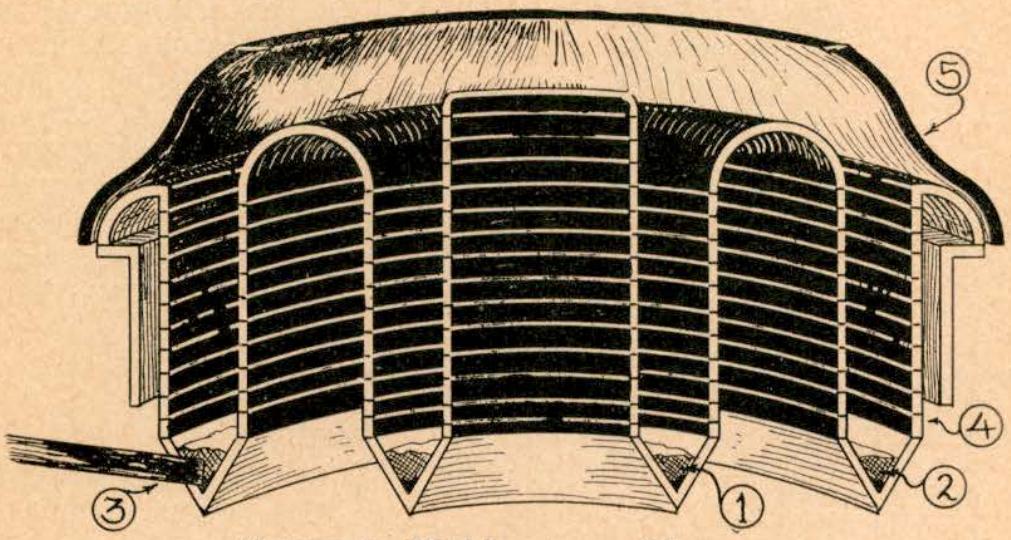


FIGURE 4.—Wickless type of burner

1 and 2. Oil troughs.
3. Feed pipe.
4. Metal pieces with openings to admit air.
5. Collar to direct flame.

The wickless type of burner is primed by a volatile liquid, such as gasoline or alcohol, which will ignite with a match. The primer heats the burner sufficiently to vaporize kerosene. In this type, the flame is close to the utensil, or just below the

grates and is only partially visible. Figure 4 shows details of the wickless burner.

PERFORMANCE OF THE FOUR TYPES OF BURNERS

The user of any kerosene stove is probably most interested in its capacity to meet the following requirements:

1. Reasonable speed of heating,
2. Reasonable cost of operation,
3. Freedom from soot and unpleasant odor,
4. Ease of operation and cleaning.

To determine how the four types of burners compare in ability to meet these requirements, tests have recently been made at the Nebraska Agricultural Experiment Station on ten selected stoves representative of the four types. These studies are reported in detail in Nebraska Agricultural Experiment Station Research Bulletin 48, "A Study of Kerosene Cook Stoves," by Edna B. Snyder, Department of Home Economics.

The stoves were operated according to the directions of their manufacturers, the burners being adjusted for maximum heat. Comparative laboratory tests, in which equal weights of water at the same temperature were heated by the different burners, showed that all types were fairly satisfactory in heating speed, after the burner was fully heated. However, they differed considerably in the time necessary for a cold burner to reach full heat. The long-chimney wick type was quickest, in spite of the fact that the flame is about ten inches below the utensil. This type of burner was one of the first manufactured, and was originally known as a "blue flame" burner. Because of this, many persons use it only with the blue flame, and complain that it is slow. The manufacturers of long-chimney burners recommend that, for intense heat, the flame should be turned up, so that yellow tips 1½ inches long form above the blue flame. With the flame as directed, the speed was increased about 30 per cent in the Nebraska tests. This type of burner is so simple in construction that it is fully heated very soon after the cold burner is lighted. The short-chimney wick burners and those with kindling rings are about equal in speed. These burners require from 3 to 5 minutes for the flame to rise to the top of the burner after it is lighted. The wickless burner (because of the heavy iron parts) is slowest of the four types. When cold, considerably more time is required for it to become fully heated.

Along with speed of heating, it is important to know how quickly the burner cools. Tests showed that the burners which were slow to heat were also slow to cool. The wick burners cooled most rapidly; those with long chimneys cooled in slightly less time than those with short. The lighting-ring

type did not cool as quickly as the wick types. After the oil is shut off from the burner bowl in the former, the flame continues until all oil left is used. The wickless burner, because of its heavy iron parts, holds heat longest.

While speed is perhaps first in the minds of the users of kerosene stoves, cost of operation is important. Tests in which equal weights of water at equal initial temperatures were evaporated by the different burners showed that the long-chimney wick type used the most oil of the four—the others differing little.

There were points of practical importance which could be learned only by using the stoves under kitchen conditions. Such tests gave information as to the time used and cost of operation in the actual cooking of food. Standard menus were cooked on the four types and records were kept of the time and oil used and the quality of the product. The burners were operated with the minimum use of time and consumption of oil.

Cost of Operation and Time Required for the Cooking of a Week's Meals for Six Persons on Four Selected Stoves Representing Four Types of Burners

Type	Total time	Total oil	Cost of oil	Cost of wicks or primer	Total cost per week
	Burner hours	*Gallons*	*Dollars*	*Dollars*	*Dollars*
Long chimney with wick	77.3	5.234	.74	.068	.81
Short chimney with wick	82.9	4.305	.61	.092	.71
Short chimney with lighting ring	77.8	4.637	.65	.051	.71
Wickless	85.5	4.540	.64	.21	.76

Kerosene figured at 14 cents per gallon.
Gasoline figured at 18 cents per gallon.
Wicks for long-chimney burner—3 for $1.00—last approximately 375 hours.
Wicks for short-chimney burner—3 for $1.00—last approximately 300 hours.
Lighting rings—10 cents each—last approximately 150 hours.
Wickless burners require an ounce of gasoline for each priming.

The data in the table above show that the long-chimney burner required the most kerosene but was the most rapid of the four types. However, the short-chimney lighting-ring burner was almost as quick and used less kerosene. The wickless burner used less kerosene than the long chimney but was slower. The total cost of the wickless burner, including gasoline for priming, is almost as high as that of the long

chimney, which included wicks. Considering the higher speed of the long-chimney burner, the slightly lower operating cost of the wickless is of slight significance. The total operating cost of the two short-chimney burners, including wicks and lighting rings, was the same. It is possible that over a long period of time the long-chimney burner, which is rapid, as well as quickly and easily turned out and lighted, might consume no more oil than other types. For a large number of cooking processes of short duration, there would probably be less tendency to waste oil with this type of burner.

Food cooked on the different burners was satisfactory in appearance and quality. There were some variations, however, which were interesting. Meats cooked as pot roasts were more tender over the wick burners than over the other types. Steaks were more uniform in quality than pot roasts. Probably this is because the burners using wicks were more easily adjusted for varying temperatures. The use of extra grates or asbestos pads under utensils is a help in regulating temperature, but it means waste of heat and the care of additional pieces, which are frequently misplaced. Loaf cakes and roasts, which require slower ovens, were of better quality over the wick burners, again probably because these burners were more readily adjusted. By using only one burner under the oven for the other types, lower temperatures could be obtained. There was, however, always the disadvantage of slow flame adjustment. Foods requiring very hot ovens, such as cookies, muffins, and some pies, were satisfactory with either type of burner.

Two features of construction of the framework of a kerosene stove affect its practical use, as well as the cost of operation. These are the type of grate used over the burner and the draft spaces behind it. Most kerosene stoves have open grates similar to those used on gas stoves. The burners on one stove were covered with heavy iron tops somewhat like those on coal stoves, except that there were openings in the top directly over the flame. The heavy tops decrease the speed of the burner and increase the oil consumption. Because they retain heat, they may, in some cases, be an advantage for keeping food hot. The draft spaces back of the burners provided on some stoves are enclosed so that surplus heated air from the burner is retained and used for slow cooking or for keeping food hot. Simmering temperatures can be obtained over the draft spaces, and can be utilized to complete the cooking of foods which have been heated directly over the flame. Where several foods are being cooked, the additional space and heat provided by the draft space add convenience and save oil.

Fuel is wasted by using utensils which are not suited in size to the size of the burner. Very small utensils used over giant burners are extremely wasteful of fuel, as the amount of oil consumed is high in proportion to the heat utilized. From the standpoint of speed and economy, utensils about twice the diameter of the burner are most efficient.

The formation of soot on utensils from kerosene burners is very annoying. Burners constructed so that soot can be prevented will go far toward lessening possible prejudice against kerosene stoves. To determine how the different types of burners varied in this respect, records of soot formation were kept during the entire study. Utensils used over the long-chimney wick burners with the flame adjusted to form yellow tips 1½ inches above the blue flame were entirely free from soot. The short-chimney types, with wicks and with lighting rings, formed soot in varying amounts in about 60 per cent of the times the burners were used and the wickless type in 75 per cent. Where the flame is in contact with, or very close to, the utensil, it is affected by factors outside the burner, such as draft, drops of water from the utensil, or contact with a cold utensil. The distance of the flame from the utensil in the long chimney and the fact that it is protected by the chimney prevent the formation of soot, if the height of the flame is adjusted as directed.

In order to compare the extent to which the various burners cause odor, the stoves were placed one at a time in a small room and the odor was rated by eight persons under the following conditions: (1) immediately after the burner was lighted; (2) when burning at full heat; and (3) immediately after it was turned out. All burners were rated as having most odor under the first condition and least under the second. As to type, the long-chimney burner was rated as giving least odor, the lighting ring and wickless as giving most. The wickless type had, in addition to the kerosene odor, the odor of the primer.

CARE AND MANAGEMENT OF KEROSENE STOVES

Directions from manufacturers accompanying stoves should be read and carefully followed. The following are general points which may be applied to stoves with any type of burner.

To get maximum service, all parts of the burner must be kept clean and free from carbon or food particles so that there are no obstructions to the entrance of air and the proper combustion of fuel. Burners may be cleaned with a cloth or brush or by boiling in a solution of washing soda.

All parts must fit together properly or there will be smoke and noise.

The oil pipe must not be allowed to become clogged. If such a condition arises, the pipe should be cleaned by tipping and draining oil out of the opening provided for that purpose in the end of the pipe. Rinsing should be done with clean oil, not water. If there are obstructions, they may be removed by a wire. Occasionally the connection between the burner and feed pipe must be removed and cleaned.

The oil supply should not be allowed to run out while the stove is in operation. This wastes the wick and causes objectionable odor.

Stoves should be level. Position is more important for stoves having burners with lighting rings or wickless burners than for the burners with wicks.

Stoves should be placed where draft will not affect them.

When the stove is to be out of use for some time, it should be drained, wiped with an oiled cloth, and stored in a dry place.

SPECIAL RULES FOR STOVES WITH LONG-CHIMNEY BURNERS

The long-chimney burner, being simplest in construction, is easiest to clean. The chimneys are enameled and can be washed with soap and water. The condition of the wick is very important. It should be kept even and free from char. This requires a few minutes daily (depending on the length of time the burner has been used). To clean the wick, the chimney and outside collar must be removed. The wick may be cleaned by rubbing with a cloth wrapped around the finger; or the flame spreader may be inverted, covered by a cloth, and turned forward and backward in contact with the wick; some manufacturers provide a wick cleaner for this purpose. Wicks may be patted down with the fingers but should never be evened with scissors.

Care should be used to adjust the flame for temperatures suitable to the cooking process. The burner should be heated thru before the wick is turned up for maximum heat. This requires about two minutes. If the flame is turned high too soon after lighting, it will creep up as the burner heats. If the burner is provided with an automatic wick stop, the flame is prevented from going too high. The wick should never touch the flame-spreader, as this obstructs the circulation of air.

Wicks should be kept turned down when not in use to prevent oil creeping up into the burner and causing an objectionable odor when the burner is relighted.

Wicks may be kept loose from the wick tubes by turning them up and down after the burners have been in operation for several hours.

Flame spreaders should be cleaned with a dry brush, as water rusts them.

SPECIAL RULES FOR SHORT-CHIMNEY BURNERS WITH WICKS

This type, having combustion chambers inside the chimney, is not so easily cleaned as the long-chimney type. The combustion tubes and chimney are enameled and can be cleaned with soap and water and a long-handled brush.

The utensil should not be placed over the burner until the chimney is lowered after lighting, as a cloud of smoke is always formed which will blacken the utensil.

If the burner is not provided with an automatic wick stop, the wick should be "set" before lighting. Directions for this will accompany the stove.

The flame should be kept blue to prevent soot.

The chimney should be kept raised and the wick turned down when the stove is not in use to prevent oil from creeping up into the combustion tubes and causing an objectionable odor when the burner is relighted.

Wicks should be cleaned every few days or weekly, using the method as directed for long-chimney burners; carbon should not be allowed to collect in the wick tubes, as it causes the wick to stick. Some manufacturers provide a device for keeping the wick tube clean. If this is not available a sharp knife may be used.

SPECIAL RULES FOR BURNERS WITH LIGHTING RINGS

This burner, being similar in construction to the short-chimney wick type, is not so easily cleaned as the long-chimney type. It can be cleaned as directed for the short-chimney wick type.

Care should be taken that there is not too much oil allowed to run into the oil trough before the burner is lighted or the flame will rise too rapidly and flare, forming soot.

Utensils should not be placed over the burner before the drum is lowered after lighting, as smoke rises and will blacken them.

The flame should be kept blue to prevent soot forming on the utensil.

Lighting rings should be kept loose from the oil trough. They may be loosened by running a knife around the edge of the trough and inside the ring. Burners should be cleaned weekly and any loose particles brushed out. Lighting rings should be replaced when they are charred or sooty.

Care should be taken that oil is kept turned out of the trough when the stove is not in use.

SPECIAL RULES FOR WICKLESS BURNERS

Even tho of heavy parts, the burner is not difficult to keep clean, as food falling on the burner becomes charred and is easily removed by a stiff brush.

The burner must be hot enough to vaporize the kerosene before the latter is turned into the troughs. About seven minutes are required to heat the burner.

Care should be taken that not too much oil is turned into the troughs at first or the flame will rise too rapidly and smoke the utensil.

Hot burners should not be primed. After a burner has been turned out, if it is hot enough to vaporize kerosene, the kerosene may be turned in without priming. Otherwise the burner must be allowed to cool before relighting.

The flame should be kept below the grates to prevent the formation of soot on the utensil.

To save fuel, the burner should be turned out before cooking is finished, as this type of burner holds heat much longer than other types.

Oil should be kept turned out of the troughs when the stove is not in use.

FEATURES OF FRAMEWORK THAT ADD TO CONVENIENCE

The framework should be high enough so that the operator does not have to stoop. Many stoves are so low that even a person of average height cannot comfortably operate them. A few stoves are provided with means of regulating heights. A suggested height for such working surfaces as stoves or tables is one which allows the worker to stand with back straight, shoulders erect, and with arm and hand at comfortable angles. This position brings the elbow five to eight inches above the level of the working surface, the difference depending upon the length of the forearm and hand.[1]

The stove should be solidly constructed with joints so made that they do not work loose.

Finish should be durable and easy to clean.

There should be removable trays under the burners made of material which is easily cleaned and does not discolor. The space under the burners should allow room for cleaning or recovering articles which have fallen under them.

It is convenient to have both giant and standard burners so that the utensil may be suited to the size of the burner. Burners should be far enough apart to allow for various sized utensils.

Stationary shelves above the burners, where dishes or cooking tools may rest, are convenient.

There should be no projections which catch clothing easily.

Oil tanks should be large enough so that frequent filling is unnecessary. They should be located in an easily accessible

[1] From studies of heights of working surfaces made by Mary A. Mason, Head of the Division of Household Equipment, Department of Home Economics, University of Nebraska.

position and made of material which allows the oil supply to be visible.

Built-in are more convenient than portable ovens but require more floor space for the stove. Food may be kept satisfactorily hot in a built-in oven with the minimum consumption of oil, that is, one burner at low flame. The oven should not be located back of or above other burners; such positions make it necessary for food to be lifted over burners which may be hot.

Heavy tops, which require a long time to heat, have the advantage of keeping food hot. It is a question whether such advantage outweighs lack of speed and responsiveness.

Draft spaces back of the burner are convenient for slow cooking or for keeping food hot. If such spaces are provided, the depth of the stove from front to back should be great enough to provide room for different-sized utensils. Otherwise the draft space is of little use.

OTHER POINTS TO KEEP IN MIND WHEN PURCHASING STOVES

It is undesirable to purchase any stove which cannot be serviced or for which supplies cannot be purchased.

When choice of stove is influenced by appearance, the purchaser should question just what portion of the price paid is for appearance alone. Many features which attract the eye, even if desirable, have nothing to do with efficient performance.

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