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Pressure Gasoline and Pressure Kerosene Stoves

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PRESSURE GASOLINE AND PRESSURE KEROSENE STOVES

Factors of Safety

FIRE HAZARD
SHUT-OFF VALVES
CARBON MONOXIDE

Facts of Construction

THE "SATISFACTORY STOVE"
BURNERS
COOKING TOP GRATES
OVEN INSULATION
EXTERIOR SURFACE

Features of Performance

HEATING EFFICIENCY
OVEN CONTROL
COMPARATIVE PERFORMANCE OF FUELS AND STOVES

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Pressure Gasoline and Pressure Kerosene Stoves[1]

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THERE are people who believe that pressure gasoline and pressure kerosene stoves are dangerous cooking appliances to use in the home. Possibly this opinion is, in some instances, justified. Nevertheless, these stoves deserve careful consideration because: they are much more efficient than the ordinary gravity flow kerosene stove; they have insulated ovens; they often have a good temperature indicator, and, what is most important, they cook and bake rapidly. The important factors to consider when either purchasing or operating a stove of this type are safety, construction, and performance.

SAFETY

Fire hazard. Whether or not a gasoline stove is dangerous depends mainly upon the way in which the gasoline is handled. Under certain conditions gasoline becomes a violent explosive. One should remember never to pour gasoline near an open flame. There should be no leaks in the stove. When any gasoline is spilled, it should be wiped up immediately; the cloth used in the act should be put outside to let the gasoline evaporate or be deposited in a covered metal container. Although kerosene is not as volatile a fuel as gasoline, the same precautions listed above should be observed in its handling.

Safety thermostatic shut-off valves. A further way to control the fire hazard is to equip the stove with a satisfactory safety valve which will shut off the fuel supply whenever the generator burner flame is accidentally put out. Unfortunately, some of these valves do not perform satisfactorily and may cause the stove to become a fire hazard. Three of the stoves which were studied had "safety" valves, (see Figs. 10, 11, and 12), but only the one shown in Figure 10 proved to be satisfactory. The valves shown on the cooking tops in Figures 11 and 12 did not close the fuel line and allowed liquid fuel to gather in the manifold (see figures) and burn from the burner in long yellow flames. In some instances these flames rose to the dangerous height of two feet. Therefore, when purchasing a pressure gasoline or pressure kerosene stove, one should insist upon a written guarantee stating that the safety valve will completely shut off the fuel supply to the generator and burners within four minutes after the generator flame goes out.

Carbon monoxide. The dangers of inhaling carbon monoxide gas are in general very well known to the public, but little or nothing has been said about its production when using gasoline or kerosene stoves. From extensive laboratory tests conducted on these stoves it was concluded that though in a few cases considerable carbon monoxide was produced, these stoves may be operated continuously for periods of at least one and one-half hours, and in the majority of cases for longer periods, without producing ill effects from

[1] For a detailed report of the technical study of these stoves refer to Nebr. Agr. Exp. Sta. Res. Bull 127, "An Analysis of Pressure Gasoline and Pressure Kerosene Stoves," March, 1942.

carbon monoxide poisoning. In arriving at this conclusion the essential factors which affect one's susceptibility to carbon monoxide were considered.

CONSTRUCTION

The time that a stove will last with normal use and care depends upon the construction and the kind and quality of materials used. Pressure gasoline and kerosene stoves of the class shown in Figures 1 to 4 were well built. None of these stoves has all of the characteristics desirable in a satisfactory stove,[2] but by choosing the best features of each, a stove having desirable characteristics can be visualized and used as a basis for comparing stoves found on the market.

FIG. 1.—Stove A, pressure gasoline.

FIG. 2.—Stove B, pressure gasoline. 8. starter valve, 9. fuel and operative valve, 10. pressure gauge and fuel level gauge, 11. pump, 12. filler cap, 13. generator valve handle.

In the satisfactory stove the burners are readily removable for cleaning, and they are designed for easy and correct re-assembly. The burner head gives either a large or small flame spread, depending upon the pan that is being used. The gas issues from ports or slits in the side of the burner head and produces a horizontal flame. Burner manifold systems are securely held in place to keep the burners level. Oven burners lighted through a hole in the oven bottom are properly placed with respect to the lighter tube to assure positive lighting.

[2] A "satisfactory stove" may be taken to mean one that meets ideally all requirements and expectations.

The cooking top grates are rugged but not heavy, and they are designed to be placed only in one proper position on the stove. Grate arms are designed to support a one-quart pan. The grates have adequate vertical clearance to support 10-inch pans with flat or recessed bottoms without smothering the flame. Under the grate there is a bowl surrounding each burner. The bowl helps to collect or direct boil-overs and also limits the amount of excess air that must be heated.

FIG. 4.—Stove D, pressure kerosene.

FIG. 3.—Stove C, pressure gasoline.

The gasoline supply lines are copper or brass tubing with connections rugged, tight, and easily accessible for repairs. All joints at the supply tank are sealed with a cement or sealer not affected by gasoline or kerosene. The manifold is supplied with a drain plug. The generator is easily removable for cleaning and repairs, and it is designed to prevent incorrect assembly. The generator is also protected from boil-overs. The starting or carburetor valves at the tank are simple in construction and positive in action. The air pump for producing pressure is easily accessible for repairs. The fuel tank is made of rust-resistant metal and it is protected from excessive heat.

Although automatic lighter tubes on the cooking top are not essential, they are a convenience. When used they are properly aligned to insure positive lighting of the cooking top burners within four seconds.

The range body has an angle iron base or one of similarly strong construction, well braced with welded joints. The side frame is either angle iron with welded joints or pressed steel braced for rigidity. No deformation is produced by a heavy load supported on the cooking top.

Exterior surfaces are finished in porcelain enamel or some equally effective rust-resistant finish. The back may have a baked enamel finish.

Doors and drawers can not be deformed by twisting and the drawers slide on non-tilt guides. Oven and broiler doors are insulated with mineral wool or glass wool.

The oven has insulated side walls and top. The insulation is at least one inch thick and is uniformly packed. Oven and broiler linings are finished in porcelain enamel or they are made of rust-resistant metal. There are sufficient rack spaces properly placed to allow baking six loaves of bread at one time without the bread touching either the middle rack or the top of the oven. The oven racks are non-tilt and rust resistant. The broiler pan is

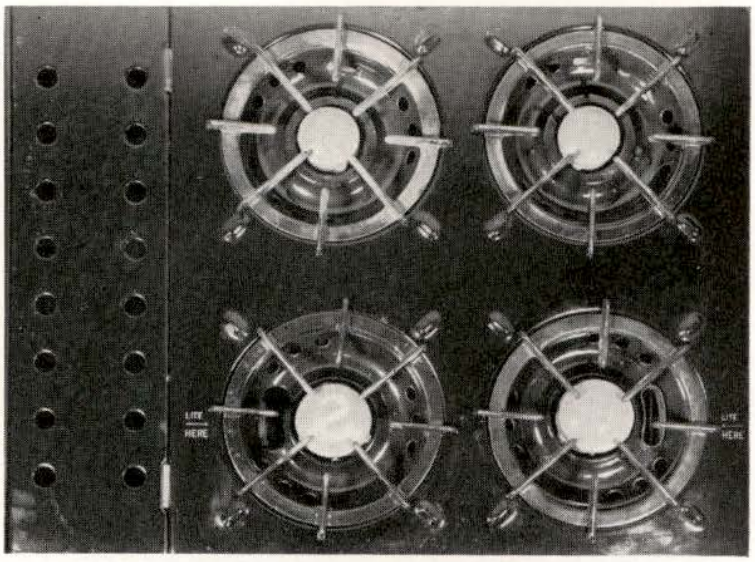

FIG. 5.—Cooking top, stove A.

the non-inflammable type. The oven bottom is removable for cleaning. To indicate oven temperature, the oven is equipped with a good thermometer located in a sensitive place.

These are the essential characteristics of a good stove. Study the stove you intend to buy to see how closely it will compare with the stove described above.

Typical cooking tops, designated A, B, C, D, are shown in Figures 5 to 8. Cooking tops A and B have the best design; the principal fault with top D is its unprotected generator burner. Cooking top C fails in several ways to meet the requirements.

Study the detailed views of the generating systems, burners, manifolds, and safety valves shown in Figures 9 to 12. Note that the burner ports are on the side of the burners for stoves A, B, and D. Note the lighter tubes on cooking tops B and C, Figures 10 and 11.

Now that the desirable characteristics of the satisfactory stove have been enumerated what kind of performance can be expected? The answer may be obtained by considering the performance of the different stoves A, B, C, and D.

PERFORMANCE

Since adequate instruction in the general operation of each range and advice concerning the usual causes of trouble are furnished the purchaser, discussion of performance will be limited to the improvement of efficiency. For efficient operation it is important to maintain proper tank pressure. Moreover, the stove will be found to operate most successfully if the generator tube is kept very hot. When using only one burner and a very low flame, however, this is not always possible. When the generator is not sufficiently heated, the gasoline may not be completely transformed into gas and a disagreeable odor may result. To overcome this difficulty the flame at the burner must be made larger even though more heat than is needed is actually being used.

FIG. 6.—Cooking top, stove B.

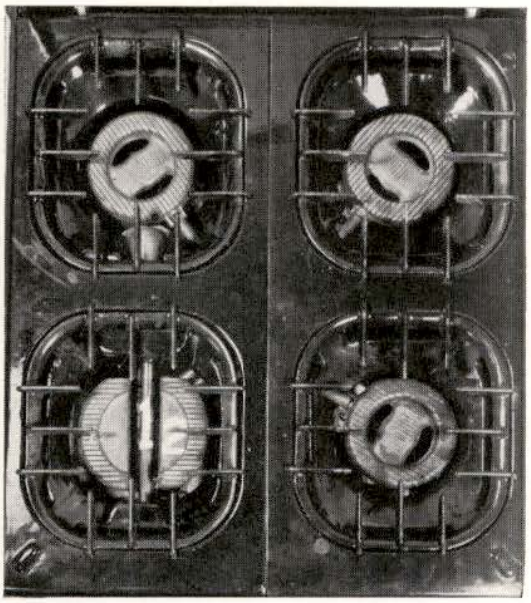

FIG. 7.—Cooking top, stove C.

Cooking top. When choosing one of these stoves, it is desirable to know how much of the gasoline supplied to the burners is actually used to heat the utensil and food. In order to answer this question properly the size of the utensil must be considered. Less heat is lost when using a pan with a large bottom, such as pans 4 and 9 in Figure 13, than when using the small sized one- and two-quart pans, 7 and 8 as shown in Figure 13. Specifically, 37 per cent to 45 per cent of the fuel is delivered to pan 4 containing 5 pounds of water, whereas only 18 per cent to 23 per cent of the fuel is delivered to pan 8 containing 1½ pounds of water. Cooking tops A and D were superior in this respect to cooking tops B and C.[3] However, it must be pointed out that the highest percentage of heat transfer is accomplished with those burners where part of the generator heat can be utilized. The burners on cooking top B, the right front burner of cooking top A, and the right

[3] Based upon results shown in Nebr. Agr. Exp. Sta. Res. Bull 127.

front and rear burners on cooking top D all transfer approximately the same amount of heat to the utensil and its contents; the amount of heat transferred from the burners on cooking top C is considerably less.

Many housewives want to know how long it takes to boil water. These burners can be adjusted to boil 2½ quarts of water within 11 to 16 minutes—when the water is initially at 68° F. For all practical purposes, this is rapid heating. Unlike gas and electric stoves where the fuel rate is fixed for full heat, gasoline and kerosene stoves have adjustable fuel rates at full heat. Consequently, the time of heating can be varied, depending upon the setting of the generator, that is, there is no fixed maximum full rate.

Unfortunately, the flame on the cooking top burners studied can not be turned low enough to keep water gently boiling without great evaporation

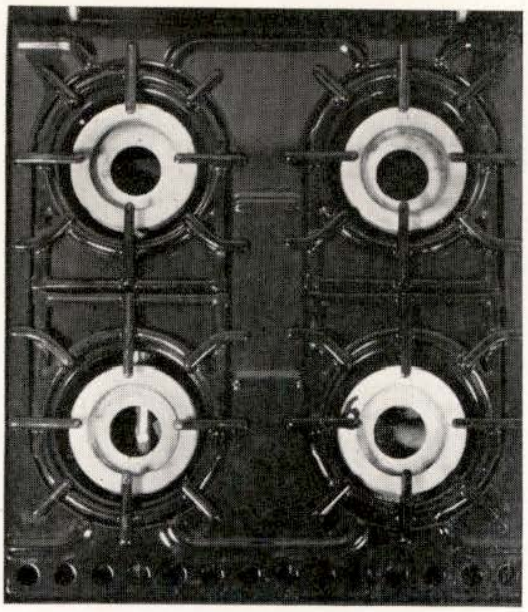

FIG. 8.—Cooking top, stove D.

loss. As previously stated, when the flame is turned too low the generator does not keep sufficiently hot. Finally, the flame begins to flutter and then goes out.

When it is necessary to prepare food over a low flame, be sure to use a little extra water to compensate for evaporation. However, do not use a great amount of extra water; use just enough to complete the cooking without boiling dry. With a high flame even more water is necessary than with a low flame.

For such cooking as pan broiling steaks and baking griddle cakes, all of the various types of burners shown in the figures have a sufficient flame spread to do efficient work.

Although no one intentionally lets food boil over, this is apt to happen occasionally. Burners of cooking tops shown in Figures 5 and 6 or 9 and 10 are not affected by boilovers, nor are the generator burners; but the burners on cooking top C, Figure 7, are likely to get clogged, and the generator

burner on cooking top D, Figure 8, can get clogged even though the burner ports are apparently well protected.

For all-round performance and convenience, cooking top B ranks first, cooking top A ranks second, cooking top D ranks third and cooking top C ranks lowest.

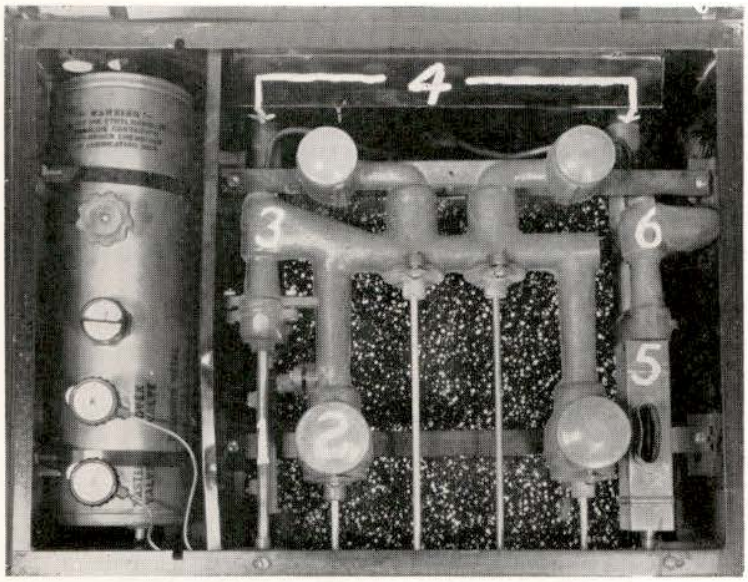

FIG. 9.—Cooking top burners and generator system, stove A. 1. generator for top burners, 2. master burner, 3 top burner manifold and mixing chamber, 4. air intakes for top burners and oven burner, 5. generator for oven burner, 6. oven manifold.

Ovens. An oven that performs well should lighten decidedly the task of baking. An oven that preheats rapidly saves time. To accomplish this efficiently the oven burner must burn the fuel without showing a yellow tinge around the flame. It likewise follows that the generator must be able to convert the liquid fuel into gas. When one overloads the generator with too much liquid fuel, the flame becomes tinged with yellow. To remedy this the inflow to the generator should be decreased by closing the generator valve a trifle. With this lessened intake of fuel, the warming up time will be obviously lengthened. Laboratory experiments show that the optimum preheating times to raise the oven temperature 420° F. above room temperature for the stoves shown in Figures 1 to 4 were 20 minutes for stove A, 14 minutes for stove B, 13½ minutes for stove C, and 26 minutes for stove D. Whether or not the stove you intend to buy has an oven that can be preheated in 14 minutes is a matter for you to decide by actually timing the warming-up period when the flame is burning with a bright blue color.

For successful baking, the proper oven temperature must be maintained, and furthermore the distribution of the temperature in the oven should be fairly uniform. It is not difficult to get uniform temperatures if the oven is insulated and properly vented and though the oven temperature is controlled by adjusting the generator valve with the hand, one easily learns how to make

this adjustment after a few trials. In fact, actual baking tests indicated that all of these ovens shown in the figures baked satisfactorily. An additional good reason for insulation is to retain the heat in the oven and thereby keep it out of the kitchen. Moreover, an insulated oven does not require as much fuel to operate as does an uninsulated oven.

It is both desirable and convenient to have an oven equipped with a thermometer which can be read from the outside. The usual oven thermometer

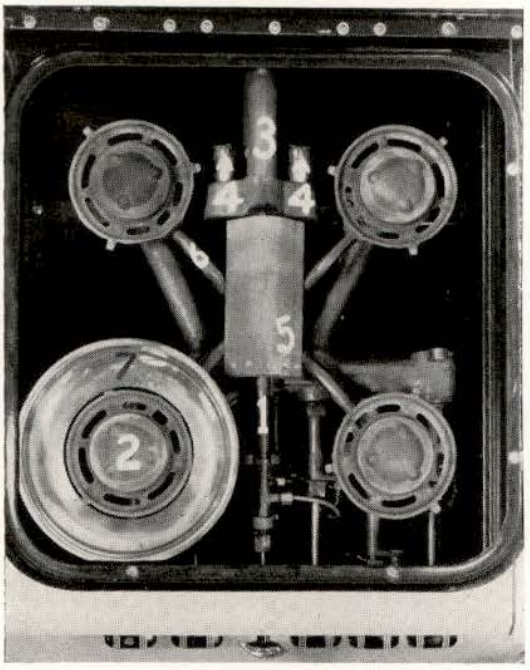

FIG. 10.—Cooking top burners and generator system, stove B. 1. generator for all burners, 2. master burner, 3. burner manifold and mixing chamber, 4. air intakes, 5. shield over generator burner, 6. automatic lighter tube, 7. burner bowl; safety valve directly under generator.

is the bi-metallic strip type. It is preferable to have the bi-metallic strip exposed to the hot oven gases. Thermometers placed in the oven door panels as shown in Figures 2, 3, and 4 prove to be rather insensitive. When the oven is being preheated, the thermometer lags too far behind the actual oven temperature with the result that the oven actually has a higher temperature than the thermometer indicates.

That it is possible to have a thermometer which indicates the true oven temperature was demonstrated by the one on stove A, Figure 1. (This thermometer does not appear in the photograph because it is located on the upper outside corner of the right side-wall near the oven door.) The heat sensitive element was directly exposed to the hot oven gases.

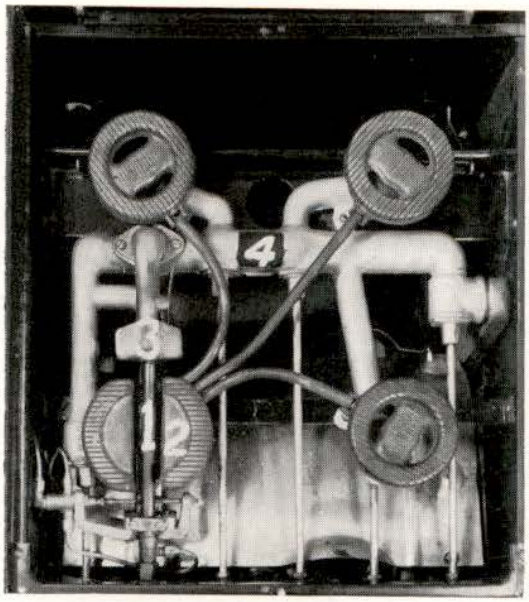

FIG. 11.—Cooking top burners and generator system, stove C. 1. generator for all burners, 2. master burner, 3. air intake and mixing chamber, 4. manifold. Also shown are lighter tubes radiating from the master burner and safety thermostat (horizontal rod) in front of master burner.

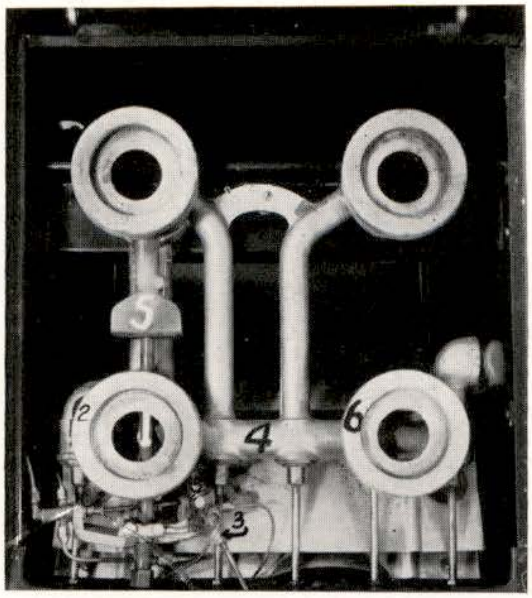

FIG. 12.—Cooking top burners and generator system, stove D. 1. generator for all burners, 2. master burner, 3. starting torch, 4. manifold, 5. air intake and mixing chamber, 6. regular burner. Also shown is safety thermostat (slightly inclined rod) in front of master burner.

FIG. 13.—Typical pans used for cooking. No. 1—3 qt. aluminum sauce pan, No. 2—4 qt. aluminum sauce pan, No. 3—3 qt. porcelain enamel sauce pan, No. 4—5 qt. porcelain enamel sauce pan, No. 5—6 qt. aluminum stock kettle, No. 6—8 qt. aluminum stock kettle, No. 7—2 qt. aluminum sauce pan, No. 8—1 qt. aluminum sauce pan, No. 9—3 qt. aluminum sauce pan.

COMPARISON BETWEEN PRESSURE GASOLINE AND PRESSURE KEROSENE STOVES

In most respects pressure gasoline and pressure kerosene stoves are constructed and perform very much alike. Nevertheless, in choosing one or the other, the fuel used becomes a deciding factor. One must always remember that gasoline improperly handled is a dangerous fuel. Kerosene, though inflammable, does not have the explosive characteristics of gasoline. For that reason, the kerosene stove fills a distinct need for those who do not wish to have gasoline in the kitchen.

Despite these dangers in handling it must be pointed out that the gasoline stove has an advantage over the kerosene stove in the matter of lighting. Gasoline is so volatile the burners will light instantly, but the kerosene generator must be preheated by a starting torch, which is one of the inconvenient features of the kerosene stove, and considerable practice is necessary to become acquainted with its use.

When summarizing the advantages and disadvantages of these two types of stoves, the result becomes in the end a question of safety. Except for the possibility of purchasing a stove with a faulty thermostatic safety valve the problem of safety depends primarily upon the individual. If one uses the stove carefully, it will give good service and performance; if one is careless about handling the fuel then he exposes himself and others to unnecessary dangers.

THE FINAL WORD OF CAUTION SHOULD BE: DON'T TAKE ANY CHANCES.

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