

Reference books not to be taken from the library.

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

S. W. STRATTON, Director

CIRCULAR OF THE BUREAU OF STANDARDS

No. 116

[Issued AUGUST 17, 1921]

HOW TO GET BETTER SERVICE WITH LESS NATURAL GAS IN DOMESTIC GAS APPLIANCES

A MILLION DOLLARS' WORTH OF GAS WASTED EVERY DAY IN THE HOMES

It is estimated that 150 000 000 000 cubic feet of natural gas is wasted annually with domestic appliances alone. This waste could largely be prevented by efficient methods of utilization. If this amount of wasted natural gas was replaced by artificial gas at \$1.25 per thousand, it would cost \$375 000 000, or an average of about \$1 000 000 per day.

GAS USERS WILL SOON HAVE TO DO THEIR COOKING WITH COAL OR WOOD

Statistics tabulated by one prominent engineer show that only a small percentage of the more than 2100 small communities now supplied by natural gas are large enough to maintain manufactured gas plants when natural gas is no longer available. This will mean that when the natural gas is gone they will have to go back to solid fuel with its many inconveniences. Geologists tell us that there will be a steady decline in the current supply of natural gas, at least in territories contiguous to the centers of our population. It is therefore a matter that concerns our national welfare and should be a matter of real concern to every user of natural gas that this most ideal and cheapest of all fuels should be used carefully and the supply made to last as long as possible.

**A LARGE PERCENTAGE OF OUR POPULATION ARE DEPENDENT UPON
NATURAL GAS**

Of all the towns in the United States that have gas, about one-half have natural gas. There are more than 2100 communities supplied with natural gas, having a total of over 2 500 000 gas consumers.

**REDUCTION OF PRESSURE AN IMPORTANT AID IN REDUCING GAS
LEAKAGE**

In connection with the very earnest efforts of the gas companies to reduce the very large leakage in the distributing systems, many of the gas companies are asking the utilities commissions to allow them to reduce the pressure to as low a point as is possible without interfering with the quality of service. This is a very important means for reducing the losses in the distributing systems when it is realized that the leakage at 4 ounces (7.0 inches) pressure is approximately 40 per cent greater than it is at 2 ounces (3.5 inches).

**QUALITY OF SERVICE NOT AFFECTED BY REASONABLE REDUCTIONS
IN PRESSURE**

A great deal of misconception exists in the minds of a large number of consumers of natural gas regarding the quality of the service and utilization efficiency of natural gas when supplied under different pressures. From the domestic consumers' standpoint there should be absolutely no objection to a reduction in pressure to 2 ounces (3.5 inches), or even less, since every experiment and demonstration shows that the quality of service is not thereby impaired but, on the contrary, very much improved, if proper adjustments in appliances are made at the time that the pressure is reduced.

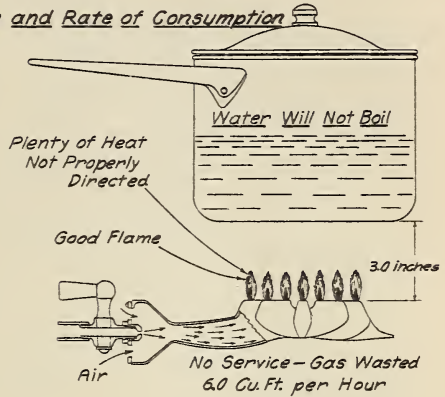
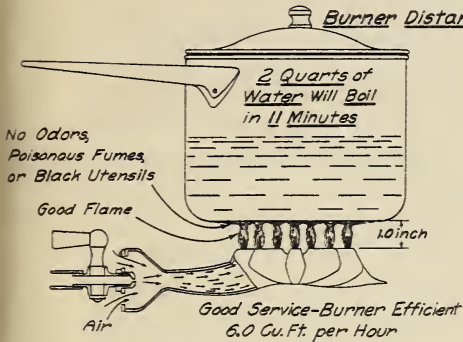
It is true that with many natural-gas appliances, as they are at present adjusted with the burner $2\frac{1}{2}$ inches or more from the utensil, which makes it necessary to burn a large quantity of gas to get good service, a high pressure is necessary to inject enough primary air into the burner to prevent a smoky luminous flame which blackens the utensils. Investigations made by the Ohio State University, Department of Agriculture, Bureau of Mines, and Bureau of Standards show that when burners are $2\frac{1}{2}$ inches from the utensil they are very inefficient and therefore wasteful. The cost of raising the burners is but a small sum compared to the saving that can be accomplished. It should not be argued that

THE OPERATION of NATURAL GAS BURNERS

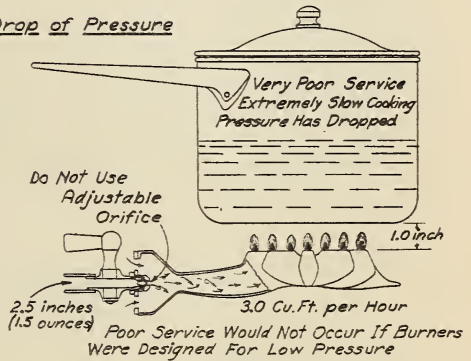
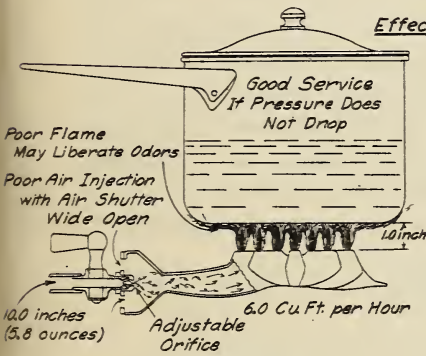
A Study of a "Standard 4-Inch" Star Burner

Bureau of Standards, Department of Commerce
Washington, D.C.

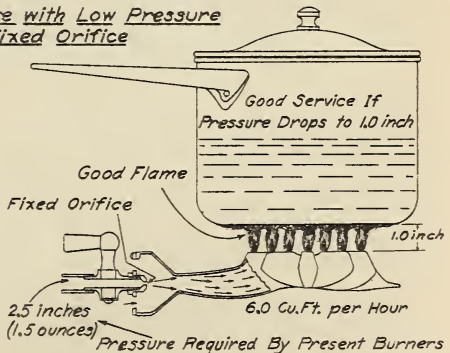
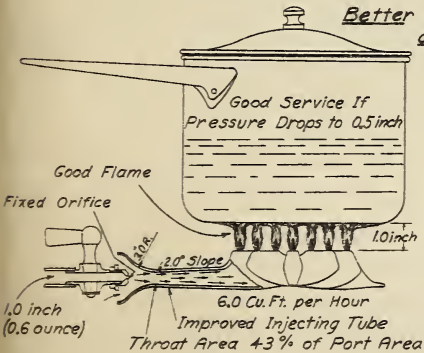
Burner Distance and Rate of Consumption



Effect of Drop of Pressure



Better Service with Low Pressure and Fixed Orifice



If the present natural gas burners now in use were operated with a fixed orifice and a pressure of about 2.5 inches service complaints would be fewer. Improved burners require only 1.0 inch of gas pressure to inject the air into the burner.

high gas pressure and low-set burners should be continued merely to enable the careless user to have service.

**COMBUSTION OF NATURAL GAS IS SLOW AND HIGH GAS PRESSURE
CAN NOT BE UTILIZED**

The combustion of natural gas is very much slower than that of artificial gas, and it has been noticed by every user of natural gas that when the gas pressure is high there is a tendency for the flames to leave the ports of the burner. This is especially true if the air shutter is left open. With an average burner operated at 4 ounces (7.0 inches) pressure it is necessary to have the air shutter of the burner practically closed. If the pressure is reduced to 2 ounces (3.5 inches), the size of the gas orifice must be slightly increased to give the same gas rate, and the air shutter must be opened a little wider to secure a good flame. We have, therefore, in the case of two burners, one operated at 4 ounces and the other at 2 ounces pressure, the same volume of gas entering the burner, the same volume of air drawn into the burner, resulting in exactly the same appearance of flame in both cases. The efficiency of utilization should be identically the same, which has been shown by a great many laboratory tests to be the case. That rapid cooking is wasteful can be readily demonstrated, and since it is possible with 2 ounces pressure to get all the gas into a burner that can be effectively utilized, there can be no advantage in supplying it at a higher pressure.

**CORRECT POSITION OF BURNERS MEANS LOWER GAS BILLS AND
BETTER SERVICE**

If the standard size natural-gas burners are placed properly (within about an inch of the utensil) a consumption of about 6 cubic feet of gas per hour is sufficient to give the speed required for all ordinary cooking operations and much gas will be saved that otherwise would be wasted. With this gas rate almost any burner can be easily adjusted to burn gas with a good flame with pressures even lower than 2 ounces. With the present low-set natural-gas burners the service is greatly impaired if the pressure drops from 4 to 2 ounces, assuming that the burner was designed and adjusted for 4 ounces pressure. The advantage of being able to operate a raised burner designed for 2 ounces pressure is that the service is not appreciably affected until the pressure drops below 1 ounce.

IT IS EASIER FOR THE COMPANY TO GIVE GOOD SERVICE WITH LOW PRESSURE

The lower the minimum pressure at which the gas companies are allowed to supply the gas to the consumers the easier it is for the company to maintain satisfactory pressure conditions. In many cases the line pressure is quite sufficient to give good service, but it is not properly utilized due to the poor design of the burner and burner orifice and dirty burners.

SOLID TOP STOVES WITH LOW-SET BURNERS WASTE GAS AND GIVE POOR SERVICE

By removing the solid top and raising the burner close to a grid the efficiency will be increased approximately 400 per cent. Instead of a standard burner in a closed-top stove, consuming about 16.0 cubic feet per hour (17 000 heat units per hour) as at present, the raised burner in an open-top stove, consuming about 6.0 cubic feet per hour (6500 heat units per hour) will do the work in one-half the time.

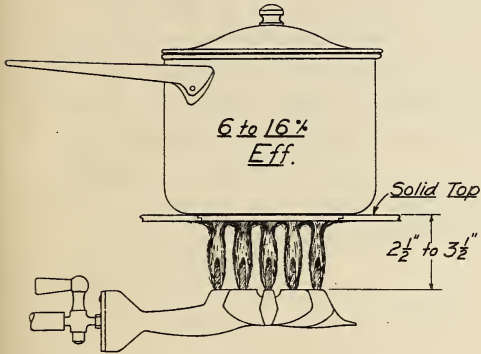
Technical Paper 257 of the Bureau of Mines, "Waste and Correct Use of Natural Gas in the Home," gives instructions on raising burners to the correct position. In general, it would be advisable to consult with the local gas company first, for they are glad to give advice and are often equipped to make the necessary changes with the least cost.

WASTES THAT OUGHT TO BE PROHIBITED

(SUMMARY FROM TECHNICAL PAPER 257 OF THE BUREAU OF MINES)

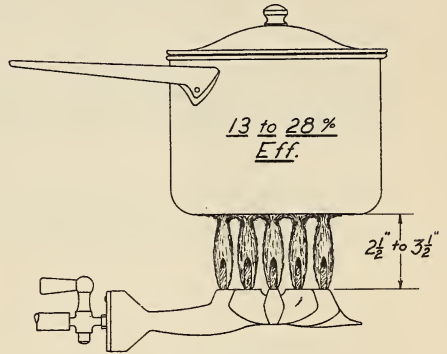
- (a) Improper adjustment of appliances, resulting in imperfect combustion.
- (b) Low burners; that is, burners more than $1\frac{1}{4}$ inches away from the cooking vessel on cook stoves.
- (c) Solid tops on cook stoves. Grid tops or skeleton lids only should be used.
- (d) Use of gas in coal furnaces and stoves. Especially built gas-heating appliances, giving an efficiency of at least 75 per cent should be used.
- (e) No hot-water heater should be used that gives an efficiency of less than 75 per cent.
- (f) No tank heater—that is, tank with burner underneath—should be used without an outer jacket and flue connection.
- (g) All daylight burning of lamps ought to be prohibited.

RIGHT and WRONG USE of NATURAL GAS
 Bureau of Standards, Department of Commerce
 Washington, D. C.



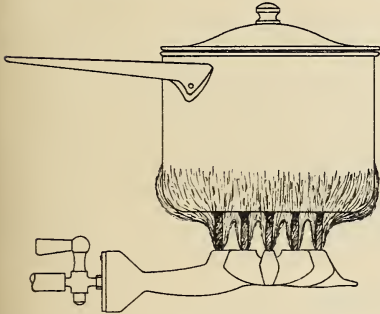
WRONG

No Service with Low Pressures



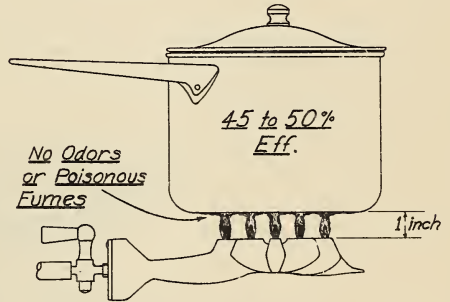
WRONG

No Service with Low Pressures



WRONG

Odors - Poisonous Fumes - Waste of Gas



CORRECT

Good Service with Low Pressures

If the solid tops of stoves are removed and replaced by grids, the burners raised, and all domestic appliances operated correctly, at least \$1,000,000 worth of natural gas would be saved daily.

Faint header text at the top of the page, possibly including a title or page number.

First main section of faint text, appearing as a paragraph or list of items.

Second main section of faint text, continuing the content from the previous section.

Third main section of faint text, possibly containing a sub-section or specific details.

Fourth main section of faint text, continuing the narrative or list.

Fifth main section of faint text, appearing as a distinct block of information.

Sixth main section of faint text, possibly a concluding paragraph or summary.

Seventh main section of faint text, continuing the overall content.

Eighth main section of faint text, appearing as the final block of content on the page.

Faint footer text at the bottom of the page, possibly including a date or page reference.

The prohibition of the foregoing wasteful uses of natural gas would—

(a) Greatly improve the quality of the service.

(b) Immediately convert low-pressure conditions into usable service for cooking.

(c) Cut down the needed consumption during the cold-weather period, where the demand is now greater than the available supply, so as in effect to make more gas available for all.

(d) Add 15 to 20 years to the period that natural gas will be available for domestic use.

(e) Because of the greatly increased efficiencies obtained, even with decidedly higher prices per 1000 cubic feet, would permit the domestic consumer to get the same service without a greater annual outlay of money.

(f) Permit the many small towns that are too small for the introduction of manufactured gas to have gas service for a much longer period.

WASHINGTON, July 30, 1921.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY
SUBSCRIPTION PRICE, 20 CENTS PER YEAR

▽

