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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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Letter
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OIL HEATING

1. Numerous inquiries have been received by the Bureau in reference to the advisability of substituting oil for coal as a fuel for house heating. The following general information has been compiled to meet such inquiries.

2. The advantages usually claimed for oil fuel are cleanliness, convenience, better control of the fire, availability of the fuel at times when coal can be obtained with difficulty, if at all, and sometimes lower cost of fuel.

3. There are also possible disadvantages connected with the use of oil fuel, among which may be mentioned, odor, noise, higher cost, due to high first cost of some types of installations, higher operating cost, and increased fire risk.

4. With a suitable installation, it is undoubtedly true that oil will be superior on the grounds of cleanliness and convenience as well as ease of control. The matters of odor and noise will depend upon the fuel used and the type of installation and information upon these features should be obtained before making a purchase. The noise may be due either to the roaring of the flame or to a mechanical appliance, such as a motor driven fan. It should be borne in mind that noise due to mechanical appliances tends to increase as the appliance becomes older. A noise that may appear to be unimportant in an installation on exhibition, may, to a person of nervous temperament, become intolerable if continued, either continuously or intermittently, for extended periods.

5. The use of oil undoubtedly involves a greater fire risk than the use of coal. The greater hazard, however, usually leads to the adoption of additional precautions, which in many localities are mandatory. Furthermore, some of the oil burning appliances have been tested with reference to fire hazard, and approved by the insurance interests. It may be said in general, that if an installation is approved by the insurance interests, the fire risk is reduced though not absolutely provided for.

6. Outside of the questions considered in the two preceding paragraphs, there remain the questions of availability and cost, which are rather intimately related. At the present time, (1923), most of the oil-burning appliances sold for house heating burn

12,500
2000

25,000,000

kerosene or a similar light oil and are not designed for using the heavy and cheap fuel oils. At the present time, the amount of kerosene which can be produced is in excess of the demand, but any extensive introduction of oil burning appliances for house heating would probably result in a demand for this grade of fuel which would greatly influence the price. In the future, oil-burning installations which can utilize the heavier grades of fuel will undoubtedly have a distinct advantage, not only on account of the lower price, but on account of the greater quantity of such fuels available. For the present, however, such installations are apparently not on the market and considering only these types which use a fuel something like kerosene, it may be said that in the long run, it is possible that users of oil burners may have as much difficulty in obtaining fuel, as the users of coal, but during the next few years it is quite possible that there will be periods when oil can be much more easily obtained than coal.

7. The availability of a particular grade of fuel may depend upon the locality. It is probable that in most of the smaller cities of the country, a barrel of low grade fuel oil, delivered to the customer would at present cost more than a barrel of kerosene, in spite of the fact that the cost of the fuel oil, at a distributing center, might be only one-third that of kerosene. Before installing any type of oil-burning equipment, the purchaser should, of course, assure himself that means are available for supplying the grade of fuel required.

8. The relative cost of heating with oil and with coal in any particular installation, could not in general be determined without detailed data, but certain general considerations are of interest. The combustion of one pound of oil will yield about 18000 Btu (A British thermal unit, or Btu, is the amount of heat required to raise the temperature of one pound of water by 1°F). Assuming an oil weighing seven pounds per gallon, its heat of combustion would be about 125000 Btu per gallon. The amount of heat which can be produced by the complete combustion of a pound of coal ranges from over 14000 Btu for the higher grades to below 10,000 Btu for the lower grades. In the following it will be assumed that coal as sold for domestic heating has a heat of combustion of 12500 Btu per pound. One gallon of oil has therefore about the same heat of combustion as ten pounds of fairly good coal.

9. In order to heat a house a certain number of Btu must be supplied, and the cost of heating, other things being equal, will be proportional to the cost per Btu, or per million Btu. In the following table the cost of a million Btu or rather the cost of 8 gallons of oil is compared with the cost of 80 lbs. of coal, each of which if completely burned, would according to the preceding paragraph, yield a million Btu.



<u>Cost of Oil</u> <u>per Gallon:</u>	<u>Cost of 8 Gals.</u> <u>(1 Million Btu)</u>	<u>Cost of Coal</u> <u>per 2000 lbs.</u>	<u>Cost of 80 lbs.</u> <u>(1 million Btu)</u>
5 cents	\$0.40	\$5.00	\$ 0.20
6 "	.48	6.00	.24
8 "	.64	8.00	.32
10 "	.80	10.00	.40
12 "	.96	12.00	.48
15 "	1.20	15.00	.60

10. From the above table it might be inferred that coal at \$15.00 per ton of 2,000 lbs. was equivalent to oil at about 8 cts. per gallon, or that heating with oil at 12 cents per gallon would cost twice as much as heating with coal at \$12.00 per ton. Such a comparison would probably be unfair to oil, for a number of reasons. Coal is never burned completely, while the losses due to incomplete combustion of oil are probably very small in a good installation. A suitable type of oil burner will permit a close control of the fire and for this reason oil heating might be much less wasteful than coal heating.

11. A fairer comparison may perhaps be made by assuming that of the heat of combustion of coal 40 % is usefully applied, while with oil, 60% is usefully applied in domestic heating. This would mean that oil is used 1-1/2 times as efficiently as coal. If this is true, the cost per million Btu, actually utilized would be as shown in the following table:

Cost per million Btu. with oil heating (60% efficiency) and coal heating (40% efficiency.)

<u>Cost of Oil</u> <u>per gallon.</u>	<u>Cost per</u> <u>Million Btu.</u>	<u>Cost of Coal</u> <u>Per short ton</u>	<u>Cost of Coal</u> <u>Per long ton</u>	<u>Cost per</u> <u>Million Btu.</u>
5 cents	\$0.67	\$5.00	\$5.60	\$.50
6 "	.80	6.00	6.70	.60
8 "	1.07	8.00	8.95	.80
10 "	1.34	10.00	11.20	1.00
12 "	1.60	12.00	13.40	1.20
15 "	2.00	15.00	16.80	1.50

12. In making comparisons, the cost per short ton or long ton of coal may be used according to the way the coal is bought, and comparison based on prices which prevail or seem likely to prevail, may be made. The figures in the table seem to correspond fairly well with the experience in the very few cases in which information was obtained as to the relative cost of heating with oil and with coal.

13. There are a large number of oil burning appliances on the market and the Bureau is frequently requested to recommend the most efficient one. In reply to such questions it may be stated that an appliance which is inefficient is very likely to produce a great deal of smoke, so that the efficiency of the burner as such usually proclaims itself. In reference to durability, reliability, etc., the Bureau has made no tests or examinations of the various appliances, and if it had it would not be at liberty to make specific recommendations on competitive products. It may be said, however, that the vaporizing type of burner which can easily be assembled from a few castings and pieces of pipe is in general unsatisfactory. In such burners, the oil is vaporized in a closed pipe or casting, and the vapor issuing from very small holes is ignited and ~~the~~ burning, heats the oil in the closed pipe, thus providing a continuous supply of vapor. Such burners operate well on gasoline, but with heavier oils, have a tendency to clog, and require constant attention. To start such a burner the vaporizer must first be heated, which is sometimes done with wood alcohol or gasoline, sometimes with kerosene, in case the smoke produced is not too objectionable. The burners on the market range from this simple type to much more elaborate systems which are sold at a price comparable with the cost of an ordinary heating plant.

14. It is well to bear in mind when examining oil burning appliances, to observe ease of starting, ease of control, adaptability to automatic control, and to disregard claims as to hotness of flame, etc. If combustion is reasonably complete the amount of heat which can be obtained with a burner depends upon the amount of oil burned, and not upon the appearance of the flame. In reference to any appliances, the purchaser should assure himself that the manufacturer is reliable and likely to continue in business, and that prompt and reliable service in case repairs are necessary, will be available.

15. Most oil-burning appliances as now sold are intended for installation in a coal burning heater. It might be expected that a complete installation designed for oil burning, would prove more efficient and satisfactory in general than a converted coal burner. On the other hand, the possibility of returning to coal burning in case oil heating for any reason proves to be or later becomes unsatisfactory, may prove to be of great value.

16. This letter is sent out only in reply to individual inquiries and publication of its contents either in whole or in part, is not authorized.



