ECONOMIC METHODS IN DOMESTIC HEATING, IS SUBJECT OF BULLETIN

Department of Mines Gives Expert Advice as to House Heating

HOW TO SAVE COAL

From a bulletin on the subject of the "Economic Use of Coal for Steam-Raising and House-Heating," by John Blizard, B.Sc., Fuels and Fuel-Testing Division, Mines Branch, Department of Mines, practical advice to householders on the use of coal in domestic heating is reproduced below, in part, as follows:—

TEMPERATURE.

The heat required to maintain a house at a definite temperature varies directly as the difference between that temperature and the temperature of the outside air. If, during a heating season, the mean outside temperature is 30° F., and seven tons of coal are used to keep the temperature inside at 70° F., then about one ton more will be used to maintain this temperature than would be required to maintain the house at only 65° F. It is most important, therefore, not to overheat a house.

Experience shows that the average person feels no discomfort in a house heated only to 60° F., at the beginning of the heating season, and he does not require a temperature greater than 68° F. to 70° F. in the middle of winter.

HUMIDITY IN THE HOUSE.

When the outside temperature falls below 45° F. the house may be rendered more comfortable and healthy to the occupants by partially saturating the air with steam. This process is known as humidifying or moistening the air, and when used it is possible to keep the house comfortable at a temperature several degrees lower than when it is not used.

While schemes for humidification of the air are undoubtedly desirable, they are not necessarily a means of saving coal. This is because, in the average house, the heat used to evaporate the water to moisten the air is greater than that gained by maintaining the house at a lower temperature. To save coal it would be necessary for evaporating this water to use the hot flue gases leaving the furnace instead of the heat which would otherwise be used to raise the temperature of the house.

AIR LEAKAGE INTO THE HOUSE.

All air should as far as possible be excluded from entering the house through crevices, by means of weather strips and other devices. In bedrooms and living rooms air may be admitted through the window when required; but when these rooms are not in use they should be closed as tightly as possible.

At night, when the bedroom window is open, cover up the radiators with rugs or close the hot air registers, and so avoid using up heat which would go otherwise to warm the remainder of the house. All rooms not required during the winter should be sealed up, and little or no heat supplied to them.

REGULATING THE FURNACE.

The furnace should be so regulated that the temperature in the house remains fairly constant. It may be possible to have the temperature somewhat lower in the morning when the occupants of the house are moving about, than later in the day, but this change should neither be very great nor should it be suddenly raised by burning coal in the furnace rapidly for short periods.

BURNING THE COAL.

The rate at which the coal is used up in the furnace depends entirely upon the rate at which the air passes up through the fuel bed. The supply of air converts the coal substance into a gas. It oxidizes the lower layers of the coal, the heat from which distills the gases from the upper fresh charge. But it is impossible to supply sufficient air beneath the average fire bed to burn the gases completely. To complete the combustion, a second current of air must be supplied above the bed of coal. This second current of air should be regulated by opening or closing the damper in the fire door to suit the quantity of combustible gases rising from the fuel bed. The flow of these gases will depend upon the quantity of air passing through the fuel bed, the condition of the fuel bed, and the presence of freshly fired coal. After the coal has been charged and the coal gas from it evolved, the damper in the fire door may be almost or even completely closed, since with the ordinary fire door sufficient air leaks through its crevices to supply sufficient air to burn the combustible portion of the gases then leaving the fuel. Experience alone will show the best method of operating a particular furnace, but the following is a rational scheme of working:—

Immediately after firing a new charge of coal on to a hot bed of coals, close the ash-pit door and admit a good supply of air through the fire door to burn the gases distilled from the coal. After these gases have passed off, less air over the fire is required, and it is then possible to adjust the furnace so that it may heat the house for some hours without attention. The amount of coal burned during this time will depend on the quantity of air which passes through the grate and up through the fire. This flow of air varies with the thickness of the fire, the size of the fuel, the quantity of ashes on the bars, and the "pull" or draft on the top of the fire which tends to draw the air through it. The "pull" or draft is caused partly by the furnace, and principally by the chimney, which contain gases at a higher temperature and lighter than the outside air. These light gases tend to rise in the furnace and chimney, and pull behind them air through and over the fire bed. Their effect in drawing the air through the fire bed may be reduced, by turning the damper in the flue, by admitting air into the flue or through the fire door, and by closing the damper in the ash-pit door. The damper in the flue throttles the flow of gases. Care must be taken not to close it to a point where the chimney draft is so slight that poisonous gases from the furnace pass to the house. Nor should it be closed soon after firing, unless the gases over the fire are burning freely, since by doing so the rising column of unburnt gases and air may explode. The air admitted into the flue acts as a damper, because it cools the gases passing to the chimney, and takes the place of air which would otherwise pass through and over the fire bed.

The first draft to be closed should be the turn damper in the flue; if this does not throttle down the air sufficiently, close the draft in the ash-pit door and also the draft in the fire door in order to maintain the correct proportions of air above and below the fire. If the draft is still too strong, open the damper which admits air to the flue pipe, and finally, if required, open again the damper in the fire door. There are two good reasons for using as little as possible those dampers which reduce the draft by allowing air to pass in and cool the gases. In the first place it is clear that the air must all come originally from outside and so cool the house, and, secondly, that it will cool the hot gases and so prevent them from giving up as much heat to the house in passing through the flue or furnace as they would do when not mixed and cooled by the air. When, in spite of reducing the draft by the turn-damper and ash-pit door damper, the coal still burns too freely, a better plan than using the other dampers is to either burn a smaller size coal or to supplement that already in use with buck-wheat or other very small coal.

For the same draft a thin fire will burn more rapidly than a thick fire, since it offers less resistance to the flow of air through it. In mild weather it is wrong, therefore, to try to burn the coal less rapidly by decreasing the thickness of the fire below that prescribed by the makers of the furnace. On the other hand, in cold weather if there is too poor a draft to burn the necessary amount of fuel in a deep fire bed, a shallower fire may be used, but it will require more frequent attention. The fire must never be allowed to become dead or burn through in patches, since large quantities of air flow through them and cool the furnace.

SIFTING ASHES.

The direct return to be gained by sifting the ashes from a furnace will depend largely on whether the grates are in good repair and whether the air spaces in them are so large that a portion of the coal may pass through with the ash. After sifting, the pieces of ash and clinker left above the screen or sieve must be separated from the fuel, and only the latter returned to the fire. The residue is in smaller pieces than the original coal, and is an ideal fuel for placing over the fire at night or at other times when it is desired to reduce the rate of combustion of the coal.

CHEMICALS TO IMPROVE COMBUSTION.

Compounds appear on the market from time to time, under various names, which are supposed to cause the coal to give out more heat. The sellers of some of these articles recommend that they be sprinkled in small quantities, about one pound to a ton, on the coal before firing, or on the ashes after their removal and before returning them to the furnace. Since coal burnt completely in air gives out all the heat it contains, and since it is impossible to burn the ash in the coal, these articles can neither increase the heat energy in the coal nor endow ash with heat energy. If these compounds contained a large percentage of oxygen, the amount would not be sufficient for the combustion of half their weight of good coal. Would-be purchasers are strongly advised not to listen to the extravagant claims made by agents for their sale, and to devote their attention to the scientific combustion of their coal with the oxygen of the air, which may be easily obtained free of cost.

AIR LEAKAGE IN THE FURNACE.

Dampers in the furnace and flue are provided for the purpose of supplying the air necessary for burning and regulating the rate of combustion of the coal. Any other supply of air is wasteful. Care should be taken to see that the cleaning door closes tightly and that crevices through which air is drawn are filled with cement or putty.

SOOT REMOVAL.

All soot must be removed at frequent intervals from the interior of the furnace and gas passages. A very thin deposit of soot retards the transmission of heat to the water or air.

FREIGHT CAR CAPACITY OF CANADIAN RAILWAYS

The capacity of freight cars on Canadian railways is shown in the following table, which is taken from the annual report of the Department of Railways and Canals for 1918:—

	1915.		1917.		1918.	
	No.	Capacity in tons.	No.	Capacity. in tons.	No.	Capacity, in tons.
Box	145,307	4,825,543	145,290	4,899,651	150,074	5,126,659
Flat	25,315	798,671	25,322	816,245	23,414	759,768
Stock	7,638	236,190	7,883	232,185	8,556	253,350
Coal	15,703	611,020	15,649	538,609	16,949	692,785
Tank	463	14,604	731	35,134	485	16,306
Refrigerator	4,713	139,350	5,234	155,510	5,893	176,890
Other	2,551	99,677	3,390	137,122	3,664	141,012
Totals	201,690	6,731,265	203,499	6,798,456	209,026	7,166,770

The capacity of 217 cars was not reported.

MUCH OF HEAT ENERGY IN COAL IS WASTED

The heat energy content, or caloric value of coal, is commonly given in British thermal units (B.Th.U.) per pound. The British thermal unit is 1/180 part of the quantity of heat required to raise one pound of water from 32° F. to 212° F. This energy is liberated by burning the coal, and is used for heating purposes, or for doing work in a heat engine.

It is possible to make use of practically all the energy in coal, for heating purposes, but is impracticable, since it would involve the installation of a bulky and expensive plant. The efficiency of a modern steam boiler plant seldom exceeds 80 per cent; not because it is the absolute limit to the possible efficiency, but because it is not economical to build a more elaborate installation to improve it. For the generation of power, however, it is possible to use only a small fraction of the heat energy of coal; for example, a modern steam turbine plant seldom attains an efficiency of over 20 per cent, as stated in a recent bulletin issued by the Mines Branch, Department of Mines, entitled "The Economic Use of Coal for Steam Raising and House Heating," by John Blizard, B.Sc., Technical Engineer, Fuel and Fuel-Testing Division. The principal and almost sole inflammable constituents of coal, the bulletin continues, consist of carbon and hydrogen, largely in the form of compounds of both, known as hydrocarbons.

Heat Less from Steam Pipes.

A bare steam pipe of 6 inches diameter, containing steam at 100 pounds per square inch pressure, loses heat equivalent to about three-fourths of a pound of steam per hour for every foot of its surface exposed to the air. The higher the temperature in the pipe, and the smaller the diameter of the pipe, the greater are the heat losses per square foot of exposed area. A covering of good insulating material will reduce this loss to an extent that depends on its quality and thickness, it is stated in a bulletin issued by the Fuel and Fuels Testing Division, Mines Branch, Department of Mines.

Unit Length of Survey.

The standard of length of the Geodetic Survey of Canada is a nickel bar, known as Number 10239. This bar is of H form section, total length about 102·6 cm., and length of side about 2·5 cm. The graduations are on the natural plane of the bar, and are at each millimetre from 0 to 100 cm. A millimette scale divided into tenths is added immediately beyond each end of the fundamental distance 0-100 cm., as stated in a bulletin issued by the Geodetic Survey, Department of the Interior.