

the steam supplied to the radiators is varied to suit the changing weather conditions. This is the basic principle of the Dunham Differential Vacuum Heating System. (Fig. 1083A).

The heating profession has long realized that there is a large amount of heat wasted in mild weather because buildings are overheated. The cause of this waste in steam heated systems is that most all of them are operated on and limited in their operation to pressures above atmospheric, even in mild weather. Steam pressures ranging from a few ounces to 2 or 3 lb. afford but a small operating range of steam temperatures to meet changes in weather conditions. That is steam at a relatively constant pressure is usually supplied to the radiators regardless of what the outside weather may be.

The heat output of the radiators will therefore, be entirely too high in mild weather, when only a fraction of the radiation installed would actually be required

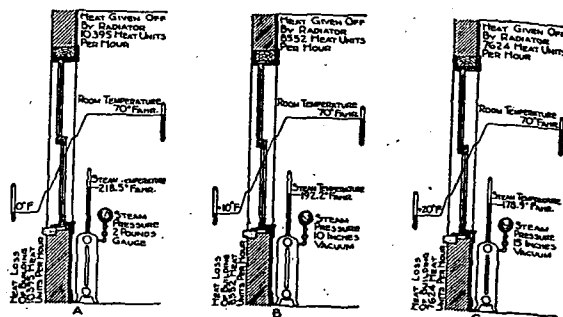


Fig. 1075A. Relation of Heat Loss and Heat Emission to Temperature Difference

This illustration shows how the room temperature is maintained uniformly under changing weather conditions, by varying the steam pressure so that the heat given off by the radiator equals the heat lost by the building.

to balance the heat loss of the building and maintain the desired temperature. The building temperature will increase above that desired, resulting in excessive heat loss from the building structure. This is generally termed overheating and represents a direct waste of fuel. Government weather reports show that extreme weather prevails during about 5 per cent of the average heating season when the system must be operated at full rating. This leaves 95 per

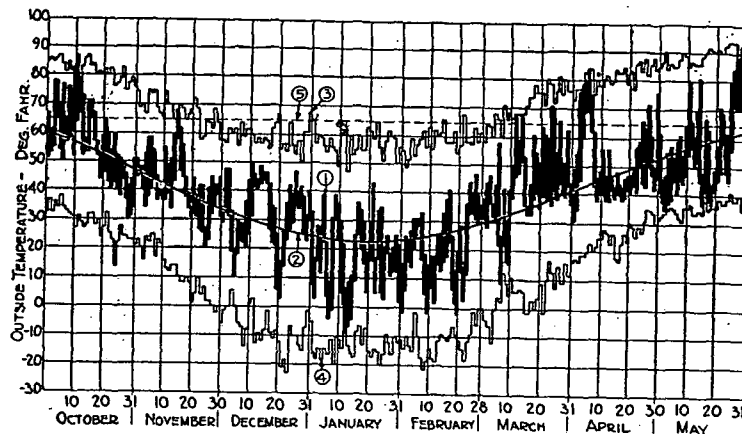


Fig. 1288. Average Temperature for Chicago Heating Season 1928-1929 = 40.2 deg.

- (1) Maximum and minimum daily temperatures for 1928-29.
- (2) Normal daily temperature from 54-year record.
- (3) Highest temperature on record.
- (4) Lowest temperature on record.
- (5) 65 deg. temperature base for degree-day calculation.

cent of the heating season when the heat output of the system must be reduced if uniform room temperature is to be maintained.

Daily weather reports show that the temperature rises and falls quite rapidly over the greater portions of the country. Temperature changes of 40 deg. per day occur each winter in the Chicago area, while daily changes of 20 deg. are but slightly higher than normal. To this variation in heat demand must be added the cooling effect of wind, if a true picture of

the great fluctuations in heating requirements is wanted.

The graph, Fig. 1288, shows the official maximum and minimum temperatures at Chicago for each day of the heating season of 1928-29. It clearly shows the temperature fluctuations for that season and also the extreme limits of temperature recorded in the previous 54 years. During that year, there was a total of 131 hours when the temperature was 10 deg. or lower, with but 35 hours of this at zero or below. The heating season was but 0.4 deg. warmer than the average since the year 1900.

Fuel Saving of 25 Per Cent or More Compared with Ordinary Types of Steam Heating Systems

On buildings changed over to the Dunham Differential Vacuum System the performance records show actual fuel savings of 25 per cent or more compared with previous system.

The charts and illustrations on this and the following page tell this story in a non-technical way.

Fig. 1066C, Steam Table Applied—
This drawing gives a comparison of the properties of steam as used in the ordinary type heating system and the Dunham Differential Vacuum System.

The Ordinary System Has—

- (1) Operating range zero to 5 lb. gauge pressure or higher.
- (2) Temperature range 212 deg. Fahr. to 227.1 deg. Fahr.

- (3) Volume per pound steam 26.79 to 20.42 cu. ft.

The Dunham Differential Vacuum System Has—

- (1) Operating range 25 in. vacuum to 5 lb. gauge pressure or higher.
- (2) Temperature range 133.22 deg. Fahr. to 227.1 deg. Fahr.
- (3) Volume per pound steam 145 to 20.42 cu. ft.

By comparing the steam volumes and temperatures used in the two types of systems an index to the flexibility of each is obtained. The extreme flexibility of the Differential System eliminates overheating and reduces the heat lost through open windows.

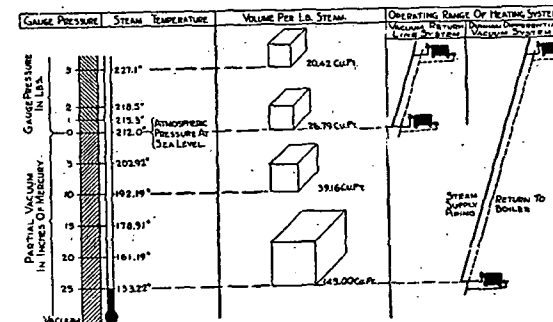


Fig. 1066C. The Steam Table Applied

Comparison of steam pressures, volumes and corresponding boiling points. Steam is produced at lower temperatures and circulated just as easily at 20 in. of vacuum as at 2 to 3 lb. gauge pressure.