

The meaning of this is plain when we remember that the dry heat is not sufficient to kill the bacteria carried by the dust, and that we inhale them in much greater numbers **owing to the currents of air** created by heaters, more especially those with unsanitary surfaces. It is also the presence of fine dried dust which is often responsible for complaints from dryness. The real cause is not dryness of air, but dried dust. Pure dry air has never been shown to be harmful. It has also been established that whatever little ozone may enter a room with the outer air is quickly used up in contact with organic dust, especially when heated. A small percentage of oxygen is absorbed in the same manner, but the extent and exact bearing of this fact has not yet been determined. These last points alone would account for the lifeless quality of the air as it generally issues from a register.

When these factors are considered, it will be admitted that an open grate, carrying its own vitiation up the flue, or a tile oven with clean, moderately warm surfaces, or even an iron stove kept polished, could not vitiate the room air to the same extent as will a radiator with inaccessible dusty surfaces, or a register blowing hot air from a musty source beyond inspection.

All this is not meant to advocate a return to the old-fashioned ways of heating, but only to show that the newer methods are actually at fault, and should be improved along lines suggested by the recent findings of hygienists. The result eventually will be a merging of the good features of past and present methods.

Sanitary Heating.

When planning apparatus, the first point in hygiene to be borne in mind should be to reduce contamination through dust by using the cleanest possible radiation. This means that heating surfaces should be in plain view, and accessible all around by hand, so that they will be kept clean, not by special effort, but as a matter of course in the ordinary routine of a household. Dust on concealed radiation, even if made accessible, is not seen, and, therefore, is invariably forgotten and neglected.

These facts should be sufficient, quite aside from engineering and economic reasons, to condemn all radiator screens designed for purposes of meaningless decoration. They are not the true solution of the problem and really turn direct radiation into a hot-air system without air supply. Screening is a sham, and should be vigorously opposed, not mildly tolerated. We should rather encourage neat, substantial appearance, inconspicuous finish and simplicity in arrangement of radiation. Unsightly bulk can often be reduced by judicious disposition and selection of the most advantageous style, or by deliberate reduction of the heat requirement, such as using double glass.

When direct radiation is indicated, it is possible, even in highly ornamental and formal rooms, to satisfy the artistic sense of architects without resorting to concealment. It is mainly a matter of judgment as to style and neatness in disposition, also of having the courage of one's conviction in arguing with the client. Of course, the public must yet be educated on the sanitary points, and the engineer on the ways and means to meet the situation. The present disinclination to expose radiators is mainly due to the shabby, clumsy and tasteless treatment that now prevails.

Radiating surfaces placed overhead or tight against walls are also objectionable. They are never dusted, except by an occasional air current, and then with a decided effect on the air. Fussy, round-about pipe connections behind radiators, creating dirt corners never cleaned out, are too often seen even in the better class of buildings. They always

contribute to stuffiness, as do many styles of heating surface which are designed too much with a view to saving space and give too little chance for keeping them clean.

As will be pointed out later, indirect heat should be used only with certain restrictions. The casings enclosing the stacks should never be soldered up, or provided with a hand hole only. At least one full side should be hinged or made removable to invite occasional inspection and cleaning. Air filters should be used in cities to keep out the dust as much as possible. In general, dust pockets and dirt corners must be avoided. They are objectionable anywhere, as a latent menace to health, but become at once an active agent for mischief in connection with heat, which brings out the lurking germs and distributes them where they are most likely to do harm.

Temperatures of Heating Surfaces Should Be Lowered.

The second point of importance is the lowering of the temperature of heating surfaces, both with a view to preventing dry distillation, and for reducing the intensity of air currents. Hot-water heating gives the simplest and most effective means to this end. With the piping calculated and balanced accurately to secure even circulation at any flow temperature, it gives practically a full range of general control and makes it possible to carry heat strictly to suit the weather.

This means that for the greater portion of the heating season the temperature of heating surfaces need not reach the point at which decomposition is beginning to be felt. In hospitals, schools, and in other cases the surfaces might be increased within reasonable cost to keep the highest flow temperatures down to 160 deg. or 170 deg. so that a slight formation of gas could only occur under extreme conditions.

With hot-water heat applied by clean, well distributed radiation it is, therefore, quite feasible to eliminate practically all vitiation of room air currents through dust.

This is the reason for the popular feeling that this form of heat does not dry the air as much as steam. With the latter it becomes all the more important to insist on the cleanest form of surfaces, and to reduce the working pressure or temperature as much as possible. At best, steam heat will always be less desirable from the hygienic point of view. Hot-air furnaces, to be tolerable at all, should be installed of very ample sizes, giving the desired heating effect without excessively hot surfaces.

When heating by warm air, whether furnace or indirect stacks, the registers should always be in vertical position, never horizontal. Floor registers, especially, are dirt catchers in the most aggravating form, throwing up the dried dust and microbes straight into one's nose.

Overheating.

According to Fluegge, the proper attention to room temperature is hardly second in importance to the benefits of ventilation as generally accepted. He has demonstrated, that overheating is just as injurious, if not more so, than the effect of ordinary foulness of air due to lack of renewal. He explains this through heat congestion, caused by decreased emission from the human body, with a consequent disturbance of certain functions. It may be held at first thought, that summer heat would be equally, if not more injurious, but the conditions are distinctly different. Lighter clothing and freer air circulation usually allow of much greater heat emission by evaporation, except in the hottest and sultriest weather, which is known to be a tax on vitality even for short periods. In crowded, overheated though ventilated rooms, with the occupants close together, keeping