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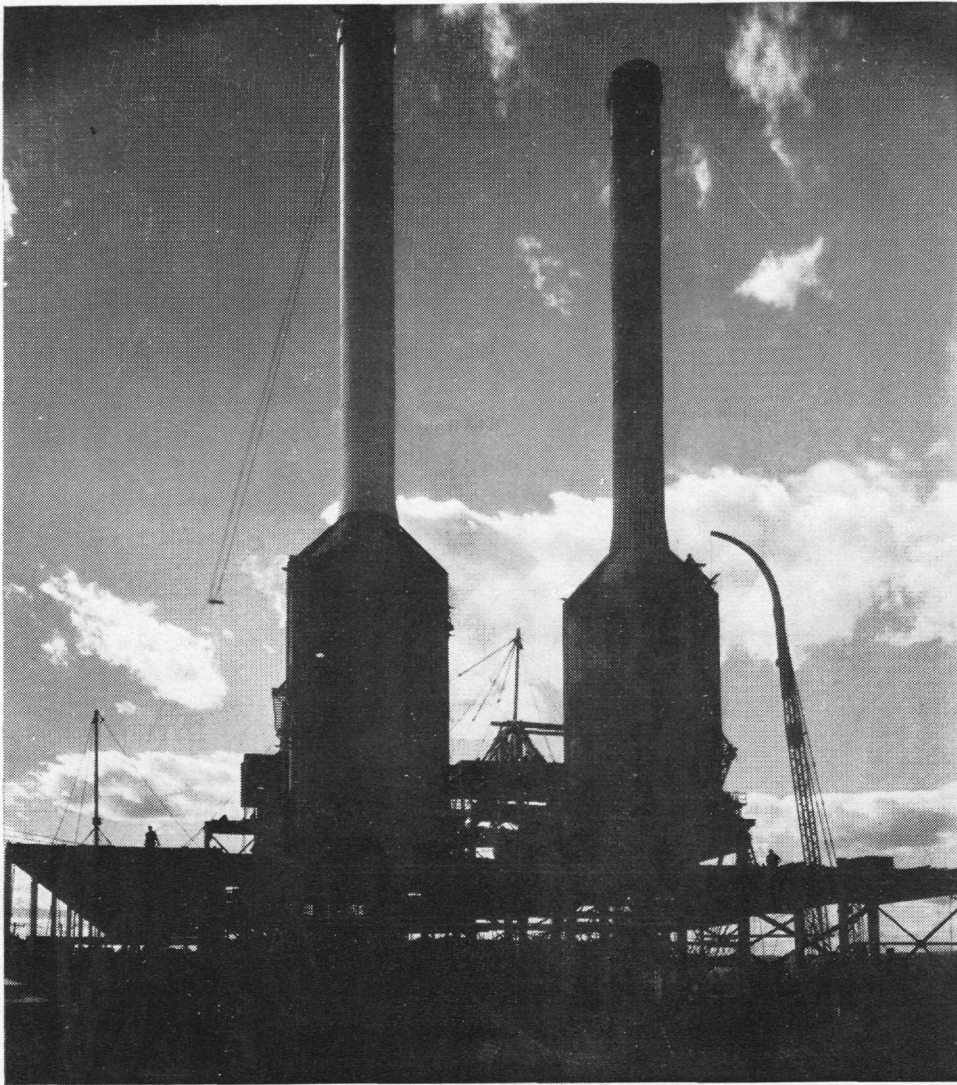
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Smoky Skies Are No Longer Symbolic of Great Production . . . Elimination and Utilization of Smoke Are Being Profitably Carried Out in Many Locations . . . An Engineering Feat Resulting in Blue Skies for City Dwellers

SMOKE

By KENNETH O. FRILEY

SMOKE, strangely enough, has had as romantic a history as fire. The ancients thought it a vehicle for communion with the gods above, and took oracle from its varied eddies and whorls. The Orientals perfumed its vapors, sending sweet appeasements to their heavenly protectors. The savages talked from hilltop to hilltop by the sharp contrast between the clear, unadulterated air that used to be quite common in this country, and the dark column of smoke from a smothered wood fire. Today, the farmers smoke their hams, their bees, their pipes, and their orchards, but the urbanites are not so discriminating. Everybody and anything is subjected to the smoke of the city.

Post cards, business cards and letterheads used to picture their respective factories with clouds and clouds of jet black smoke pouring from the chimneys. Even today, smoke is significant of prosperous conditions. Politicians promise food for the empty dinner pail and smoke for the empty chimney. In addition, the politicians might point out, if they dared, what these belching smokestacks mean to Mr. Taxpayer in health and happiness and in dollars and cents.

Unfortunately, however, the problem of smoke abatement is not limited to factories and centralized industry. Except in a few cases of the large industrial cities, most of the smoke does not originate in the power plants and factories, but from the residential districts, from the small homes, apartments, stores and offices. This is against popular opinion and, of course, if any of smoke abatement program is to be carried out, industrial smoke must be eliminated first.

Smoke, technically, is the solid and gaseous product of combustion emitted from the stack and may include unconsumed carbon and various hydrocarbons, ash, sulfuric acid, chlorine and ammonia. Part of this is visible and part invisible. While the carbon is not poisonous but is absorbed by the lung tissue, the other constituents are deadly poisons.

Under certain conditions these slow poisons become quick acting. In Europe cases of as many as sixty-five deaths are on record. Vegetation, too, suffers in this country, whole crops have been killed overnight by smoke. Another physiological aspect is the filtering out of the ultra-violet rays of the sunlight. Cases are common where up to eighty per cent of the sunlight has been eliminated by polluted atmosphere and sooty window panes.

The soiling and tarnishing of metals is an obvious effect due to smoke, but an effect not quite so apparent is the eating away of the metal by the sulphurous

and sulphuric acids absorbed in the soot. The life of the metals of construction is reduced by one-half, and in some cases, by an even more startling fraction. Copper, for instance, has no limit to its useful life in a smokeless atmosphere. However, in smoky cities copper is expected to last less than fifteen years. Iron screens which remain sound for fifteen or twenty years in a smokeless atmosphere, have been known to fall to pieces in less than a year of use in a smoky atmosphere.

One thinks of stone as an invulnerable building material, but nothing prevents the beautiful new monuments and buildings from acquiring, chameleon-like, the dingy black color of the surrounding constructions.

In cleaning, a drastic and expensive method such as sand-blasting must be used. This restores the original color for a short time but destroys the natural coating on the surface and lays open the pores to the acid-bearing soot. Stone and mortar under such circumstances become soft and disintegrate rapidly in weathering.

The effect of smoke on exterior painting is probably the most obvious ravagement. Surveys show that in smoky cities the better classes of buildings have to be repainted every three years. After a limited number of coats, however, the paint begins to blister and crack, and all the old paint must be removed before applying new. Then, too, each time a new coat is applied, the old must be thoroughly cleaned or else the smoke acids will undermine the new paint as well as attack the exterior surface. The landlord who attempts to make his paint last five or six years by using a dark paint will have difficulty in renting a dull, drab house.

It would be an endless task to enumerate all the results, damages, and costs of the malignant smoke clouds which envelop so many cities. Some of the direct, everyday results are: excessive cleaning and painting of exteriors and interiors of buildings of all kinds, destruction of buildings, monuments, and objects d'art, destruction of merchandise, extra illumination costs, excessive laundry and dry cleaning. Who can estimate the cost of ill health, sickness, and death resulting from smoke? Did you ever stop to think what psychological effect the sooty, smoky, foggy atmosphere of the cities has on the nation?

All in all the combined costs of things which are estimable has been set for United States at an annual figure of \$500,000,000. This is a startling peace-time figure. This is no "New Deal" figure where so and

so many billions have been transferred from the employed to the unemployed or from the rich to the poor or vice versa, but it is \$500,000,000 annually wasted, destroyed—gone up in smoke!

In the 1937 steel strikes in Cleveland, it is alleged that one mill burned tar paper so that the resulting inky black smoke would lead the strikers to believe that the mills were operating efficiently and that picketing was in vain. This may or may not have duped the picketers but it does show that the idea is common; that dense smoke and efficient operation go hand in hand.

It follows, then, that a sensible smoke abatement program must deal, not with tricky little smoke eating gadgets, but with education. Of course, the ideal way of solving the problem would be to have the salesman insert one of his expensive little gadgets in the chimney or else throw a handful of mysterious powder on the hot coals and thereafter one's smokestack would emit nothing but carbon dioxide. Unfortunately, most of these cure-alls do more harm towards smoke abatement than good. Exceptions to this are the filter method, the electrical precipitation method and the centrifugal blowing method which acts on the same principle as a cream separator. In the electrical method, the chimney is wired so that ascending particles are given a strong negative charge and repelled against collection plates which are cleaned at intervals.

Chief contributors to the smoky atmosphere in order of their responsibility are: the home hot air furnaces, the business heating boilers, the industrial power boilers, the railroad locomotives. The last, the railroad situation, is an example of what can be done. Electricity or liquid fuel are rapidly coming into use within the cities. Where coal is used, it is handled by skilled firemen. In the case of the industrial power boilers, there is usually municipal regulation and usually there is earnest effort on the part of the plant

management to eliminate as much smoke as possible.

In the first two citations lies the real problem of smoke abatement. In the second, the responsibility lies with the employer of the fireman. It is up to him to see that his fireman is skilled, at least in this one particular problem. Too often the fireman has to be everything from doorman to janitor so that he hasn't time to do a real job of firing. The solution to this is employment of more help or installation of a mechanical stoker. Stokers are automatic and when operated on the underfed principal, give a minimum of smoke.

The hardest source of smoke to attack is the home furnace. Each home is an individual problem and each fireman an experimenter when it comes to solving his individual furnace problem. If too little draft is allowed, most of the volatile constituents of the coal will go up the chimney without burning. If there is too much draft, solid particles will be carried up the chimney along with most of the heat. In refueling, the important thing is to place the fresh coal beside the incandescent coal and *not* to spread it on top. Up to forty per cent of coal is driven off as a gas and when fresh coal is spread on top of the hot coals, this gas rises unburned.

Some furnaces are so constructed that coke may be burned advantageously; others may use cheaper soft coal; still others are restricted to anthracite. It is up to the fellow who fires the furnace to discover the kind of fuel and firing that is the most efficient in his own furnace.

Here at the University, the Experiment Station has issued several pamphlets and charts demonstrating efficient firing. All over the country, more and more cities are adding Smoke Abatement Divisions as a part of the Department of Health or the Department of Public Safety. Smoke abatement is a growing problem; a problem for engineers.