IMPORTANT EVENTS IN THE HISTORY OF SMOKE CONTROL

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DURING man's long slow development up from savagery to his present state of civilization, there are one or two very striking events or epochs that must have changed his whole method of life and manner of living.

Probably the most important event in man's past was when he discovered how to light a fire; or perhaps it would be more accurate to say, when he invented a way to produce fire. It must have altered his whole outlook on life. It allowed him to live in cold countries and to eat foods he could not digest before. This event is so far back in the dim past that we have no knowledge of how it came about. We do know that primitive people have worshiped fire, and even as late as Roman times a flame was kept continuously burning in certain places.

Another event that changed man's mode of living was the domestication of animals. This took place long before even the origin of the rather dubious legends with which history begins. Toward the end of the old stone age, dogs joined human society, probably first as scavengers. From what we know of primitive societies it is likely that the initiative came from the dogs. Man's existence at this time depended on hunting; and the idea of keeping herds of animals with a tribe instead of having to hunt them, was an upward step in civilization.

A third event has so very recently come into man's civilization that we are too close to it to realize its full significance. It is a very strange thing that in all the ages that man has existed on this planet it was only about one hundred and fifty

1Read at a meeting of the Historical Society on November 28, 1948. Professor Ely is superintendent of the Pittsburgh Bureau of Smoke Prevention.—Ed.
years ago that he discovered how to build a machine-driven tool. In other words, the machine age started and made possible the great industrial development we have today.

This has changed society from top to bottom. The machine now supplies the skill, and the old-time skilled artisan has been replaced by cheap labor. Only machine-tenders are now needed. Labor-saving machinery has produced goods in such mass and abundance and so cheaply that all classes have shared the benefit. Never before has wealth and comfort been so widespread. It is even possible under such a system that man could produce enough armament so that future wars might destroy civilization.

However, this may all be, the mechanical age has come to stay and of course has produced a tremendous demand for fuel and metals. However, fuel and metals alone could not have resulted in making our present industrial age; we had to have the power-driven machine tool, the instrument which allowed us to fashion and build furnaces that were capable of producing the metals we needed.

Wood, of course, was man’s first fuel, but as industry developed he needed hotter fires and fuel that possessed more heat per pound. This led to the production of charcoal, for it had been found that charcoal was better adapted to industrial purposes. Charcoal was obtained by piling wood rather loosely, then covering it with earth. It was lighted from the top, burning downwards with a limited supply of air, so that the volatile content of the wood was burned out leaving the carbon content in the form of charcoal. This operation produced quantities of smoke and dirt. We all know the smoke, soot, and grime made by the beehive coke ovens of today. Coke-making is a similar process using coal instead of wood.

The word “col” existed in the Old English Language. Coal or black stone as it was sometimes called had been known for a long time and now as industry developed coal became more and more popular and with industry growing at an ever
increasing pace, wood and charcoal were gradually displaced by coal.

There is a record of a complaint against coal smoke in 1257 made by Queen Eleanor of Henry the Third. By the end of the thirteenth century the quantity of coal used in London produced smoke enough to annoy the nobles and a royal proclamation was issued in 1306 prohibiting artificers from using coal in large furnaces. There is a report of the execution of one offender, but this seems to have had no effect in stopping the smoke.

Attempts were made to banish the smoke nuisance in 1578 when brewers near Westminster Palace offered to burn wood only in their brewhouses, because Elizabeth "findeth herself greatly grieved and annoyed by the taste and smoke of sea-cooles."

In 1595 one Thomas Owen proposed to transport low volatile and anthracite coal to London from South Wales. Nothing appeared to come of this and by 1612 bituminous coal was used generally in the houses of the nobility, gentry, and clergy.

An interesting event in the history of smoke abatement was the publication of a book by a citizen of London named John Evelyn entitled "Fumifugium." The title page of this book is reproduced here. The book was a brilliant and severe indictment of the smoke of that day. Evelyn dedicated his book to King Charles II and states later in his diary that his Majesty was much gratified with it.

The dedication begins as follows:

"TO THE KINGS MOST SACRED MAJESTY

SIR:

It was one day, as I was Walking in Your MAJESTIES Palace at WHITE-HALL, (where I have sometimes the honour to refresh myself with the Sight of Your Illustrious Presence, which is the Joy of Your Peoples hearts) that a presumptuous Smoake issuing from one or two tunnels neer Northumber-
FUMIFUGIUM:

OR,

The Inconvenience of the AER, AND

SMOAKE of LONDON DISSIPATED

TOGETHER

With some REMEDIES humbly proposed

By John Evelyn Esq;

To His Sacred MAJESTIE, AND

To the PARLIAMENT now Assembled.

Published by His Majesty's Command.

Lucret. 1. 5.

Carbonumque gravis vis, auque odor insinuatur.

Quam facile in Cerebrum?
land-house, and not far from Scotland-yard, did so invade the Court; that all the Rooms, Galleries, and Places about it were filled and infested with it; and that to such a degree, as Men could hardly discern one another for the Clowd, and none could support, without manifest inconveniency.”

Evelyn’s desire in writing the book was to get King Charles and his Parliament to take some legal action. He writes: “I propose therefore, that by an Act of this present Parliament, this infernal Nuisance be reformed; enjoying, that all those Works be removed five or six miles distant from London below the River of Thames.”

By “those Works” he refers to “Brewers, Diers, Sope and Salt-boylers, Lime-burners, and the like.” He also includes in the suggested act that, outside of London in certain counties and in certain months, it be forbidden to kindle outdoor fires for burning wood, heather, broom, etc. Suffice it to say that King Charles did nothing about it.

From that time to the present, many books have been written and hundreds of acts passed against smoke.

During these years there was a torrent of industrial expansion, which finally flooded the whole modern world. Industry had no time to listen to such idealists as John Evelyn. With the development of steam power the demand for coal was increased to such enormous proportions that we can justly say that our present industrial civilization has been built on coal.

Coal was of such cheapness and plenty that until comparatively recent times no attention was paid to its economical use; there was an orgy of waste with the result that manufacturing towns and areas were a mass of blackness, grime, and squalor. During this time of industrial expansion certain sayings or slogans became current. One was: “Where there’s muck there’s money.” Another, better known, has persisted, and today we often hear that “smoke means prosperity.” These only serve to indicate the misconception, lack of under-
standing, and ignorance of the real problem of smoke abatement.

Hundreds of laws and restrictions have been written against smoke over the years, but it is only very recently indeed that any reduction in smoke has been brought about. Why have all the attempts to curb it been failures? Well, there are a good many reasons, but fundamentally the people were not behind it. As in the case of prohibition, a few enthusiasts have tried to impose on the general public what it did not want. Therefore, to put over a successful smoke campaign, we must have the public solidly behind it.

Let us consider the slogan, "smoke means prosperity." We know that smoke does not mean prosperity. Smoke is waste. The same mill operating without smoke will produce the same power and use less coal. The correct slogan would be "smoke decreases prosperity."

If we burn coal and give it enough air so that it burns completely, it will burn to carbon dioxide. That is: an atom of carbon in the coal will unite with two atoms of oxygen from the air. But if we burn the coal and do not supply enough air, it will burn to carbon monoxide. That is: the carbon atom can unite with only one atom of oxygen. There is not enough oxygen to go around.

Using average values:
1 pound of coal burning to carbon dioxide evolves 13,000 heat units.
1 pound of coal burning to carbon monoxide evolves 4,000 heat units.
Loss of heat due to incomplete combustion is 9,000 heat units.

This shows a theoretical possible loss of $\frac{9000}{13000} = 70\%$ of the heat. In practice, even with lack of air, coal does not burn uniformly and some dioxide will form; but losses of 30%, 40%, and 50% are very general.

In Pittsburgh we burn about seven million tons of coal per
A patented hand-fired furnace that will burn soft coal without smoke. If loaded with seven or eight hundred pounds of coal, the furnace does not have to be touched for a week or more in ordinary winter weather. The house temperature is automatically maintained by thermostatic control.
year. Instead of 30% or 40% saving, let us suppose that we could save merely 5%. This would not seem difficult. You would think that almost any fireman with a little care could save one shovelful out of twenty. Five per cent of seven million is 350,000 tons saved per year. To visualize this figure, remember that the ordinary railroad coal car carries 50 tons. This would mean that we would save 7,000 carloads of coal.

This represents the work of some 300 miners, who would be working merely to produce smoke. Furthermore, such a saving would release two or three hundred cars to the railroad; and then the value of the coal itself is some two million dollars. While such figures are impractical and only roughly approximate, nevertheless, they do give an indication of the economics of smoke loss.

If we throw a shovelful of fresh coal on a red hot burning bed of coal, the shovelful burns completely because there is plenty of surrounding air and there will be no smoke. But if instead of one shovelful we put on thirty or forty, in other words blanket the fire, air now cannot get into this mass and carbon monoxide is produced. But there may not be even enough air to form carbon monoxide, and smoke results. Smoke is soot, finely divided particles of unburned carbon.

This is what the ordinary janitor or poor fireman does. He comes in the morning, gets the fire started and loads coal into the furnace—as much as he can get in; and then does not go near it for the rest of the day. Naturally, it smokes all day. Here is where the mechanical stoker comes in. It does not get tired but feeds a little coal continuously. An expert fireman can make a better showing than the stoker; but he will be on his feet all the time, putting a shovelful here and there, seeing that the correct amount of air is admitted under the grates, that the door is cracked at times to admit overfire air, etc. No ordinary fireman will do this. He proposes to put coal on in such quantities that he can sit down and rest most of the time.
It would seem at first thought that we could teach the public how to fire and at least in great measure help the domestic smoke problem. Such educational campaigns have been tried again and again and they have all failed. A conspicuous example is St. Louis. After long trials and failures results were obtained only when they made it foolproof by obliging hand-fired furnaces to use smokeless fuel, such as low volatile coal, anthracite, gas, processed fuels, etc.

Smokeless fuels cost a little more, although today we are allowing mixtures of anthracite and soft coal that are very little more expensive. Smoke abatement cannot be attained without some cost and trouble but the results are worth it in cleanliness, bright days, better air and the benefits that go with it.

Pittsburgh, even in its early days, was a smoky place. In 1804, General Presley Neville wrote a letter complaining of the smoke. About 1865, the English novelist Anthony Trollope visited Pittsburgh. He wrote: "Pittsburgh is without exception the blackest place which I ever saw. When looked down on from above the tops of churches are visible and some of the larger buildings may be partially traced through the thick brown settled smoke. But the city itself is buried in a dense cloud."

The first legislation was passed in 1869, forbidding the use of coal or wood in any locomotive. This ordinance was never taken seriously.

In 1883 natural gas was introduced into Pittsburgh, but by 1890 the gas was exhausted and coal was back again. Nevertheless, the gas, because it cleaned the city while it lasted, served to stimulate civic interest against smoke and in 1892 a very lenient ordinance was passed; but was followed by a more rigid one in 1895. A lawsuit against it, however, made it inoperative.

So far little had been accomplished; but in 1898 Andrew Carnegie asked the Chamber of Commerce to appoint a smoke
committee. The result was that a new ordinance was passed in 1906 establishing a Smoke Bureau with William H. Rea as chief smoke inspector. The opponents of this ordinance succeeded in 1911 in having it declared null and void by the Commonwealth of Pennsylvania. The State said it had not given its authority and that it was unreasonable.

However, general agitation against smoke continued and this brought forth an elaborate report in 1914. The report was made by the Mellon Institute of Industrial Research, assisted by the University of Pittsburgh and others. This resulted in the passage of a new ordinance in 1917 with H. B. Meller as chief inspector. He was given powers of enforcement; but private residences were exempted.

During the years the 1917 ordinance was enforced, the Smoke Bureau made some elaborate studies of air pollution and a great deal of valuable data was collected; but not a great deal was accomplished in the way of enforcement. Pressure against the ordinance by industrialists, coal interests, and others became so strong that in 1939 they virtually forced the city to give up the fight and the Smoke Bureau was abolished.

Conditions now grew worse and worse and much of what had been accomplished was lost. About this time reports began to be received of how St. Louis was having wonderful success in abating its smoke. Dr. I. Hope Alexander, director of Pittsburgh's Department of Public Health, became interested not only from a health standpoint, but as a matter of civic pride as well, for he really has the welfare of the city at heart. He also possesses the knowledge, persistence, and energy to carry through what he undertakes.

He went to St. Louis, returned with a most favorable report, and induced Mayor Cornelius D. Scully to appoint a board of citizens to draw a new ordinance, following the St. Louis plan of including private residences.

The chairman of this board was Councilman A. L. Wolk, who since that time has been the chief exponent of smoke
abatement in the city council. He has given the Bureau the needed support of city authority and his interest and faith in smoke abatement is largely responsible for our success.

Another factor without which we could not have succeeded was a strong backing by a citizens' committee. The Civic Club had for a long time a smoke committee of which Mr. M. Jay Ream was chairman. Later, Mr. Ream formed the United Smoke Council, which is now affiliated with the Allegheny Conference on Community Development. With his enthusiasm and energy, Mr. Ream was able to interest influential citizens, women's clubs, and other civic-minded organizations. The United Smoke Council by lectures, radio talks, newspaper publicity, etc., has obtained the backing of the general public. A late census taken by a Pittsburgh advertising agency showed that 75% were in favor of continuing smoke control.

The Smoke Bureau is often asked, especially if the weather is foggy, what per cent of smoke is in the atmosphere. That question cannot be answered. There is no instrument or method for separating smoke from fog, dust, sand, tar, fly ash and all the other pollution that may be in the air. We can, of course, measure the total pollution of dust, plus fly ash, plus cinders, etc. but we cannot separate them.

What proofs then have we that the Smoke Bureau has improved Pittsburgh? First, we have the testimony of residents, especially of housewives, that it is generally cleaner, that the air is clearer, fogs whiter, snow remains white longer. Second, the Pittsburgh U. S. Weather Bureau's records show some 65% better visibility. Third, cans left on house tops have some 25% less dust fall into them. Fourth, aviators' testimony that they can see the Pittsburgh airport from four or five times the distance they used to.

The present ordinance passed in 1941, was only in partial operation during the war but has now been in full effect since October 1, 1947.