

STEPS IN THE DEVELOPMENT OF A SMOKELESS CITY.

W. F. M. Goss.

1. *The Presence of Smoke* in those cities of our country which are within easy reach of its soft coal mines is becoming more serious every year. People are beginning to understand that this smoke which, in earlier days, was welcomed as evidence of a city's growth, and of its industrial prosperity, is, in fact, a source of heavy expense to all of its citizens. The annual smoke bill of such a city as Indianapolis is, in fact, enormous! This arises, not from the loss of fuel or heat in the form of smoke, for that is so small as to be almost negligible, but in the damage which is wrought by its presence, upon the architectural embellishment of the city, upon the fixtures and furnishings of its homes, and upon the apparel of its citizens. Loss also occurs through the extensive use of artificial light which the presence of smoke enforces, and because of its effect upon the welfare of those from whom it shuts out the sunlight and takes away the purity of the atmosphere.

Thus far urban communities have sought to protect themselves through prohibitive legislation, with the result that while flagrant abuses have sometimes been abated, the atmosphere of the city as a whole has not materially improved. It is doubtful if such legislation, unsupported by corrective measures which are broadly co-operative, can ever be made an effective instrument in the abolition of smoke. The problem is one of many complications and its solution can only be reached through action based upon a full understanding of difficulties to be overcome.

2. *The Sources of Smoke* in cities may be separated into five different groups, each of which will require different treatment. They are as follows:

1. Large furnace fires such as are employed in metallurgical processes.
2. Large boiler plants, by which is meant all plants in excess of 500 horse-power.
3. Small boiler plants and small industrial fires.
4. Domestic fires.
5. Locomotive fires.

Accepting this classification as a convenient one for the purpose in hand, we may inquire as to the process by which the smoke now being delivered by each of the several groups is to be eliminated.

3. *Large Fires Such as Are Employed in Metallurgical Processes.* Except in a few cities, of which Pittsburg is the best type, the proportion of the total smoke delivered from such fires is small. In the city of Indianapolis, for example, it is exceedingly small. Moreover, the managements of industries using such fires are, in many cases, finding increased efficiency in operation by the installation of gas producers which receive the coal and deliver highly heated gas for use in the furnaces. The gas producer makes smokeless the process of converting coal into heat. As its use under a wide range of conditions will result in economy in operation, no injury would be done by the prohibition of smoke from all fires which might properly be served by producer gas, provided a reasonable period is allowed between the passage of the prohibitive ordinance and its going into effect. Fires of this group which can not be thus treated in such cities as Indianapolis will be so few that their effect will be negligible.

4. *Large Boiler Plants.* The suppression of smoke from fires of this class by the adoption of a suitable automatic stoker, will effect an economy in operation, hence owners will not seriously object if they are required, after suitable notice, to so equip their plants. An ordinance requiring all boiler plants of more than 500 horse-power to be thus equipped within three years of the date of its passage would not be unreasonable.

5. *Small Boiler Plants and Small Industrial Fires.* Referring first to boiler plants, it should be noted that the fires of this group are ordinarily prolific sources of smoke. Boilers of 100 horse-power or less are all over the modern city. Generally speaking, no economy can result from the application of automatic stokers to these small boiler plants and hence owners can not be influenced to add to their fixed charges in the expectation of securing a money return. The requirement that such furnaces employ anthracite coal, coke, or other smokeless fuel, would in all cases work serious hardship and in many cases it would be prohibitive. The wisest and most effective course to follow with reference to such fires is to provide a satisfactory substitute, then abolish them. So far as such plants are now employed in the production of power, they can be rendered unnecessary through the cheaper and more effective distribution of electrical power. So far as steam from such boilers may at present be used for heating they can be rendered of no effect through the supply of heat from a

central station. There are, however, in every large city many minor industrial establishments, such as dye works, bleacheries and laundries, requiring steam at high pressure, and for these a general system of supply from a central plant must be provided. That this may be the more readily accomplished, such industries should be encouraged to group themselves within a prescribed area to better accommodate themselves to some reasonable plan of steam distribution. To properly supplant the fires of numerous small boilers now in service, it will be required, therefore, that stations be established throughout the business portion of the city, capable of delivering electric current for power and lights, steam or hot water for heating, and a limited amount of high pressure steam for industrial uses: these central plants to be of sufficient size to justify the use of stokers which will make them smokeless. When by municipal co-operation these shall have been provided, under conditions which will safeguard the interests of all consumers with reference to costs, then it will be in order to prohibit, after a series of years, the use of soft coal under all boilers of the city, except in connection with automatic stokers.

Small industrial fires other than those under boilers should be sustained by gas drawn from sources hereinafter referred to.

6. *Domestic Fires.* While individual domestic fires are not the source of heavy volumes of smoke, their number in any city is large, and their effect in the aggregate as a source of smoke is as pronounced as that of any other single group of fires. So long as soft coal can be had more cheaply than anthracite coal, just so long will there be a desire on the part of the consumers to employ it in domestic service. Domestic fires being small, it is impracticable to apply to them effectively the principles of smokeless firing. A necessary step, therefore, in the development of a smokeless city is a complete prohibition of the use of soft coal for domestic purposes. As a preliminary step, two things are essential. First, a supply of low-priced gas for use in cooking; and second, the distribution from a central station of large capacity of steam or hot water for domestic heating.

There are no real problems in the supply of gas for cooking except such as may grow out of existing franchises. At prices now prevailing, this form of fuel is much used in cooking and generally is less expensive for that purpose than solid fuels. Add to this the fact that the cost of gas to the producer is reduced as the quantity sold is increased, and an abundant supply at a cost sufficiently low to permit all people in a city to

use it for cooking, becomes not only possible, but attractive as a means of economy.

The establishment of centralized heating plants of sufficient size to justify the maintenance of smokeless fires therein, and in such number as to serve an entire city, constitutes a problem presenting no serious engineering difficulties. Such a system would need to be developed under sufficient municipal control to insure satisfactory service to all portions of the city and to guarantee to the consumers of heat a cost not greater than is required to insure a fair return upon the investment made. Enough has already been accomplished in heating from central stations to insure the practicability of such a scheme. While the loss of heat in transmission is necessarily large, this loss is more than neutralized by the use of low grade coal in the central station, in the place of high grade fuel now employed in domestic heating, so that, basing an estimate on the heat delivered, the cost should not be greater than under present conditions of domestic heating. Attention should be called to the fact, however, that such a system would be easily practicable even at some advance in cost, for freedom from smoke and the convenience of a supply of heat from outside sources are matters for which people will be willing to pay.

7. *Locomotive Fires.* These, in railroad centers such as Indianapolis, are prolific sources of smoke. Moreover, if soft coal is permitted to be used in fire-boxes the delivery of smoke from locomotive stacks can not be prevented. As a consequence, prohibitive legislation in various American cities has thus far had but little effect in reducing the amount of smoke delivered from locomotive fires. It is not the fault of the railway management; it is due to the difficulties which are inherent in the case. There are, in fact, but two ways out of the difficulty, and the acceptance of either solution will involve railway companies in heavy expenditures and will entitle them to concessions or direct aid from municipalities. The first and simplest is to be found in the requirement of all steam locomotives operating within the smoke limits of a city, to be supplied with smokeless fuel, that is, with anthracite coal or with coke; the second solution is to be found in the prohibition of the use of steam locomotives and in the substitution of electric locomotives within the smoke limits of the city.

The development of either of these plans will involve the establishment of locomotive terminals upon every road outside of the smoke limits of the city. By the use of such terminals the road locomotive of an approaching train can be stopped before reaching the city, its place being taken

either by a steam locomotive using coke or anthracite coal for its fuel, or by an electric locomotive which will serve to carry the train on to the city, and afterward out of the station and across the city to another terminal where it will stop, its place at the head of the train being taken by another road locomotive having its usual supply of soft coal. Such a plan has been put into effect in New York City, and has been settled upon for Washington, D. C., where the commissioners of the District of Columbia, on November 17th, took final action on an order to prohibit the use of any except electric locomotives in drawing trains into the new Union Station. Excepting in very large cities, however, the cost of electric transmission will be prohibitive. It will be far cheaper for railway companies, and quite as satisfactory to the urban communities, to admit steam locomotives, provided they are supplied with a fuel which prevents smoke.

It is evident that procedure under this outline with reference to locomotive fires must necessarily involve plans extending through a series of years. An equitable scheme of co-operation between the railroads and the city must be devised, plans must be made and adopted, and time must be given for financing and executing them.

In the working out of the general plan described by this brief outline for the elimination of smoke, many difficulties are to be met and antagonistic interests to be harmonized, but there is nothing which, from an engineering point of view, is impracticable, or which can not, as a business matter, be reduced to a satisfactory procedure. A city, to be made smokeless by the measures suggested, would first seek to fix limits defining the area to be controlled. Within this area would be developed a series of power and heating plants which would be spaced upon a system of squares in the business portions, at intervals of a mile or a mile and a half, and in the residence portion at intervals of two miles. From these several stations would go out currents of electricity for all power and light needed by the city. From certain of them steam at high pressure for industrial purposes would be distributed over the limited areas and from all of them would go out steam or hot water for heating. By a suitable grouping of equipment within these stations, those in the residence portions would be made to serve as heating plants alone and hence would be out of service during a considerable portion of the year. Because of their size and the perfection of equipment, all would be operated by smokeless fires. All small fires, which at the present time serve for heating and power in individual buildings, would cease to exist, and large fires under boilers of great industries

and in furnaces of metallurgical establishments, would be made smokeless by means which would enhance their economy in operation. Railroad trains passing through the controlled area would be drawn by smokeless locomotives, and above and around the city a clear atmosphere would contribute to the cleanliness of all things and to the comfort and peace of mind of all its people.