

SMOKE ABATEMENT.*

By C. H. Benjamin.

The subject of smoke abatement presents itself under three heads:—

1. The proximate causes of the evil.
2. The most efficient means for its abatement.
3. The ethical and legal questions involved.

Bituminous coal which, fortunately or otherwise, is to-day our cheapest and best fuel, all things being considered, is a compound of hydrogen and carbon together with certain non-heat producing elements which may be neglected in this discussion. When carbon, which is pure, or approximately so, as in the case of anthracite coal or coke, is burned in a furnace, be the combustion complete or otherwise, no objectionable smoke is produced. When any hydro-carbon, and this includes not only bituminous coal, but coal oils and gases, is burned in the ordinary manner, either an insufficient supply of air, too low a temperature, or insufficient mixing of the products of combustion, results in the precipitation of some of the carbon present in the form of black smoke or soot. The ordinary phenomena attending the burning of oil in a common oil lamp are excellent illustrations of this peculiarity. As long as the chimney of the lamp maintains a proper draft, a suitable quantity of air is admitted, properly heated by the fine gauze underneath the flame, and the wick is at the right height to supply the proper proportion of oil, a clear, bright flame without smoke results. Any change in these conditions produced by raising the chimney from the burner or by turning the wick too far up or down, results in imperfect combustion and a precipitation of soot. In the boiler furnace the same result is produced by putting on too much coal at one time, by an insufficient or poorly regulated draft, or by bringing the boiler too close to the fire. It is possible to prevent smoke by skilful hand-firing, but it is usually not practicable. The use of unsuitable grades of coal, ignorant and poorly-paid firemen and the overcrowding of boilers are common reasons for black smoke.

Numerous devices have been invented and patented for regulating the quantity of air to the demand and for thoroughly mixing it with the gases. Some of these are very efficient, and practically solve the smoke problem when properly cared for. The most usual form of this apparatus consists of a steam jet, which is turned on by the opening of the fire door simultaneously with the opening of an air damper above the fire. A dash-pot containing air, oil or water, slowly shuts off the steam and air after the door is closed. Some of the pictures which I shall show prove the efficiency of this apparatus. The indifference and antipathy of firemen and engineers are frequently responsible for the failure of such apparatus.

The down-draft furnace and various water arches have also been successful in abating smoke, and may be regarded as efficient means of prevention when comparatively pure water is available. If the boiler feed contains many scale-forming impurities, the repair bill on this class of apparatus is apt to be serious.

All things being considered, the mechanical stoker has gone the furthest toward solving the problem of any means yet devised. Whether taking the form of a shaking grate with inclined bars, by which the coal is gradually fed from the hopper downward under the boiler, the under-feed stoker, with the coal and air fed up from below so that all of the latter is obliged to pass through the incandescent fuel on its way to the boiler, or the travelling chain grate, which feeds the coal gradually and uniformly back from the hopper, burning as it goes, and automatically discharging the ash and clinker at the rear—these have all proved their excellence as abaters of smoke when properly set with reference to the heating surface of the boiler. [The use of the brick arch or reverberatory furnace in connection with these adds much to their efficiency.

Probably the most efficient furnace in the world is the reverberatory one used in connection with open hearth steel-making where complete combustion at a high temperature is insured before the heat is used for manufacturing purposes. I look for future development along these lines as a complete solution of the smoke problem.

The temptation to bring the flame from soft coal too near the relatively cool surfaces of the boiler has hindered the progress of this improvement more than any other one detail.

To prove the efficiency of properly constructed mechanical furnaces, it is only necessary to refer to the pictures, which show the condition of the same plants before and after the change was made. There is also little doubt that these good citizens who have equipped their furnaces with the proper means for burning soft coal have benefited themselves as well as the community at large, since in the majority of cases an improvement in the smoke conditions means a more economical use of the fuel. Not only is there more heat available from coal when properly burned, but the heating surfaces of the boilers are much more efficient when free from the deposit of soot, which is a necessary accompaniment of black smoke.

The claims made by the inventors and promoters of smoke-abating devices have frequently been unreasonable, but as a result of my experience and investigation I should say that a saving of 10 or 15 per cent. in the amount of fuel burned per horse-power can reasonably be expected as a result of the abatement of black smoke. I have received personal letters from a large number of manufacturers and owners of business blocks in the city of Cleveland which confirm me in this belief. The saving in these cases was shown, not as a result of short expert tests but from a comparison of the monthly coal bills before and after making the change.

From a standpoint of public comfort and social ethics, it should make no difference whether smoke prevention is profitable to the boiler-owner or otherwise. I have no more right to pollute the neighborhood with black smoke than I would have to contaminate the water supply or throw garbage over the line fence. The production of an unnecessary amount of black smoke constitutes a nuisance, and should be so designated by law. The remedy lies either in legislative enactment or municipal ordinances, according to the provisions of the city or town charter. Once proper laws are provided, everything depends upon public sentiment and upon the personnel of the office force. It is, perhaps, unnecessary to say that the department of smoke prevention, like others of its kind in the city hall, should be free from all suspicion of graft or of collusion with either coal dealers or manufacturers of smoke-preventing devices. The inspectors and officers should be chosen on account of their practical knowledge of engines and boilers. The head of the office should be a man who is technically trained; one of good judgment and unfailing tact. His subordinates can well be stationary and locomotive engineers of good reputation and habits. The appointment for political reasons of plumbers, saloon-keepers or drug clerks to positions on the force will but make it the laughing stock of the neighborhood. It must be regarded as a technical, not a political organization. Any campaign for improvement in conditions must be at first largely of an educational nature, and resort should be had to legal measures only in extreme cases. When arrests are made it is absolutely essential to have the co-operation of the police and judiciary, so that the necessary punishment can be made without fear or favor. If the people of our cities who, after all have the supreme power, would only awake to the possibilities of this movement, the advance might be rapid.

The New York City Railway Company, early this year, secured the rights from the Pay As You Enter Car Company, of New York City, to use the pay-as-you-enter system and put on 155 cars of that type. Evidently the cars were a success, for the New York City Railway has placed an order for 75 additional cars.

* Read before the Indiana Engineering Society.