and catching the vapor driven off in a bottle filled with water and inverted in a basin; the air displaced from the retort by expansion due to the heating displacing the water in the bottle. When the retort was cooled, after being heated to 350 degreees in an oil bath, the air thus expanded contracted, and returned from the bottle to the retort, leaving the bottle full of water, as at the beginning of the heating, showing that no gas had been given off, except possibly such exceedingly small amount as might be absorbed by the water."

Another member, treating on maximum economy, says: "If the object of the trial is to ascertain the maximum economy or capacity of the boiler as a steam generator, the boiler and all its appurtenances should be put in first-class condition. Clean the heating surface inside and outside, remove clinkers from the grates and from the sides of the furnace. Remove all dust, soot and ashes from the chambers, smoke connections and flues. Close air leaks in the masonry and poorly fitted cleaning doors. See that the damper will open wide and close tight. Test for air leaks by firing a few shovels of smoky fuel and immediately closing the damper, observing the escape of smoke through the crevices."

In another paper a member summed up that there are eight sources by which the heat from fuel is a total loss, as follows: 1. Loss of coal or coke through the grate. 2. Unburned coal or coke carried in the shape of dust beyond the bridge wall. 3. Heating to 212° the moisture in the coal, evaporating it at that temperature, and evaporating the steam made from it to the temperature of the flue gases, = weight of the moisture in pounds $\times$ $[(212^\circ - t) + 966 + 0.48\ (T - 212)]$ in which T is the temperature (Fahr.) of the flue gases and t the temperature of the external air. 4. The loss of heat due to steam which is formed by burning the hydrogen contained in the coal, and which passes into the chimney as superheated steam, = 9 times the weight of the hydrogen $\times$ $[(212 - t) + 966 + 0.48\ (T - 212)]$. 5. Superheating the moisture in the air supplied to the furnace to the temperature of the flue gases, = weight of the moisture $\times$ $0.48\ (T - t)$. 6. Heating of the gaseous products of combustion (not including steam) to the temperature of the flue, = their weight $\times$ $0.24\ (T - t)$. 7. Loss due to imperfect burning of the carbon of the coal and to non-burning of the volatile gases. 8. Radiation from the boiler and furnace.

Smoke measurement is also the subject of another paper. The writer says: "In a series of competitive trials between two furnaces which the writer made in June, 1897, for the Detroit waterworks, a method of obtaining a continuous record of the quantity of smoke was introduced, which seems to him of great value in making specific what has heretofore been based upon the judgment of the person conducting the observations. The method referred to consisted simply in suspending, at a suitable point in the smoke passage between the boiler and the flue, a smooth, flat, brass plate, having its face at right angles to the direction of the current. This plate served to collect a certain portion of the soot which was carried along by the waste gases, and indirectly furnished a means of sampling the gas in respect to its smokiness. The plate was 24 inches long and seven-eighths of an inch wide, and it presented a surface amounting to 21 square inches. Being inserted through a hole in the top of the flue and suspended by a wire, the hole being covered, the plate could be readily withdrawn from its place whenever desired, and the collection of soot removed by the use of a stiff brush. This was done every two hours during the progress of the trial. The quantity of soot which collected on this plate varied according to the type of the furnace and the character of the fuel, as also according to the conditions of the firing and the working conditions of the boiler. The records of the smoke-measuring device and those of the ocular observations of the chimney were in accord with each other. The quantity of soot which was collected, reduced to the hourly rate, varied in these tests from nine milligrams to 184 milligrams. The method has not as yet been tried in the case of a flue carrying very dense smoke."

CARD WIRE.

William Middleton, a card clothing manufacturer of Clackheaton, Eng., recently delivered a lecture upon card wire before the Bolton and District Managers' Association, in which he said:

"There are only three modes of setting commonly in use, namely: plain, twill, and ribbed. In regard to their merits, there are many different opinions. Some authorities tell us that plain and twill are the best, but why this should be so I do not understand, as this class of wire cannot be produced without the open edges or rows, with which every carder is familiar. The defects also in these settings are more difficult to detect than in the ribbed, for when the tooth is a little out of shape it takes an experienced man to discover it, whereas in the case of the ribbed this is not so. This, however, leads us to that portion of our subject which is perhaps the most important to deal with, namely, the material used for the construction of the card tooth. I can remember the time when what was known as L and D wire was commonly used, and was then considered by the trade to have reached the height of perfection; in fact, if this wire were now in use instead of mild steel wire, many of the difficulties which we as card makers have to face would be overcome. Both these, however, have been largely substituted by hardened and tempered steel. This also has been much improved upon of late years. This wire was originally produced in a black and scaly condition, which for some time made dirty cotton, and was the cause of much annoyance to cotton manufacturers, but it is now practically as bright and as smooth after leaving the furnace as it was before entering it. Much could be said here in reference to the treatment of the wire in the furnace, and the process of hardening and tempering. In the first place, the material operated upon is but slender, and thus the slightest variation in the heat will cause a like variation in the temper, which in turn, when set into the foundation, will cause irregular angles and will alter the form of the tooth altogether. This