

fect command of the subject to which he has given so much attention, went over many of the points of his invention. The conversation in full ran as follows:—

REPORTER—Where were the experiments made?

Mr. MALLETT—A forty-horse steam boiler, equipped with the required appliances, has been in operation for several months in this city, and was subjected to all of the tests that scientific and practised experts could suggest. The results demonstrated a fuel saving of over forty-five per cent.

REPORTER—Can you explain to me how you effect such a saving?

Mr. MALLETT—I may, perhaps, be more concise by giving you extracts from a paper which I am preparing for the Royal Academy of Sciences of Turin, in view of that body offering 12,000 lire for the most important discovery made within the past two years. The system which I termed "controlled combustion" is based on certain experiential, fundamental principles which have as yet remained undeveloped in practice. Fuel loss arises, first, from imperfect combustion evinced by the production of carbonic oxide, often seen burning with a blue flame on a coal fire and on the top of chimneys; second by heat lost in producing chimney draught; third, by insufficient absorption of heat in the boiler itself.

EXPERIENTIAL PRINCIPLES.

REPORTER—Will you mention these principles?

Mr. MALLETT—They may be formulated as follows:—

First.—Hydro-carbon fuel tends to burn with less carbonic oxide and smoke proportionately as its environing atmosphere diminishes in tension.

Second.—Hydro-carbon fuel, tends to evolve carbonic oxide and also smoke if burned in a furnace until the temperature of the fuel reaches a certain elevation.

Third.—The tension of the fuel gases within a furnace is never less than that produced by the burning of the fuel itself by natural draught, and is never sufficiently low, when compared with the rate of combustion, to prevent the origination of carbonic oxide or smoke.

Fourth.—What was considered probable by Rankin, Peckett and others is demonstrated in controlled combustion—viz., that air for dilution in furnace combustion would be combustion rendered unnecessary provided chimney draught could be dispensed with; and provided also that without such draught a supply of sufficiently heated air in divided currents could enter the combustion chamber in regulable quantities.

Fifth.—To maintain an atmosphere of the desired tension within a firebox an air exhauster must supplant the chimney, and the influx of air into the ashpit must be throttled.

Sixth.—When combustion is urged by a blast fan causing the furnace air tension to be greater than normal barometric pressure, both physical and chemical actions result, differ from those created by a draught or flue fan incompatible with perfect combustion.

Seventh.—Hydro-carbon fuel freshly charged into a furnace must not be supplied with air to initiate its burning until the temperature of the fuel is sufficiently elevated. The fuel must begin to distil before it begins to burn.

Eighth.—To compel a rapid and intimate mixture of hot air with combustible fuel gases generated within a boiler fire-box these gases must not be allowed to ascend or envelop the boiler until after they enter the combustion chamber through channels in close proximity to those conducting freshly heated air into the combustion chamber.

Ninth.—The heat from escaping furnace gases after leaving a steam boiler is, more completely radiated for additional heating and boiling of water if such gases be rendered athermous by being kept at their dew point.

Tenth.—It is possible in practice to superheat all the feed water required by a steam generator from the waste heat of the escaping gases to a temperature equal to that of the water within the generator, and also to supply a portion of the feed in the form of steam.

Eleventh.—The potential power of a steam generator may be increased to a greater limit than hitherto without diminishing the economic result.

Twelfth.—To burn fuel rapidly without creating a too high localized temperature, it should not be supplied with sufficient air to burn it at once to carbonic acid only, but considerable carbonic oxide should be produced to be afterward burned in the combustion chamber.

REPORTER—Why does diminished air tension tend to prevent smoke?

Mr. MALLETT—If we take a tallow candle that burns with a smoky flame at sea level to a summit as high as Mount Blanc we shall find that the candle not only ceases to smoke before the summit is reached, but burns at such an elevation with a barely luminous flame, resembling that of alcohol. Conversely if an alcohol flame is burned in compressed air it becomes very luminous, and by further compression of the air the flame will actually smoke. To burn fuel we know that it must mix with air, and we know also that the more rapidly we mix the more rapidly we burn small particles. Now, air, when compressed, is approaching the solid form, and possesses in a less degree that molecular mobility of more diluted air. It thus occurs that such compressed air cannot enter and mix with flame and oxidize the carbon quickly enough to produce perfect combustion. On a mountain top, however, the less dense condition of the air permits so rapid an admixture with the candle flame that the candle not only ceases to smoke, but does not even diffuse light.

CHIMNEY DRAUGHT NOT NEEDED.

REPORTER—How can you dispense with a chimney?

Mr. MALLETT—An exhaust fan replaces the chimney and produces draught by drawing the gases of combustion from the furnace instead of forcing air into the ashpit as is customary. I can assist my explanation by making you a sketch of a boiler furnace as modified for controlled combustion. In fig. 1 you notice that the furnace under the boiler is divided into the fire-box proper and the combustion chamber by a division or septum wall, which replaces the ordinary bridge wall, having openings, as shown, through which the flames and fuel gases enter the combustion chamber. The air necessary for the combustion of the fuel gases enters the combustion chamber through the grate bars, which are tubular, having one end in communication with the external air and the other end opening into the combustion chamber just below the apertures in the septum wall. To respond to the demands of principle 1, just cited, provision is made to throttle the air that enters the ashpit, and thus compel the desired amount to pass through the hollow bars by the exhausting action of the fan. As the fan constantly tends to void the fire-box of air, and as the entrance of air from the ashpit can be restricted to any degree, a curious phenomenon results—viz., an air tension of the fire-box very much below that which could possible result from chimney draught and independent of the rate of combustion.

REPORTER—Why could you not throttle the air that enters the ashpit, if chimney draught instead of mechanical draught was used?

Mr. MALLETT—It must be obvious to you that when draught is created by the burning of the fuel itself, if we attempt to diminish the amount of air entering the ashpit the draught will stop. In controlled combustion it is necessary to prevent any air gaining access to the fuel from the ashpit each time the furnace is charged with bituminous coal or wood, so that the fuel will rapidly distil before it begins to burn.

REPORTER—How can you possibly prevent fuel freshly charged into a furnace from beginning to burn until you want it to?

Mr. MALLETT—Just look at fig. 2, which shows a view of a boiler front. You see that the ashpit door has a sliding register which admits of any desired opening or can be entirely closed. You notice, also, that the open ends of the grate bars come through the boiler front, and are also provided with a sliding register. The lever handle actuates both sets of air registers. On charging fresh coal into the furnace the lever is caused to shut off all air entering the ashpit at the same time that it increases the area of the openings of the tubular bars. The heat of the furnace begins rapidly to raise the temperature of the fresh fuel, and the gases that at once begin to distil from the fuel are burned by the air passing through the tubular bars. At the proper time air is allowed to enter the ashpit and then the fuel really begins to burn. The supply of air, however, is always restricted, so as to maintain a low tension in the fire-box.

WHY FUEL IS NOW WASTED.

REPORTER—What do you mean, in principle 4, by air for dilution?

Mr. MALLETT—Fuel, when burning with such excessive velocity in a furnace, requires more air to come in contact