source of heat distinct from that derived from carbonaceous combustion. It is known that the result is cumulative, but it has not been known that there was another source, in the heat evolved from the air itself. Incandescence of the non-combustible concretion, or crystallization forming the Welsbach hood or burner, is known to be a prolific source of heat as well as of light. And there are many evidences that incombustible materials of like refractoriness may be super-heated largely when incandescent under an air-blast; the presence of carbon, and the normal consumption of carbon and oxygen, not being essential or even attendant conditions.

As a result of experiments for some years conducted, leading in this direction, and in the earlier part of this period confined to the use of an air-blast with a very small adjacent of hydro-carbon gas, the most intense metallurgic heat was produced without the use of any solid or liquid fuel, and without the production of gases as the products of combustion, in any form of carbic acid or carbic oxide. The very small proportions of carbonaceous gas — hydro-carbon gas — used as the means of setting the air-blast on fire, not being sufficient with cause delivered of carbic acid or oxide from the flue, no flue was used, in fact, as an upward delivery, and none was necessary.

These trials were but steps, however, leading to a more complete substitution of atmospheric combustion by contact with incandescent surfaces, carbonaceous at first, and of anthracite or bituminous coal the carbon of which would remain intact after hours of evolution of intense heat. The conditions of such contact are still obscure as to the point of origin of the cause of such action; but it is demonstrated that the utmost intensity of heat, not less than 4,000°C, can be and is attained with a mere initiatory of carbonaceous combustion, and, when once established, may be maintained for an indefinite period by merely preserving the incandescence of the surface. And this may be done by a slight manipulation of the surface brought to incandescence, and with some slight renewal of carbonaceous material.

The direction of these results is so clear that it is assumed to be a new and practicable method of the evolution of heat for economic purposes. The air itself, which is the only body consumed, becomes a new source of heat, acting independently of the supposed limit of ray and do yield of carbonaceous combustion. Nor is any gaseous or aceriferous compound delivered as the product of such evolution of heat or combustion, if so called. We have applied the term 'combustion' hereforeto to all combinations resulting in the evolution of heat enough to burn or disorganize organic matter.

If the air itself, its nitrogen as well as its oxygen, can be made available as a direct source of heat without the attendant conditions of the formation of waste products, such as carbonic acid or carbonic oxide, the discovery is one of the greatest in human experience. It implies the substitution of an inexpensive natural fuel for the expensive natural and artificials now in use. The mere suggestion appears too great to be credible; but it is absolutely true that this is done experimentally with complete success, and that appliances are already in use, heating the air in large buildings and melting the most refractory metals in considerable quantities. The intensity of the heat is equal to that of the blow-pipe, while the extent of space to which it is applied is adequate to any requirement for steam-generation or for manipulation of iron or other metals.

It is only true to cite so much of what are admitted facts in heat-production by the usual processes, that other and superior aids to heat-production are already reached in many cases, and that the line of reasonable progress lies in the direction of reliance from dependence on the combustion of carbon, organic or inorganic, as the source of heat for economic purposes."

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