

Concerning the mixing up of shell-beds with the kitchen-middens of the Moa-hunters, there is no reason why the latter should not have been shell-eaters also; but all the undisturbed layers with Moa bones, seal bones, and ashes, which I examined carefully at different levels, never contained any shells, and the undisturbed shell-beds did not contain any Moa bones. However, in many localities, owing to the shifting nature of the sands, I observed that the contents of the older and newer beds had very often become mixed. This was exhibited very clearly in one spot, where a small hillock, with a layer of ashes, stones, and Moa bones, had partly become destroyed, the contents of the layer rolling down and covering a bed of shells lying in the hollow between the sand-hills.

As such a destruction and mixing of beds belonging to different periods have been going on for a long time, it is evident that if, as in this case, the re-arranged beds have been mistaken for original ones, it simply proves that the excavators possessed insufficient experience to distinguish between them.

---

*On a new Fire-grate for economising the Combustion of Coals and Lignites, and increasing the Radiation of Heat.* By H. SKEY.

[Read before the Otago Institute, 4th July, 1876.]

IN a former paper read before this Institute, a method was described by which coal and lignite could be consumed without wasting the heat contained in the column of air which ordinarily passes up the shaft of the furnace of the steam-engine, and in the discussion which arose thereon the desirability was suggested of devising some method by which the combustion of brown coal and lignite could be rendered more perfect in open fires and sitting-room grates. The use of a blast for this purpose would be scarcely applicable, as it would require special machinery for each fire-place.

Experiments were, however, undertaken last year, on the combustion of these fuels in an open grate, the final result of which is exhibited in action, as I have been kindly allowed to substitute one of these grates in the fire-place of this room for the evening. The fuel used is from the Green Island mines. It is well known that stirring these fuels makes them burn worse, also that a great vertical thickness is injurious to their combustion, as the superincumbent weight crushes the fuel, so that scarcely enough heat is generated to sufficiently warm the chimney to ensure the passage of the liberated smoke and gases up the flue. For these reasons, the attempts to burn them in grates specially constructed for hard and bituminous coals, leads to anything but a cheerful result.

In the fire-place exhibited the bottom grate is constructed with oblique spaces, narrow at the back and widening out at the front, and this is fixed in the fire-box at a considerable inclination from the back downwards to the front. It is fed by placing the fresh fuel at the back of the grate on the narrow parts of the spaces, where it gets thoroughly dried and heated without slackening the fire in front. It then gradually slips downwards and forwards as the combustion proceeds; by this self-stirring contrivance the ashes are shaken and driven through the ever-widening spaces of the grate, and the glowing fuel is kept in contact with the air, thus burning clear and bright. Small coal and dross can also be burned therein.

The invention can be applied to all descriptions of grates and open fire-places.

It will be seen that the draught of air under and through the fire is sharpened by the convergence of the oblique spaces from the front to the back. When the fuel reaches the front of the fire-place, its further descent is prevented by a bar, which is also inclined so that it does not intercept the radiation of the heat to the centre of the room.

The thickness of the stratum of fire cannot exceed three or four inches, but by the inclination of the grate we get a depth virtually equal to eight or ten inches. This inclination allows the heat to be radiated into the room without waste.

The heating-power of a grate depends upon the amount of ignited *surface* which the fire presents towards the centre of a room, the ignited coals in the middle of a fire being only useful in maintaining sufficient body of fire to keep it in ignition. The heat evolved in the centre of a large fire is in a great measure lost as far as the heating of the apartment is concerned. With hard coals a thick stratum is required, but with soft coals a thin stratum, giving a maximum amount of surface with a minimum amount of consumption of fuel, is obtainable.

All the fuel in this grate burns away to a clean ash and passes through the grate, so that the fire remains clear, and continues heating the room as long as there is any fuel left in it; for the fire does not die out but burns out, and this without any stirring, which sufficiently proves its adaptability for the combustion of the fuel obtained from those numerous coal-fields of Otago which are already becoming so rapidly developed, and which bid fair to become one of the most valuable natural products of New Zealand.

---