earth. On the contrary, I suppose that the last stragglers only, which escaped annihilation by physical changes and causes, may have continued to exist down to Man's first appearance on the British Isles; and as precisely similar views regarding the extinction of the Dinornis in New Zealand have been advocated by Dr. Mantell in one of his last communications to the Geological Society, I shall make no apology in concluding with his remarks when speaking of the Moa-beds:—Both these ossiferous deposits, though but of yesterday in geological history, are of immense antiquity in relation to the human inhabitants of the country. I believe that ages, ere the advent of the Maoris, New Zealand was densely peopled by the stupendous bipeds whose fossil remains are the sole indications of their former existence. That the last of the species was exterminated by human agency, like the Dodo and Solitaire of the Mauritius, and the Gigantic Elk of Ireland, there can be no doubt; but, ere man began the work of destruction, it is not unphilosophical to assume that physical revolutions, inducing great changes in the relative distribution of the land and water in the South Pacific Ocean, may have so circumscribed the geographical limits of the Dinornis and Palapteryx, as to produce conditions that tended to diminish their numbers preparatory to their final annihilation.

In the absence of James Nasmyth, Esq., C.E., of Patri- croft, Manchester, Mr. Durden read that gentleman's communication

ON A NEW SYSTEM OF PUDDLING IRON BY STEAM.

In order to render the object and nature of this invention more clearly understood, it will be as well to describe and explain the nature and object of the process in the Iron Manufacture termed "puddling," or the process whereby cast iron is converted into malleable iron.
The difference between cast iron and malleable or wrought iron, is chiefly due to the presence in the former of a considerable quantity of carbon in combination with the iron. In order, therefore, to convert cast iron into malleable iron, it is requisite that we remove or drive off the carbon from the cast iron. This object is effected by exposing the surface of a quantity of molten cast iron as it lies in that state on the bottom of a suitable reverberatory furnace, to the action of a current of heated air, so that the oxygen of the air, as it passes over the surface of the molten cast iron, may combine with the carbon and carry it off in the form of carbonic acid and carbonic oxide gases.

But as the naturally tranquil surface of the molten cast iron would not present sufficient surface of metal to the action of the air drawn over it by the draft of the furnace, and would, if left in a tranquil state, require a very long time to elapse ere the carbon was by the action of the air abstracted from the cast iron, it is found requisite to agitate the metal, so as to continually expose fresh surfaces to the decarbonising action of the air.

This agitation is effected by raking the molten metal backward and forward by an iron rake or paddle called a "rabble," worked by the attendant at the furnace, who puddles amongst the molten iron with his rake to effect the agitation required—hence the term "puddling." As these iron rabbles have to be made of considerable strength and weight, and as the iron through which it is moved is somewhat stiff, although in a fluid state, the labour of this process of puddling is excessive, and it has in the ordinary system to be continued without interruption for upwards of thirty-five to forty minutes, the workman being all the while exposed to the violent heat of the surface of the furnace, distant only three to four feet from his person.
After the carbon has been sufficiently carried off by the oxygen of the air, the molten cast iron becomes stiff and pasty, losing its fluidity, and shortly exhibits a granular condition caused by the accumulation of particles of malleable iron which collect together and are made up into "balls" by the workman, who, by means of a suitable iron paddle, presses these granulated particles into larger masses within the furnace, from whence they are in due time removed, and beat and rolled into bars by aid of hammer and rolls.

Now, having given this description of the process of puddling and its object, I shall proceed to describe the nature of my improvement: which simply consists in employing the combined mechanical and chemical action of steam, to effect at one and the same time the effects for which such a vast amount of manual labour is required, in the ordinary mode of agitating or puddling the iron by hand, so as to enable the air passing over the surface of the iron to remove or abstract the carbon.

In order to accomplish the desired object, I introduce a current of steam beneath the surface of the molten cast iron, by means of a curved iron steam pipe, so that when the steam is let on, and the orifice of this pipe is depressed down to the bottom of the pool of molten cast iron, the steam, in passing up through the molten iron, not only throws the metal into violent agitation, but also by reason of the intimate contact of the steam with the molten iron, the steam is decomposed, the liberated oxygen passing to the carbon of the cast iron with which it combines, and passes off in the condition of carbonic acid and carbonic oxide gases; while, the hydrogen liberated at the same time, combines with another portion of the carbon of the cast iron, forming carbureted hydrogen, and another portion of the hydrogen unites with any sulphur which the iron may contain, and removes it in the form of sulphuretted hydrogen.
In order to enable the operator to cause the steam to act equally on all portions of the molten iron, the steam pipe is made with a flexible joint, so that the submerged orifice of the steam pipe may be moved about within the furnace, and the current of steam made to pass up through the molten iron at any part of the basin. Such, however, is the energetic action of the steam in agitating the molten metal by its passage up through it, that a very gentle action of the steam pipe suffices to cause every particle of the iron to be subjected to the decarbonising and desulphurising action of the decomposed steam.

Such is the extraordinary ease and rapidity with which we are enabled to decarbonise the cast iron by the introduction of a current of steam up through the molten iron, that in four to five minutes from the time of introducing the steam pipe beneath the surface of the molten cast iron, its conversion into malleable iron is effected; thirty-five to forty minutes being required on the old system.

No special alteration in the furnace is required, and about 60s. will provide the requisite steam pipe. The submerged end of the steam pipe gets coated over with the cast iron, but the waste of it is very slight, and as it is only the submerged end that does waste, that part is made removable. Each end lasts fully eight to ten days, and only costs 9d each time it is removed.

The introduction of steam with the puddling furnace has before been made the subject of patents; but no success attended the application until I introduced the steam up through the molten iron by means of a submerged moveable pipe in the manner above described.

Messrs. Rushton and Eccersley, of Bolton, have now twelve puddling furnaces in constant action by my steam system, and yielding first-rate iron.