

a sulphur-crested cockatoo (*Cacatua galerita*) from Australia. Soon after my arrival in England I had occasion to cut his wing, and this destroyed all his former friendly feelings towards me. On my removal from Blackheath to Dublin, I placed him for a few weeks in the Zoological Society's Gardens, Regent's Park. Being in London in May I brought him with me on my return to this city. I went to the Gardens for him myself, and was interested and somewhat pleased to find, on speaking to him, that he had apparently forgotten me. On my way, in a cab, to the hotel where I was staying, he was very friendly; but on my arrival there, as soon as I took off my hat, it was evident that he recognised me, for his old manner at once returned. On arrival here he appeared to remember my children, and resumed his former friendliness towards them, but he still regards me as his enemy.

17, Leinster Square, Rathmines, Dublin S. J. WHITMEE

Proceedings of the Aberdeenshire Agricultural Association, 1878

YOUR article (vol. xx. p. 288) touches a subject of vital importance to the farmer in these bad times, and I hope you will follow it up by an appeal to Mr. Lawes and to the Royal Agricultural Society of England to institute a parallel and independent course of experiments, in order to test the conclusion in regard to phosphatic manures announced by the Scotch Association.

The possible presence of humic, carbonic, and other acids in more than usual proportion in Aberdeenshire soil and water has often occurred to me as accounting for the similarity of results between those local experiments of soluble and insoluble phosphates, but it can hardly be denied that a case has been established for further experiments. The fact that acid and manure makers have a direct pecuniary interest in the existence of a prejudice in favour of soluble phosphate might alone have led farmers to require some evidence before spending their money under such scientific dictation, but now that they have three years' experiments testifying distinctly against the doctrine, they may surely look to their advisers for something more than bare assertions on authority that a "mineral phosphate is of little or no value as a manure until it has been rendered soluble by acid in course of manufacture."

ALFRED S. JONES

Wrexham, July 27

Spicula in Helix

WHILST dissecting, a few days ago, a common garden snail (*Helix aspersa*), I came across two calcareous spicula, lying immediately under the "albuminiparous gland," which I cannot find mentioned in any of the text-books. I at once dissected three other snails of the same species, and in two I found no spicula, while in the third I found one lying in the same place as the two before-mentioned. Can any reader of NATURE tell me whether these are of the same nature as the diffused spicula of Doris, or if not, of what nature they are? They could not have been "spicula amoris" (Huxley) of the dart-sac, as they were not contained in any sac at all, but were lying free in the above position.

EDWD. B. PARFITT

3, Waterfield Terrace, Blackheath, S.E.

GENERAL RESULTS OF EXPERIMENTS ON FRICTION AT HIGH VELOCITIES MADE IN ORDER TO ASCERTAIN THE EFFECT OF BRAKES ON RAILWAY TRAINS¹

II.

SOME special experiments were made with blocks of small area. The brake-blocks generally used in these experiments were 12 inches long, by 3 inches wide, giving a surface of 36 square inches; the small brake-blocks were made so as to afford a surface of pressure against the wheel of only one-third of this amount, or 12 square inches, thus making the pressure per square inch three times as great as before. The diminution of surface was obtained by casting projections upon the face of the block. The author is not prepared to say that any greater coefficient of friction was obtained by the extra pressure per square inch, although in one of the experiments, at a velocity of sixty miles an hour, the rotation of the wheels was arrested by these blocks, whilst this effect had not been produced at that speed in other experiments. The

¹ Continued from p. 295.

experiments on this form of block were stopped because the blocks were entirely worn down in the course of about twelve experiments.

Mr. Rennie showed² that high pressures per square inch produced a greater coefficient of friction between surfaces either moving very slowly or nearly at rest; but it must be borne in mind that the author's experiments were made with high velocities, whereby a serious element of disturbance is introduced, viz., the grinding away of the surface; and it is therefore probable that the increase in the coefficient of friction due to increased pressure, may have been neutralised by the lubricating effect of the fine particles ground off the surfaces.

While no certain opinion can be expressed as to the relation which the coefficient of friction bears to pressure, so far as these experiments are concerned, it is quite clear that in proportion as the pressure is increased or diminished so will the actual friction obtained be increased or diminished. When the friction which exists between the brake-blocks and the wheel reaches a certain point, the wheel ceases to rotate, and becomes fixed. This point is reached when the frictional resistance of the blocks exceeds the adhesion between the wheel and the rail if the speed is kept up; or, if the speed is slackening, when it exceeds the adhesion between the wheel and the rail, plus the effort required to retard the rotation of the wheel equally with the retardation of the train; and the excess of resistance then acts as an unbalanced force, tending to destroy the momentum of the wheel.

Usually there are in a train a certain number of vehicles braked and a certain number unbraked. If the brakes acted on all the wheels, then the rotating momentum of the wheels does not add to the distance in stopping a train, because that momentum can be acted upon by the brakes directly, without in any way affecting the adhesion of the wheels to the rails. It simply requires an additional amount of brake-block pressure.

With the unbraked portion of a train the rotating momentum of the wheels is an addition to the momentum due to the weight of the train (including therein the actual weight of the wheels), which cannot be utilised for retardation; and it therefore seems important that there should be brakes on every wheel of a train.

As it thus appears that it is the adhesion which governs the retardation which the brake-blocks can exert on wheels, it is manifest that the pressure brought to act on the brake-blocks should never give an amount of friction which exceeds the adhesion. At a high speed, however, the pressure required to produce a degree of friction equal to the adhesion is much greater than what is required at a low speed.

The following table gives approximately the proportion which the pressure to be applied to the brake-blocks should bear to the weight upon the braked wheels, with coefficients of adhesion between wheel and rail varying from '30 to '15 of the weight on the wheels:—

Ratio of Brake-Block Pressure to Weight on Wheels

Speed.		Approximate ratio of total pressure on brake-blocks to total weight on braked wheels.			
Feet per second.	Miles per hour.	Coefficient of adhesion '30.	Coefficient of adhesion '25.	Coefficient of adhesion '20.	Coefficient of adhesion '15.
11	7½	1'20	1'04	0'83	0'60
22	15	1'41	1'18	0'94	0'70
29	20	1'64	1'37	1'09	0'82
44	30	1'83	1'53	1'22	0'92
59	40	2'07	1'73	1'38	1'04
73	50	2'48	2'07	1'65	1'24
88	60	4'14	3'47	2'77	2'08

² Phil. Trans. for 1829, p. 159.