wings nine times per second, or five hundred and forty times per minute. These movements represent an incredibly high speed even at the roots of the wings, but the speed is enormously increased at the tips of the wings, from the fact that the tips rotate upon the roots as centres. In reality, and as it has been already indicated, the speed at the tips of the wings increases in proportion as the tips are removed from the axis of rotation and in proportion as the wings are long. This is explained on the principle well understood in mechanics. If a rod or wing hinged at one point be made to vibrate, the free end of the rod or wing always passes through a very much greater space in a given time than the part nearer to the root of the wing. The progressive increase in the spread of the wings in proportion as the wings become larger, explains why the wings of bats and birds are not driven at the extravagant speed of insect wings, and how the large and long wings of large bats and birds are driven more leisurely than the small and short wings of small bats and birds. That the wing is driven more slowly in proportion to its length is proved by experiment, and by observing the flight of large and small birds of the same genus. Thus, large gulls flap their wings much more slowly than small gulls; the configuration and relative size of the wings to the body being the same in both. This is a hopeful feature in the construction of flying machines, as there can be no doubt that comparatively very slow movements will suffice for driving the long powerful wings required to elevate and propel flying machines. The speed of the wing is partly regulated by its amplitude. Thus, if the wing be broad as well as long, the beats are necessarily reduced in frequency. This is especially true of the heron, which is one of the most picturesque and at the same time one of the slowest-flying birds we have. I have timed the heron on several occasions, and find that in ordinary flights its wings make exactly sixty up strokes and sixty down strokes,—that is, one hundred and twenty beats per minute. In the pterodactyl, the great extinct saurian, the wing was enormously elongated, and in this particular instance probably from fifty to sixty beats of the wing per minute sufficed for flight. Fifty or sixty pulsations of the wing per minute do not involve much wear and tear of the working parts; and I am strongly of opinion that artificial flight, if once achieved, will become a comparatively safe means of locomotion, as far as the machinery required is concerned."

BOOK REVIEWS.

Scott's Marmion; with Introduction and Notes. By T. C. L. ARMSTRONG, M.A., LL.B., Toronto. Canada Publishing Company, 1882.

MORE than any other of our English Classical Poets, Scott requires the aid of copious notes, so as to make clear the constantly recurring allusions to history and local folk-lore, traditions and scenery; and in none of Scott's poems is this more apparent than in the case of the beautiful *chef d'œuvre* so happily selected as the subject for the forthcoming Intermediate Examination of our Ontario Educational Department. A poem like the 'Paradise Lost,' or one of Shakespeare's dramas, an idyl like the 'Deserted Village,' explains itself, and is best without other comment than that supplied as occasion requires by an intelligent teacher. But in a poem like 'Marmion,' it is impossible to follow the spirit of the verse without at every step understanding the historical and local allusions. These are matters which the student ought to search out for himself, his history and geography in hand, with the aid of elucidatory annotation. His teacher will supply, what no notes