weight was first clearly demonstrated as due to the attraction of the Earth, although mere surmises had been propounded by early astronomers, and in "Troilus and Cressida" we have—"As the very centre of the earth, drawing all things to it."

But Acts of Parliament on "Weights and Measures" were extant hundreds of years before the first appearance of the "Principia"; and when the standard pound weight was defined in these Acts, it was the lump of metal preserved at the Exchequer that was described, and not the pressure on the bottom of the box in which it was kept.

13. Formerly, the words *vis inertiæ*, or *inertia*, were used instead of the modern word *mass* (often used in ordinary language as the equivalent of *bulk*). But it is useful to notice that inertia is not always the same thing as weight or mass, or even proportional to them.

Thus the inertia of a body is increased by the presence of the surrounding medium; the inertia of a sphere moving in a frictionless incompressible liquid is increased by half the weight of the liquid displaced, and of a cylinder moving perpendicular to the axis by the weight displaced; while an elongated projectile requires rotation about an axis for stability of flight, in consequence of its inertia being different for different directions of motion.

The inertia of a pendulum, or of the train in § 2, is increased to an appreciable extent by the presence of the surrounding air.

Again, the inertia of a rolling hoop is twice its weight, of a cylinder is half again as great, of a billiard ball is 40 per cent. greater; and the inertia of a bicycle, or of the train we have considered in § 2, when the *rotary inertia* of the wheels is taken into account, must be increased by a fraction of the weight of the wheels and axles equal to k^2/a^2, where a is the radius of a pair of wheels, and k the radius of gyration of the wheels and axle about the axis of rotation.

For the same reason the centre of inertia does not always coincide with the centre of gravity, or centre of mass. The buffers of a railway carriage should be at the height of the centre of inertia; and this is easily seen to be at a height

$$h \Big/ \left(1 + \frac{w}{W}\frac{k^2}{a^2}\right)$$

above the axles, w denoting the weight of the wheels, W of the body of the carriage, and h the height of its centre of gravity above the axles.

The recommendations of the A.I.G.T., in their "Syllabus of Elementary Dynamics," will only serve to widen the increasing gulf between theoretical treatises and the Applied Mechanics which engineers use, unless the Committee of the A.I.G.T. will set to work to invent a totally new word, such as *heft*, to express the pull of gravity on a given weight, as an equivalent of the French word *pesanteur*; it is hopeless to attempt todegrade the, old word *weight* into the subsidiary secondary meaning so long as in commerce, and in the Acts of Parliament, *weight* invariably means quantity of matter, *copia materiæ*.

A. G. GREENHILL.

APHANAPTERYX AND OTHER REMAINS IN THE CHATHAM ISLANDS.

IN a former letter I sent you some account of the finding of the *Aphanapteryx* in the Chatham Islands. I have now gone more carefully over the bones I collected there, and some additional notes may not be without interest. I find that, of the heads I have obtained, a number are much larger than that of *Aphanapteryx broeckei* (Schlegel), and are therefore rightly assigned, I think, to a distinct species. The tarso-metatarsus, as figured by M. Milne-Edwards, however, may, I think, prove to belong not to *Aphanapteryx*, or at any rate not to a species with so robust a tibia. I found several tarso-metatarsi in near relation to the tibiæ and femora, and heads of *A. hawkinsi*, and they are all without exception much shorter and stouter bones in proportion to the tibiæ and femora. Out of the same strata which contained *Aphanapteryx*, I obtained a number of the bones of the skeleton of a *Fulica* very nearly related to *F. newtoni*. Like the *Aphanapteryx* bones, they vary very much in size, some being equal, others much larger than those of *F. newtoni*. So much so that I am inclined to recognize them as different species, or at least different races. The larger species I have named *F. chathamensis*. The portions I have had before me are the pelvis, the femur, the tibia, and metatarsus. I have portions of a large ralline skull, which may be that of this *Fulica*, but it is rather too imperfect to enable me to speak more confidently at present. The tarso-metatarsi of this bird agree much more closely with the tarso-metatarsus assigned in M. Milne-Edwards's plate to *Aphanapteryx*. Of the *Aphanapteryx* I possess the complete cranium, femur, tibia, metatarsus, humerus, and pelvis. Among the other interesting specimens so far identified, are the humeri and pelvis of a species of Crow half as large again as *C. cornix*. They agree closely with those of a true *Corvus*. I have designated it as *Corvus moriorum*, as I found some of these bones among the remains scattered round a very ancient Moriori cooking-place, which had become uncovered by the wind in the strata in which *Aphanapteryx* occurs. Indeed, in this kitchen-midden I gathered portions of the *Aphanapteryx*, of a large swan, of several species of ducks, and of a *Carpophaga* indistinguishable from the species now living on the islands—a species (*Carpophaga chathamica* mihi[1]) new to science. I may say that it is easily distinguished from *C. novæ-zealandiæ* by the breast-shield in both sexes being altogether duller than, and not extending so far ventrally as, in the latter. The head, neck, and breast are of the same colour—a dull green, with purple and green metallic reflections when viewed with the bird between the light and the eye. It is, however, most markedly distinguished by the pale lavender colour of the external border of the wings, the much paler colour of the lower back and rump, and by the black on the under surface of the tail feathers being prominent on all the rectrices except on the anterior portions of the outer tail feather on each side, and passing under the tail coverts in a broad wedge. Mr. Travers relates that he was informed by one of the early settlers on Pitt Island that he remembered the first appearance of the pigeon in the islands. This statement cannot well be accepted in face of the presence of the bird's bones in a midden so ancient as that I have referred to above. In the *Aphanapteryx* beds, I obtained also the portions of a skull of a species of *Columbidæ*, apparently of a *Columba*, of which I can say little till I am in possession of more material. I have obtained also bones of the small hawk (*Harpa*), showing that it existed on the islands, whereas it is now unknown there, although *Circus gouldi* is not uncommon.

At about 3 feet below the floor of a small cave, which the weathering limestone has deposited, I obtained portions of a pigmy Weka (*Ocydromus pygmæus*), and also the limb bones of a rat. If they have been gradually covered to this depth by the fall of particles from the roof, as there seems no reason to doubt, their age must be very great; but whether that would take us back to a date antecedent to the arrival of the Morioris in the Chatham Islands is a more difficult question to answer with our present data.

So far, the birds of whose presence in the Chatham Islands till now we have had no knowlege, are: *Harpa ? ferox*, *Nestor meridionalis* and *? N. notabilis*, *Corvus*

[1 *? Carpophaga chathamensis* of Rothschild, P.Z.S. 1891, p. 312, pl. xxviii. —ED.]

moriorum, *Ocydromus pygmæus*, *Fulica newtoni*, *F. chathamensis*, *Aphanapteryx hawkinsi*, *Ap.*? spp., *Chenopis sumnerensis*, *Carpophaga chathamica*, *Columba* sp.

HENRY O. FORBES.

Canterbury Museum, April 2.

ADMIRAL MOUCHEZ.

WE have already referred to the loss which French science has recently sustained in the sudden death of the director of the Paris Observatory, at the age of 71. It falls to the lot of few sailors in any country to take so large a share in scientific progress as did Admiral Mouchez, or to combine great administrative capacity with thorough knowledge and power of initiation.

His love for astronomy and geodesy first made itself felt when he was at the Collège Louis le Grand. Appointed to the navy in 1843, he was captain of a frigate in 1861, but three years before this he had communicated to the Academy of Sciences observations of the partial eclipse of the sun seen by him at Buenos Ayres on September 7, 1858. He was then in that locality constructing the hydrographical map of the eastern coast of South America. A year or two later he presented to the Academy a map of Paraguay, and he was presented as a candidate for filling the seat vacated by the untimely death of Bravais in 1863. But he was outvoted, and he continued his hydrographical work. He published a description of the coast of Brazil, and he observed an annular eclipse of the sun (on October 30, 1864) at San Catharina, Brazil.

When in 1872 expeditions were being organized by all countries to observe the transit of Venus in 1874, Mouchez was placed in command of the party which was destined for the island of Saint Paul. The climatic conditions of this island—either the winds are very violent, or the heaven is nearly always overcast—did not seem to favour the observers. The head of the expedition had the greatest difficulty in reaching his post, and it was in the middle of a violent storm that he had to approach the large volcano which was to be his station.

The evening of the day before the transit the rain fell in torrents; but the next day, at the moment wished for, by quite a fortunate chance, the storm cleared in consequence of a change of wind, and the veil of mist which covered the sky suddenly vanished; the observation was thus made under most favourable conditions. Mouchez was able to recognize the atmosphere of Venus very distinct from that of the Sun at the moment of contact.

The astronomical expedition which he commanded was composed of naturalists as well as astronomers; it has furnished science with interesting accounts of the geology, zoology, and botany of the islands of St. Paul and Amsterdam its neighbour.

On Mouchez's return to France he was promoted Commander of the Legion of Honour at the same time that he was nominated a member of the Academy of Sciences in the place of the astronomer Mathieu. In October 1875, at the annual public séance of the five academies, he gave an account of his expedition to the island St. Paul.

In 1878 he obtained from the French Admiralty the funds required for establishing at Montsouris, with the same instruments used by him at St. Paul, a school of astronomy for the use of marine officers and masters. This school is in full prosperity, and every year about a dozen men are trained in conducting astronomical and magnetical observations.

When Le Verrier died, on September 13, 1877, Mouchez, then commander, was appointed to the directorship of the National Observatory, and nearly simultaneously with this Commander Mouchez received the rank of Rear Admiral. He was put on the Reserve List in 1880.

Admiral Mouchez showed himself, at the Observatory, an active administrator. He brought about many marked improvements in the different branches of the establishment. He suggested the establishment of a practical school of astronomy, which has been worked for eight years consecutively, and has furnished all the French observatories with a remarkable supply of young astronomers. Thirty have passed through the two years' course.

Admiral Mouchez always encouraged useful researches, and the magnificent work undertaken with so much success by the brothers Henry in celestial photography, and the development of the *equatorial coudé*, under the fostering care of M. Loewy, must be specially mentioned here.

But by far the most important result of this kind which we owe to the Admiral's clear foresight and power of dealing with men is to be found in the Chart of the Heavens, which will remain as one of the memorable works of the science of the nineteenth century. It was on the proposal of the director of the observatory that the Academy of Sciences convoked foreign astronomers to take part in the Congress which, on three different occasions, assembled with so much success at the Paris Observatory.

This vast undertaking would have been impossible without the genius of the French nation and without such a man as Mouchez. It is essentially an international work which England should have started, but alas! in such matters our science is scarcely national; it is parochial, and so it must remain until the relations between science and the Government are changed.

Admiral Mouchez was a very zealous promoter of colonial observatories. He travelled to Algiers in order to preside over the inauguration of the large establishment erected by M. Trépied. This very year, having travelled to Tunis to recruit his failing health, he had taken steps for creating an astronomical station in the town of Zaghouan, and he was advocating the building of observatories at Tahiti and Tananarivo at the time of his death.

There are few astronomers who will not feel the death of Admiral Mouchez as the loss of a dear friend, and one in whom loyalty, honesty, and simplicity of character were so blended that the great services rendered by the savant were almost forgotten in the esteem felt for the man.

NOTES.

M. HECKEL, the President of the Botanical Section of the French Association for the Advancement of Science, proposes, as special subjects for discussion at the approaching meeting of the Association, to be held at Pau, the flora of the Alps and of the Pyrenees, and a comparison between them; and the best means of arranging and preserving botanical collections.

PROF. T. H. HUXLEY has been elected President, and Sir Henry Roscoe and the Master of University College, Oxford, two of the Vice-Presidents, of the Association for Promoting a Teaching University for London. Motions on the whole favourable to the plans of the Association have been carried by the Senate of the University of London and the Council of University College.

PROF. RAMSAY, in his report as Dean of the Faculty of Science in University College, London, has to record many changes during the past session. Reference is, of course, made to the retirement of Prof. Croom Robertson from the Chair of Philosophy, and to the appointment of Dr. James Sully as his successor. Prof. Ramsay's predecessor as Dean, Prof. Lankester, expressed to him his regret that he had not taken steps to ascertain the number of original investigations carried