Experiments show that the progressive acceleration of the rhythm brings about the modifications represented in the following table. The acceleration of rhythm from sixty to eighty steps per minute has

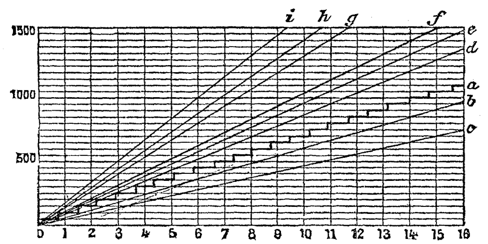

FIG. 4.

increased the length of the step, and decreased the time required to travel a certain distance; but, when we go above this, the opposite effect is produced. It is better to replace the numerical table by the diagram of fig. 5, which represents the variations in

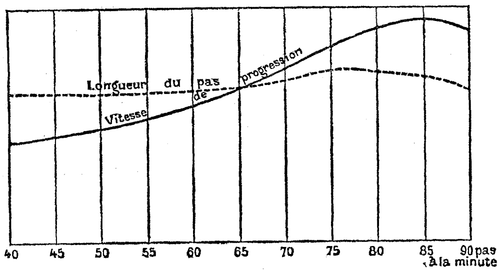

FIG. 5.

quickness of gait, and length of steps, as guided by the electric bell ringing at different rates.

Time of travelling over 1,542 metres.	Number of double steps to the minute.	Length of double steps.
20′ 30″	60	1.35 m.
18′ 40″	65	1.37 m.
16′ 27″	70	1.45 m.
14′ 58″	75	1.51 m.
13′ 52″	80	1.50 m.
13′ 3″	85	1.49 m.
14′ 1″	90	1.32 m.

NAVAL ARCHITECTURE IN ENGLAND.

FRANCIS ELGAR, professor of naval architecture at the University of Glasgow, devoted his inaugural address, on entering upon his duties in November, 1884, to a history of the science.

Until within comparatively few years but little attention has been paid to the study of naval architecture. Fifty years ago ninety-nine per cent of the British merchant-ships were under five hundred tons, and few measured more than a hundred and thirty feet. They were comparatively uniform; and, being built after an established plan, they were perfectly seaworthy when properly ballasted. In the case of war-ships the matter was more difficult; as it was necessary to get a type of ship which should be large, high out of water, and able to carry many large guns, without interfering with her sailing-qualities, or rendering her top-heavy.

In 1811 a school of naval architecture was started in England, and during twenty years it trained forty students. This was followed in 1848 by another at Portsmouth, and in 1864 by a third at South Kensington, which is now united with the Royal naval college at Greenwich. Some excellent designers have been graduated from these three schools.

Before the use of iron, ship-building required no elaborate calculations: it was simply a highly developed mechanical art. Ships were built of great relative depths in proportion to their breadth, and initial stability was deliberately sacrificed to reduce the tonnage measurement. Usually these ships would not stand up, when fully rigged and light, without ballast; and, judging from the proportions given to them, they must also have required ballast when laden with cargoes which were not composed of heavy dead-weight. What is now required of the ship-builder is to predict with great accuracy the weights of complicated iron and steel structures, with all their fittings and machinery; the weight of cargo that such structures will carry at sea; the stability they will possess in different conditions of loading, and the treatment necessary to insure a safe amount of stability being preserved upon all occasions; the amount of steam-power and the rate of coal-consumption required to maintain given speeds at sea; and very frequently the strength that is possessed by the hull to resist the straining-action of waves.

The reason that the English schools for this study have not been better attended, is that the courses are too technical in character, and the requirements too rigid, to attract any except advanced students. The idea of the newly established chair of naval architecture in the University of Glasgow is to teach in a less technical manner the new science, and to adapt the course to the requirements of the students. The policy will be first to fix what they already know, and then to go forward to a complete study. Special stress is to be laid upon long-continued and arduous practical training, combined with true science. The only way in which superiority in ship-building can be attained is by possessing a class of ship-builders who have gone through just such a training, and who by long study and work have acquired these theoretical and practical principles.

RECENT BRITISH LOCOMOTIVES.

ENGINES recently designed for the London, Brighton, and south-coast railway of Great Britain by Mr. Stroudley, were described by their designer at a recent meeting of the British institution of civil engineers. They were designed for freight-traffic, or as