Slangs	Irons	1790 (*slanged* = ironed); 1811; 1859 (*slanged;* also *slang* = watch-chain); 1873 (only a watch-chain).
Smish	A shirt	1573 (*mish* or *commission*); 1790 (*mish* or *smeesh*); 1811 (same as 1785); 1859 (*mish*); 1873 (both *mish* and *smish*).
Snuskin	A nail	[*Snuskin* = a delicate morceau. Halliwell.]
Spotted, you're	You are like to be found out,	1859 (*spot* = point out as suspected); 1873 (marked by the police). [Mentioned as 'recent' in Bartlett's 'Americanisms.']
Spread	A saddle.	
Star a glaze, to	To cut out a pane	1811; 1859; 1873.
Suck	Rum [liquor]	1785; 1790; 1811; 1859; 1873 (only *suck-casa* = a public-house).
Tapster	A dog	[Probably a mere variation of *Yapster*.]
Thumpkin	A barn of hay	[*Thumpkin* = a clown. Halliwell.]
Topt	Hanged	1673, 1785 (*topping cove* = the hangman); 1790; 1811; 1859; 1873.
Tonch, to	To rob	1785; 1790; 1811; 1859.
Trick	A watch	1859 (*trick* = any thing stolen by a pickpocket).
Undub, to	To unlock	1859 (*under-dubber* = turnkey).
Water-sneak	Breaking into a vessel	1785 (*waterpad* = robber of ships); 1790 (same).
Wheel	A dollar.	
Wibble	An anger	1785 (*wibble* = bad drink); 1811 (same); 1859 (same). [*Wimble* = an auger. Dryden.]
Yapster	A dog	[*Yap* = a cur. Halliwell.]

[When a date alone is given in the above table, the dictionary of that date gives both word and definition as Tufts gives them.]

It will be observed that a certain number of Tufts's words are not to be found in any of the books of English slang; while, from the correctness of the remainder, it is unlikely that he invented even these. The words *bonny lay* (robbery), *briar* (a saw), *drag* (a prisoner, i.e., one dragged?), *flamer* (vitriol), *gentleman* (a crowbar), *hammers to you* (implying comprehension), *hookses* (cattle), *jarvel* (a jacket), *kin* (a stone), *nipping-jig* (gallows), *roram* (the sun), *to scrag a lay* (to steal from a hedge), *snuskin* (a nail), *spread* (a saddle), *tapster* and *yapster* (a dog), *thumpkin* (a barn of hay), and *wheel* (a dollar), — these are not found in the other lists, and some of them are difficult to explain. Other phrases, though not elsewhere mentioned, are easy of derivation; as *crabkin* (crabken?), *dead up to* (like dead sure), *dinge* (dingy), *leg-bags* (stockings), *long togs* (long-clothes), *mitre* (hat), and *pradholder* (bridle). In a few cases the phrase is preserved by Matsell (1859) as a part of American slang, although not now to be found in the English slang dictionaries; thus, *trick*, in the sense of something stolen, and *undub* (unlock), which apparently survives here in the phrase *under-dubber* (turnkey). In regard to any word untraced, I should be glad of suggestions.

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WALKING AND RUNNING.[1]

Although every one pretends to know how to walk and run, still there are few who do not make useless effort; and the few good runners or walkers are not necessarily those with great muscular force, or power to withstand fatigue, or those who have merely a special aptitude in this direction, but rather the persons who by training have found, little by little, the best possible means of using their natural powers. They are incapable of transmitting the secret of their ability, and, indeed, they hardly have time to reflect upon the movements which they execute so mechanically. It is hoped that by means of the camera this secret can be found.

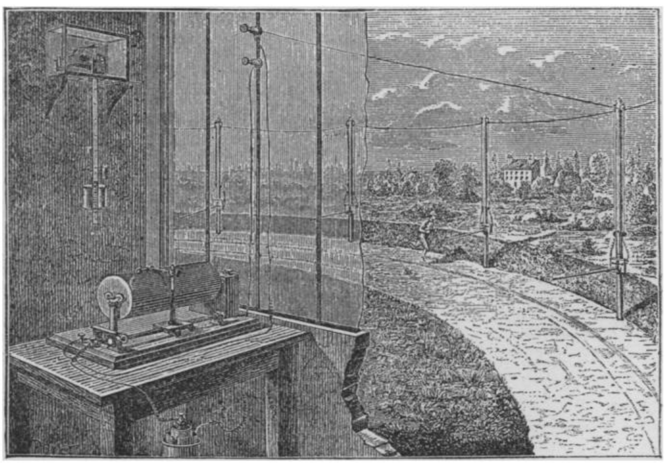

Fig. 1.

Experiments have been undertaken at the physiological station in Paris to study these movements. In fig. 1 a man is seen running upon the experiment-track, and in the same figure the recording apparatus is shown. A telegraph-line, resting upon poles placed fifty metres apart, reaches around the track, which is half a kilometre in circumference. The runner, as he passes each post, finds his course barred by a horizontal rod (fig. 2), which gives way before the slightest pressure, but which cannot be moved without causing an interruption in the circuit of the telegraph-line. This interruption records itself in the laboratory

[1] Abridged from *La Nature*.

by displacing a crayon, which traces upon a turning cylinder covered with a sheet of paper.

The mechanism of the electric interrupter is very simple, as shown in fig. 3. The rod which bars the

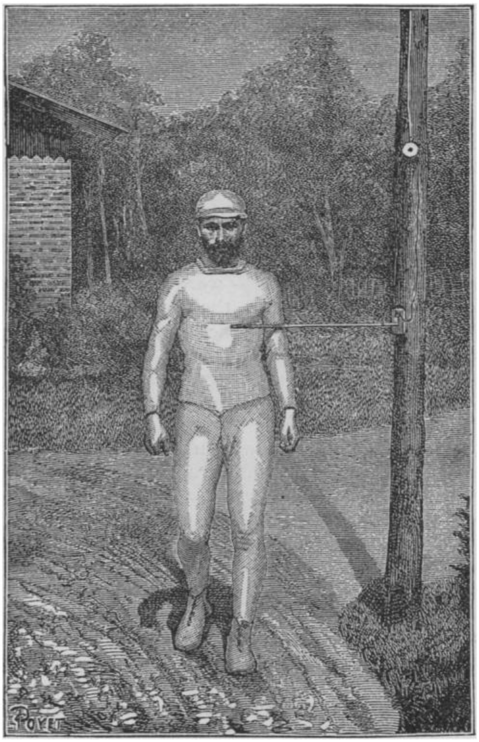

FIG. 2.

track is so arranged that it slides up an inclined plane every time it is displaced, and in so doing presses upon a spring, which, displacing a button of metal, breaks the circuit. The rod immediately returns to its original position, and the interrupted current re-establishes itself. At each breaking of the current, the wheel-work of the recording apparatus, freed for a moment, moves, and makes the crayon advance on the paper. The paper-covered cylinder turns uniformly, the rate of rotation being such as to cause the paper to pass in front of the crayon at the rate of half a centimetre per minute. On the other hand, the crayon is allowed to move only when the current is interrupted. The crayon progresses at each rupture of the current only a constant distance.

After a person has travelled around the track, the paper bears a sinuous line similar to that in (*a*), fig. 4. In the diagram the time is scored horizontally, the minute spaces equalling half a centimetre. The interruptions score themselves vertically, each upward step showing that the pedestrian has gone fifty metres: hence the course (*a*) corresponds to a march of twelve hundred metres in fifteen minutes, thirty-five seconds. In drawing a line connecting the angles of the sinuous line, we have a simpler expression of the march, as seen in the lines *b*, *c*, *d*, etc., which, by their greater or less inclination, show that the gait has been more or less rapid. The line (*i*), for instance, corresponds to a run of sixteen hundred metres in nine minutes and a half, while (*c*) corresponds to a march of seven hundred and fifty metres in sixteen minutes.

By gathering outlines from hours of marching, we have much more interesting records, in which the effects of fatigue are plainly seen, all irregularities in speed being faithfully recorded by the rise or fall of the line.

The shape of the boot has considerable effect upon the quickness of the march. In order to determine the best form of marching-boots, buskins have been made with heels which can be regulated, by removing plates, so as to be of any height from half a centimetre to six centimetres. From the experiments it is seen that the quickness of the step increases in proportion to decrease in height of heel. This result tends to an increase in the length of the step, and it is also noticed that the step increases in length and quickness when the length of the sole considerably exceeds that of the foot. Beyond a certain limit, however, the precise determination of which can only be made after many experiments, the length of the sole causes a noticeable fatigue.

The rhythm of the drum or clarion guiding the steps of soldiers has marked effect upon their speed. This problem is very complex. The acceleration of the rhythm may increase the speed to the rate of eighty steps per minute; but beyond this the increased frequency of the steps causes a slackening in the rate of march. In order to experiment upon this, an electric bell, placed in the centre of the track, is rung by a pendulum, represented above and to the left in fig. 1. The rate of ringing can be regulated, and the walker finds it impossible to keep out of step with the strokes of the bell. Starting the bell so as to cause the man to take forty steps per minute, then gradually making it more rapid, it is seen that the

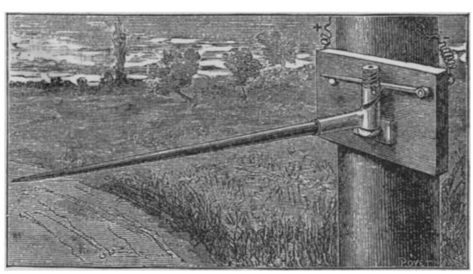

FIG. 3.

time taken to run a kilometre varies greatly. The length of the steps is simply deducted from the number of oscillations of the pendulum during a tour of the track, which represents a well-known course.

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

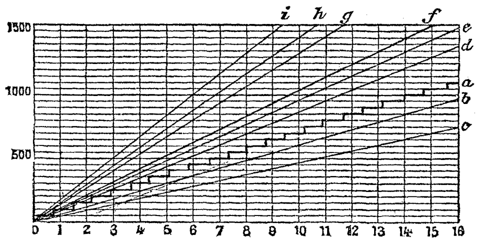

Fig. 4.

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

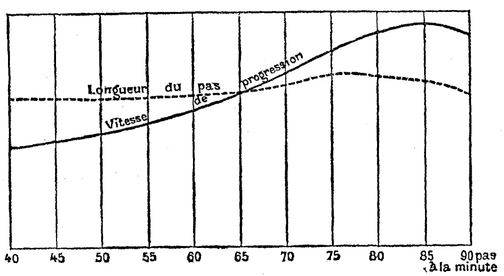

Fig. 5.

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