the sale amount to. The agent of the Delaware & Hudson Canal Company counts up the various expenses of handling, mining, commissions, etc., and claims that a tun of coal costs at tide water $4.15, while the average at the sale was but $2.42. In the coal regions, the operators say that either tolls and labor must be greatly reduced or they must suspend operations. Miners' strikes are feared, and altogether the prospects are gloomy for both laborers and owners.

THE SCIENCE OF MECHANICAL MOVEMENTS.

There are numerous treatises devoted to descriptions of great inventions and discoveries, and discussions of the processes of reasoning by which they were worked out. It has long, too, been recognized that there is such a thing as scientific invention, in which the mechanic, having definitely determined the result which he wishes to attain, proceeds to achieve it by a series of systematic steps. It is true that the genius for making discoveries, with which some men are endowed, gives them a great advantage over their fellows; but it is equally true that genius, properly directed, is far more certain of success than if it acts without a guide. This is sufficient to account for the great interest which has been taken in the matter by professional writers, and the number of treatises relating to it that have been published. Few of these works, however, go farther than to show the nature of inventions that have already been perfected, and to give discussions of the motions that are produced. It is a great advance when a writer offers to the public a method which is capable, not only of analyzing all existing mechanical movements, but also of furnishing the outlines of any movement that may be desired. This is the claim made by Professor Reuleaux in his "*Theoretische Kinematik*," a work which has excited great interest in Germany, and has recently been translated into English. Professor Reuleaux' method of analysis possesses the merit of great novelty, and a description of its nature may be received with favor by readers of an inventive turn of mind.

The reader who is familiar with analysis knows that the discussion of an equation is a very thorough method of determining all the conditions and variations of a given question. The well known problem of the lights, which is to be found in most elementary treatises in algebra, is a good example of this kind; and still better illustrations will occur to the reader in the discussions of some of the equations deduced in what is commonly known as analytical, but more correctly as general, geometry. A somewhat similar plan is adopted by Professor Reuleaux in his *Kinematik*. All ideas of force and time are disregarded in the consideration of a mechanism, and he merely concerns himself with the motions that are produced. The geometrical methods of determining changes of position are explained; and the nature of simple mechanisms and the manner of compounding them are fully illustrated. This part of the work may be compared with the introduction to the study of algebra, in which the idea of generalization is first presented to the student. Then the notation by which mechanisms are to be represented is introduced. The system adopted, which is entirely novel, cannot be properly explained in a limited space, but some of its characteristics may be noted. The different elements of a machine, such as screws, prisms, cylinders, cones, etc., are indicated by appropriate letters, accented in such a manner as to show whether they are hollow or solid. Letters connected by a dotted line indicate that the two elements are joined by a link, a comma shows connection by contact, an underscoring of a dotted line stands for a fixed link, an elastic link or spring is marked by a wavy line over the dotted one, etc. The notation is by no means complex, and can be mastered in a short time by any one who is accustomed to the use of algebraic symbols. It will be a surprise to many to find that the elementary parts of mechanism are comparatively so few in number. The use of the notation having been illustrated by numerous examples, properly graded, the author proceeds to the final analysis of mechanisms, or discussion of the expressions given by the notation. This is, of course, the object of the whole work, to which all that has preceded has been only preparatory. The reader who has followed the description so far cannot fail to see that the method seems to show the possibility of a thorough analysis of any mechanism that can be included in the notation. Those who feel an interest in rotary engines (and few engineers have not designed at least one of these machines) will find that this class of machines has been pretty thoroughly analyzed by Professor Reuleaux. The work is by no means exhaustive in every field of mechanical movements, but is rather intended to furnish the investigator an instrument which he can use in his own explorations. Even those who do not care to study the work thoroughly can scarcely fail to gain some useful ideas from turning over the pages and inspecting the sketches of the various movements shown.

SOME NEW LIGHT ON THE ORIGIN OF THE TRUFFLE.

The truffle is a species of underground fungus largely used in French cookery to give a peculiar rich flavor to meats. It comes principally from France, where it is always found in oak or beech woods, and can only be gathered through the agency of the keen scent of dogs or pigs especially trained to hunt for it. Both from the difficulty of obtaining the fungus, and from the fact that it is a delicacy highly prized by epicures, it brings in all markets a large price; and thus truffle hunting has long been a remunerative calling for the French and Italian peasantry. In appearance, the truffle is a blackish mass, covered with protuberances and weighing from an ounce to several pounds; when cut open it presents a marbled appearance, and its reproductive portion (it is sexless) is found in the veins in the shape of minute sacs which never open, each containing several spores, possessing spine-covered or honeycombed surfaces.

Numerous attempts have been made to cultivate these fungi, but with little or no success. Regarding their early development, comparatively nothing has been known, and the spawn or vegetative portion, which, in the case of the mushroom, is readily obtained, allowing the cultivation of that fungus to any degree, has not yet been definitely found in the truffle. Sprinkling the earth with water, in which the parings of truffles have been steeped, has resulted, it is stated, in producing them; and they have likewise been obtained by the slow process of planting calcareous soil with acorns and waiting for the saplings to reach a few years' growth, when the truffles could be gathered among the roots. Still no practical method of cultivating the truffle is in existence; and since they are found completely isolated from anything which could produce them, we are left in the dark as to how they are originated, or at best with merely the supposition that, at an early period of their development, they are parasites of the tree roots, or the theory that, like oak galls, they are due to the stings of insects. This last conjecture, however, arising from the fact that truffles are attacked by dipterous insects, like other nitrogenous cryptogams, has been refuted by the entomologists.

A very curious and recent experiment by M. Brefeld throws some new light on the subject, and may lead to the long sought method of cultivation. The *penicillium glaucum* is the well known green mold which appears on bread and cheese, and which owes its name to the fact that, in free air, it consists of chaplets of spores, in brush form, connected to a stem or pedicle. The mode of reproduction of this mold depends on the medium in which it exists. Now, by placing the *penicillium* in a closed vessel with very little air, M. Brefeld has obtained nodules which, after being buried in moist sand, fructify with internal *asci* which do not open. That is to say, they are produced in a manner analogous to truffles. The *asci*, we may explain here, are the little sacs in which the spores are contained, and are found in many complex forms of fungi, which build up a special organ called the *peridium* to hold these sacs.

It will be seen from M. Brefeld's discovery that he has noted two forms of green mold, one aerial, or *penicillium*, the other existing when partially deprived of air, or tuberaceous. The truffle through its subterranean location is always in confined air, present besides in limited quantities, and in that state is sexless. Now it remains to find its aerial form, to discover the peculiar *penicillium*, which placed under the conditions noted will produce, for its nodule, a truffle.

IS BROTHER JONATHAN SO VERY SLIM?

In our examination of the newly published medical statistics of the Provost Marshal General's Bureau of the late war, with regard to the relative hight of American men, we had the pleasure of showing, the other day, that the native born among our citizens and soldiers stood first in point of stature; while in every instance the foreign born exceeded the stature accorded them in the statistics of the nations they represented. We not only raise the tallest men, but draw from foreign countries, by emigration, men of more than average stature.

The artists are therefore quite right in always depicting the typical American, Brother Jonathan, as very tall. But they also make him very slim; and theorizing travelers have never hesitated to give a reason for his being long-legged and lank. One blames the climate; another, tobacco; another, bad cookery; another, his excessive "push" and eagerness in business; while the extra scientific Buchner was sure that the continent was altogether unfavorable to the European type of man, and would allow us no alternative but extermination or a speedy approximation to the Indian type. But is the average American really so slab-sided and lean?

Let us see what answer our statistics give. How do we compare with other nations in girth and weight? As statistics of mean weight have but little value apart from measurements of hight and girth, and age, we will first examine the records with regard to the degree of maturity of the several racial elements of our armies.

From the statistics gathered by the Sanitary Commission, Gould found the mean age of 1,012,273 men of all nativities, mostly volunteers, to be 25 years and 10 months. As a careful analysis of statistics of physical development shows that American born white men do not attain their full growth until between thirty and thirty-five years of age, it is obvious that the results obtained from these statistics will under rather than over rate the average dimensions of American men. It will be seen, too, from the following table of men enlisted toward the close of the war, when the average age of recruits was highest, that, with the exception of a small number of Canadian recruits, the native born element of the army was the youngest.

Nativity.	Number.	Mean Age.
United States	196,980	26·955 years.
British Possessions	14,954	25·352 "
England	10,103	27·855 "
Ireland	30,412	27·216 "
Germany	30,943	31·029 "

Unfortunately the instructions to enrolling surgeons did not direct them to record the weight of the men examined. Only the more energetic officers took the trouble to make their work complete in this respect; consequently the statistics on this point are less full than could have been desired. Still an idea of the relative bulk of the men of the five principal nativities may be had from the following tables, showing the relation of hight, girth of chest, an expansion of chest to increasing weight in over 10,000 men of all ages from 18 to 45 years. The men, when weighed and measured, were invariably naked.

WHITE NATIVES OF THE UNITED STATES.

Weight.	Number of men.	Mean hight. inches.	Mean girth of chest at expiration.	Mean expansion of chest.
Under 100 pounds	14	64·000	29·714	3·071
100 and under 120	991	65·191	30·468	3·146
120 and under 140	2,968	66·856	31·997	3·238
140 and under 160	1,894	68·424	33·642	3·289
169 and under 180	427	69·920	34·988	3·289
180 and over	65	70·215	36·554	3·269
Total and mean of total.	6,359	67·297	32·491	3·242

BRITISH AMERICANS.

Under 100 pounds	2	64·000	30·000	3·500
100 and under 120	38	64·211	30·737	3·184
120 and under 140	304	66·546	32·020	3·247
140 and under 160	198	67·848	33·606	3·298
160 and under 180	41	69·512	34·439	3·402
180 and over	6	69·333	35·333	3·333
Total and mean of total.	589	67·059	32·666	3·272

ENGLISHMEN.

Under 100 pounds	0	——	——	——
100 and under 120	56	64·067	30·893	3·107
120 and under 140	243	65·835	32·453	3·154
140 and under 150	128	67·625	33·609	3·242
160 and under 180	25	68·480	34·960	3·380
180 and over	2	69·000	38·000	3·500
Total and mean of total.	454	66·348	32·749	3·187

IRISHMEN.

Under 100 pounds	3	62·667	30·667	2·167
100 and under 120	158	64·532	31·519	3·215
120 and under 140	724	66·119	32·715	3·181
140 and under 160	450	67·609	33·916	3·233
160 and under 180	74	69·270	35·357	3·338
180 and over	8	69·000	36·750	3·250
Total and mean of total.	1,417	66·589	33·119	3·208

GERMANS.

Under 100 pounds	3	63·333	30·000	2·833
100 and under 120	168	64·167	31·357	3·262
120 and under 140	675	65·532	32·601	3·226
140 and under 160	389	66·905	33·969	3·231
160 and under 180	104	68·346	35·192	3·221
180 and over	4	69·000	36·000	3·500
Total and mean of total.	1,343	65·985	33·047	3·231

Taking into account the relative youth of the American element of our armies, and the probable inferior age of the Americans furnishing the foregoing measurements, their slight inferiority in girth of chest is not at all remarkable. It certainly does not indicate any excessive lankness in the natives of this country.

Dr. Baxter has compiled a table exhibiting the mean results of a great number of sets of observations by various authorities. Most of them are too fragmentary to be of use in this enquiry; but such as are complete as regards age, hight, girth, and weight, we have brought together in the following table: Though not sufficiently complete to warrant any sweeping generalization in regard to Brother Jonathan's physical qualities, it carries evidence enough at least to satisfy one that the typical American is a fair specimen of humanity, in bulk and weight, as well as in stature.

Nativity.	Mean age. Years.	Mean hight. Inches.	Mean cir. chest. Inch	Mean weight. Pounds.	Authority, etc.
United States	24·01	67·36	——	148·29	Coolidge: 1,537 recruits.
	23·94	67·05	34·99	147·50	Elliott: 1,700 army of Potomac.
	25·62	67·34	34·43	144·83	Gould: 8,349 volunteers.
	——	67·22	35·69	142·80	" 12,757 "
	26·39	67·30	32·49	136·05	P. M. G.'s Bureau: 6,359 recruits.
British America	24·94	67·06	32·67	138·69	" " 589 "
England	24·31	——	——	148·41	Coolidge: 3,439 U. S. soldiers.
	24·00	65·94	——	138·46	Dawson: 1,500 civilians.
	27·36	66·35	32·75	135·64	P. M. G.'s B.: 454 recruits,
Scotland	28 to 45	67·72	——	148·69	Beddoe: 1,982 civilians and soldiers,
	25·00	68·30	——	144·03	Forbes: students.
	18 to 45	67·07	33·84	——	P. M. G.'s B.: 3,476 recruits.
Ireland	26·80	66·59	33·12	136·46	" " 1,417 "
	23 to 45	——	——	137·98	Beddoe: 1,616, nearly all soldiers.
France	30·50	64·84	34·61	143·20	Bernard: 400 infantry of guard.
	30·—	66·10	35·43	141·10	Allaire: 730 cavalry "
Germany	30·10	65·98	33·05	136·48	P. M. G.'s B.: 1,343 recruits.

It will be seen that the average American compares very favorably with the best specimens of the race, the English and the Scotch, as regards bulk and weight. The most extensive series of observations on this head ever made in Great Britain are those of Dr. Beddoe, who collected measurements of over 17,000 civilians and soldiers, between twenty-three and fifty years of age. From these he calculates the mean hight of Englishmen to be 5 feet $6\frac{6}{10}$ inches, and that of Scotchmen 5 feet $7\frac{1}{2}$ inches. From the careful measurement of one half a million men, little and big, sick and well, by the Provost Marshal General's medical staff, it appears that the average hight of the men of eight of our Northern States exceeds 5 feet 8 inches. In sixteen States, the average exceeds that of the Scotch; and in one State only (Connecticut) does it fall so low as that of the average Englishman.

In the matter of bulk, the comparison, as we have seen, is not less favorable to Brother Jonathan. He is as heavy as the heaviest even in his youth: and the apparent slimness of his immaturity, due to his superior hight, is fairly made up for by the time he reaches his full development.

ARTIFICIAL TEETH.—Mr. Merrick Bemis, of New Haven, Conn., desires us to state, that his patent (which we quoted on page 106, volume XXXV, and which states that the plates are intended to fit over natural teeth, and in which the teeth are described as all molars) covers the application of the invention to all teeth.

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