every year from each plant, and about twelve tons of leaves can be cut from each acre of cultivation. It is stated, however, that if more scientific methods of cultivation were practised, the yield per plant per acre could easily be doubled. There are already over four hundred mills in operation devoted to the treatment of this flax; the exports from the country averaging over $4,000,000 per annum; and although the product is stronger and more durable than that usually employed, and is in great demand for certain classes of goods, once the degumming problem is satisfactorily surmounted, permitting the flax to be bleached readily and easily, it will constitute a formidable rival to the European and Asiatic fiber, more especially in view of the fact that it is considerably cheaper and stronger than the latter varieties. The government anticipates that by the announcement of the above award greater attention will be attracted to the problem, and a cheap and efficient process for production evolved.

A COLLEGE OF INVENTION.

BY GEORGE FREDERICK STRATTON.

Generally speaking, inventors do not make a business of inventing, but very frequently chance upon ideas which are entirely unconnected with their usual occupations, and which they seize and develop into more or less practical results. What the mental processes are that so frequently turn men from the matters with which they come daily face to face, impelling them to consider entirely foreign problems, is hardly explainable. Fulton, of steamboat fame, was a portrait painter; Morse, the inventor of the telegraph system, was an artist; Whitney, of the cotton gin, was a law student; Arkwright, who invented the spinning jenny, was a barber. Of the group who developed the steam engine, Watt was a mathematical instrument maker, Newcomen a blacksmith, and Smeaton a civil engineer. The list showing similar incongruities could be extended until it embraced a very great majority of all the inventors to whom patents have been granted. But a change has come in the methods by which patentable ideas are taken up and developed. Inventing has grown into a systematized business in which hundreds of men are now actively and steadily engaged; a very large proportion of them under salary from the great industrial corporations.

Highly-trained scientists are rarely inventors. They are rather investigators and discoverers, going deeply into causes and effects; searching for new elements and elemental forces, and determining with mathematical accuracy the scope and extent of such forces. Long before Stephenson the theories of steam—of heat, combustion, and condensation—were ably discussed and philosophically explained, but it remained for the mine laborer to put those theories to practical application in the locomotive.

It must by no means be inferred that the work of eminent scientists and philosophers is lightly thought of. To their great discoveries is due the opportunity of the inventor who follows them, and who, taking advantage of the things they have discovered, devises the means of applying them to practical uses. In short, the great intellects trained to analytical deduction and mathematical exactness concern themselves with theories, principles, research and conditions, leaving the practical results by means of mechanical devices to men less gifted in the qualities they possess, but usually far more greatly endowed with ingenuity and commercial enterprise.

It is the latter class of men for whom industrial managers are eagerly looking, and although inventors are always plentiful, as shown by the records of the Patent Office, they seem to be but seldom available for salaried positions. A firm engaged in the manufacture of textile machinery, and desirous of securing two or three men of mechanical ingenuity, searched the patent records of the preceding year, from which twenty inventors were selected. The list was not confined to improvers of appliances for manufacturing wool and silk, but included those whose patents showed unusual ingenuity in the invention of intricately delicate mechanical devices in any line of industry. Although out of the entire number only one had pushed his invention to a commercial success, from the others the firm succeeded in engaging but one man. The rest were in occupations which they could not be induced to leave. Some were in the professions; the others were small business men, clerks, or mechanics. It was found that although most of them would have been very willing to accept a salary, they were by no means confident of continued ability. Each had invented some remarkably ingenious article, sometimes several, but the idea of engaging in inventing as a permanent occupation—of feeling compelled to focus their ability or genius upon some one definite problem—was so new that it was staggering.

The manager of a great company, which has on its engineering staff nearly one hundred men who might be termed inventors, was recently asked: "Where do you obtain such men?" He replied: "It is not easy to answer. The chief men—the engineers—usually come from the colleges, as do also some of the assistants. But the bulk, upon whom we depend for all the little improvements and changes which are constantly required, come from all over. Some are mechanics; there is a doctor, a tailor, a conductor, and an agent. Most of these were secured when they came with inventions of their own, made when following regular occupations. Usually they turn out well. But we can't always hold them long, and there is trouble to replace them. I wish there was a training school for inventors!"

And why not?

In every other line of endeavor there are organized methods of education and training. For art, literature, law, medicine, and religion we have the great universities and colleges. For technical professions we have technical schools. We have manual training schools and apprentice systems for mechanics. But nowhere is there provision for training, guiding, and developing the very peculiar line of genius known as invention.

To many it may appear that educational opportunity for such men is already afforded by the institutions above noted; but all of them fall far short of the actual requirements for the best and most lucid development of practical inventive ability. Whatever the future holds for the business of inventing, it is to the past we must now look for guidance in determining the men to be helped and the methods of helping them. And that past shows, undeniably, that the most notable and ingenious inventors have not been men to whom abstruse and mathematical studies are familiar.

If we eliminate the universities and technical colleges from consideration as the best training fields for inventive natures, there remain the manual training schools and apprentice systems. And again what do we find? That the inventors of the past and the inventors of to-day have very seldom given their inventive attention to matters actually connected with their regular trade or occupation.

Many peculiarities are found continually in the study of inventors and inventions, and if they show anything, they show indisputably that the inventor is a free lance. The selective system of study or training in colleges, technical schools, and trades is not for the true inventor. Given a young man who has shown undoubted mechanical ingenuity, and keeping the past in mind, his training, commencing after his graduation from grammar school, should consist of the largest scope and opportunity for observing what has been done by others, rather than confinement to routine study. Mechanical drawing he should learn, but only sufficient to enable him to put his own ideas clearly upon paper and to read other drawings. If he is to become a professional inventor, he will not want to waste his time competing with skilled draftsmen. Models and drawings, and lectures thereupon, of every known description of mechanical movements should be provided, and every opportunity given for long and secluded study of the same. The drilling on this branch could not be too comprehensive or thorough. The calculation of the strength of beams and trusses, of the friction of the flow of liquids in pipes, would be wasted time. They are problems for the man of fixed theories and mathematical exactness—not for the imaginative inventor. A comprehensive study of patent laws and their application, and a familiarity with the method of searching for conflicting inventions, would be highly desirable. Lectures should be given upon the commercial view of inventing, so that the young man may gain some insight into the methods of estimating the values of the problems he may be tempted to fix his mind upon. These lectures should also bear upon the formation and practice of stock companies and the adjustment and payment of royalties. The great purpose should be to impress upon the student the wisdom of always putting his efforts upon things which will pay; for in mechanical appliances it is really only those things which pay that are of real benefit. Easy access to manufactories of the greatest possible diversity would be one of the most essential requirements. Such practical demonstrations of machines and tools should be considered a part of the college course, and be made one of the greatest sources of information.

Ample time and opportunity should be afforded for comprehensive study of trade magazines in every line of industry, for it is here more than in any other literature that the requirements of industry are revealed. Specializing of study would seem, in the light of the past, to be wasted time. You may keep a man's attention centered for months or even years on steam-engine construction, and if he is a true inventor he is likely, at any moment, to switch off to a labor-saving device in the shoe-making industry. His education and training should be confined to whatever will enable him to see and appreciate clearly difficulties in any existing apparatus in any line of manufacture, and should give him the confidence and patience to tackle that difficulty and eliminate it. Mechanical deftness is not an absolute necessity, although every opportunity should be afforded to qualify men in the use of tools and the making of their own models.

But above all, the greatest utility of a college of invention would be in its repression of the feverish impulse most inventors have to solve each and every problem presenting itself, merely for the sake of solving it; and in its guidance toward commercial success.

SCIENCE NOTES.

Mr. C. W. Whymper has just brought to notice a curious point with regard to the position of the ear in the woodcock. The snipe, it may be remembered, are remarkable for the fact that the external ear is placed *under*, instead of *behind*, the eye, as in other birds; but in the woodcock it is placed in *front* of the eye, and more so on one side of the head than on the other. This asymmetry, furthermore, extends to the shape of the aperture, which is slightly different on the two sides of the head.

A method of preserving meat has been brought out in France by H. De Lapparent which seems to have met with considerable success. It can be also applied on a small scale for household purposes. The principle consists in exposing the meat to sulphurous acid fumes. By burning a small amount of sulphur in a receptacle containing the meat hung up in place, it can be preserved for several days, even in summer. There is no taste left from the sulphur fumes and there seems to be no danger to health. Such a method can be used also on a large scale for preserving meat for army use, as it is quite simple and easy to apply in practice. From experiments made on a large scale it appears that the meat fumigated with sulphur did not contain more than 22 grammes (340 grains) of sulphurous acid gas per 100 kilogrammes (220 pounds) of meat, which is on the order of ten thousandths. The meat should be fumigated as soon as possible after killing and preferably on parts which have no cut bones. Lean meat is found to keep best. To preserve it for several months, meat can be inclosed in vessels full of carbonic acid gas. It has the appearance of fresh meat and its taste is not changed after cooking. In England, Mr. Lascelles Scott proposed a method which consists in immersing the meat in a solution of bisulphite of lime.

The possibilities of certain grasses being utilized for the purpose of fertilizing, and thereby reclaiming for cultivation, waste stretches such as sand dunes, has been strikingly demonstrated upon King Island, which is situated between the coasts of Tasmania and the Australian mainland. This island has always been an arid waste of sand and other non-arable soil. Some few years ago however a vessel was wrecked off the island, and when broken up under the force of the waves a number of the sailors' mattresses, which were stuffed with the yellow-flowered clover, a kind of grass, were washed ashore. A certain quantity of seed was contained among the stuffing, and in due course these took root, and owing to their prolific growth, in the space of a few years covered the sandy stretches with rich verdure. It is a long-established fact that clover and other leguminous plants have the peculiar capacity of fertilizing a waste soil, owing principally to the action of bacteria, thereby enabling the plants to draw nitrogen directly from the atmosphere. In the case of King Island, owing to the properties of this yellow-flowered clover, what was previously a waste stretch of sand is now one of the richest grazing districts in the Australian continent. The growth of the plant completely changes the character and color of the soil from a dirty white to a rich dark brown or black loamy nature.

THE CURRENT SUPPLEMENT.

From time to time during the past two or three years there have been references to Maguay fiber in the public press, and now small quantities are finding a market in this country. Charles Richards Dodge, in the current Supplement, No. 1650, presents a careful *résumé* of his investigation of the varieties of the Maguay fibers, and accompanies his text with many interesting illustrations. A torpedo guided by aerial electrical waves is described. Augustus B. Tripp gives an account of a wireless telegraph apparatus for lecture purposes. There are but few problems in the design of ships, as in most branches of engineering, that can be exactly or completely solved, in the full scientific meaning of the word, and those are of a secondary character. These important problems are considered by Francis Elgar in an excellent paper entitled "Unsolved Problems in the Design and Propulsion of Ships." Lieut. Schackleton's expedition to the Antarctic is described and his equipment illustrated. "The Seed, a Chapter in Evolution," is the title of a paper by Prof. F. W. Oliver which may be considered a trustworthy review of recent knowledge. The paper is concluded from the last Supplement. James Asher presents some rough and ready methods of estimating heights and distances. Clocks, Ancient and Modern, are described by W. S. Eichelberger.