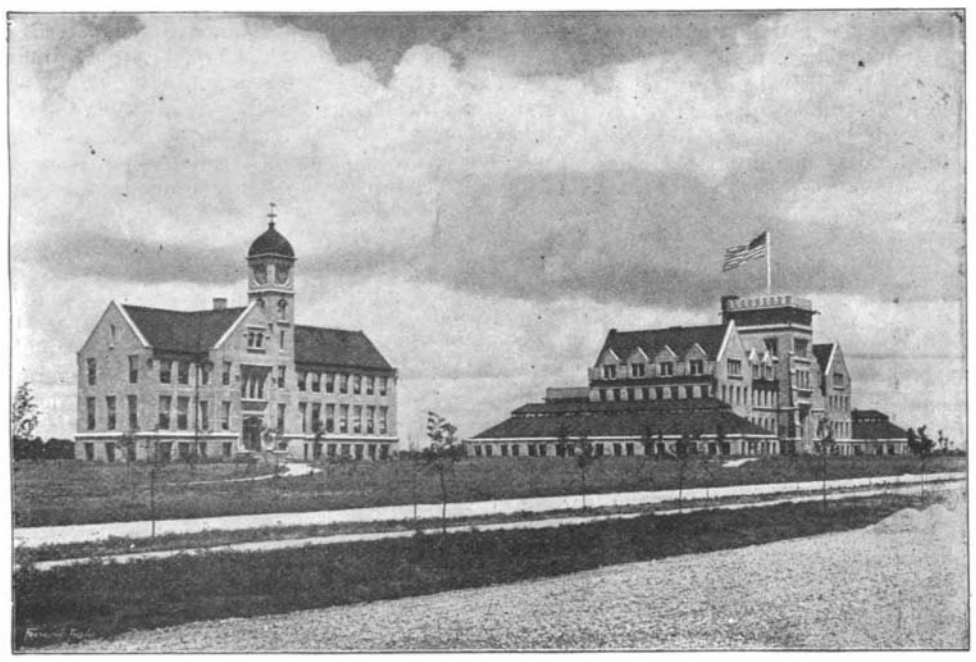
THE BRADLEY POLYTECHNIC INSTITUTE AND SCHOOL OF HOROLOGY.

Polytechnic institutes are by no means uncommon in these latter days of the nineteenth century, and have made a decided impress upon the youth of the last two generations. The Bradley Institute, however, located in Peoria, Illinois, presents at least one unique feature, in that it has a department devoted to horology, one entire building being wholly given to instruction in this art.



GENERAL VIEW OF BRADLEY POLYTECHNIC INSTITUTE.

The first horological school known in this country was instituted by Mr. J. R. Parsons some twelve years ago, steadily increasing in growth and popularity until the founding of the Bradley Polytechnic Institute, by Mrs. Lydia Bradley, in 1897, when it became a department of such institute, Mr. Parsons remaining the principal. Like the departments devoted to the arts and sciences, this school is open to both sexes; and it is said, in the finer and more expert details of mechanical work, that the lady pupils are in no way inferior to their male compeers. Here is taught, both theoretically and practically, all the minutiæ of watch and clock making, including repairing and the reproducing of parts to scale; the making, designing, and repairing of jewelry; coloring, alloying, plating, and drawing of metals; engraving and designing of patterns, crests, and monograms; likewise all the arts of the lapidary and optician. So successful has been the brief career of this school, that it is confidently expected it will shortly prove considerably more than self-sustaining. Recently, in the brief period of five weeks, a student designed, and made from the raw materials, a watch of the finest and highest grade, exhibiting the perfection of mechanical art. This is certainly an effective denial to the claim that the details of delicate mechanism in the highest grade of watches is beyond the scope of the American producer, though it has long been acknowledged, even among the Swiss that American factory-made watches are without equal in their respective classes.

The day is, perhaps, not far distant when the tables will be turned, and the United States export the finer grades of hand-made watch and clock mechanisms, instead of the same, as at present, being a considerable item among imports. But even if this should never occur, the impetus that will be given to the higher grade of mechanics, as represented by the watch, clock, and jewelry trades, by such an institution as the Bradley Horological School, will be of inestimable value. Teaching of the kind afforded must result in the gradual displacement of tinkers and half-taught tradesmen, who are now, unfortunately, too often in evidence, by a class of experts competent to judge and be judged of in their special lines of labor. In one of the engravings we show a specimen of the work done by one of the pupils of the institution. It is a thin 16 size pocket chronometer, nickel plates, gold wheels, raised gold settings, with seventeen pigeon blood rubies, stem and pendant setting of the Institute's design, the movement is handsomely finished and adjusted to isochronism; heat, cold, and six positions.

The wheels and pinions were all cut on an ordinary watchmaker's lathe with the aid of Parsons' wheel cutter.

Returning to the institute as a whole, it may be added it is fitted up in the most thorough and complete manner, and the instruction is of the most practical and helpful character. Aside from history, the languages—both modern and "dead"—and mathematics, all forms and grades of mechanical and decorative art, are taught. Large and roomy workshops and perfectly equipped laboratories invite the students to special lines of study and development. In the biological department are aquaria, an herbarium, and all the facilities for the preservation and study of the lower forms of life, animal and vegetable, in natural surroundings and under normal conditions, in connection with such aids as are afforded by microscopes, dissecting models, charts, manikins, etc., all the essentials in fact for laying a firm foundation in zoology and botany. The same completeness likewise obtains to the laboratories devoted to physics and chemistry. Here is everything necessary to the investigation of the processes of heat, light, sound, electricity, crystallization, and analytical research — even photography is taught. A steam engine and dynamos furnish light and ventilation besides motive power in the shops devoted to wood and metal working in all their branches. And still another feature is the department of domestic economy, wherein is taught sewing, cutting, fitting, mending, housewifery, etc. Even the kitchen is so complete in its furnishings and curriculum as to fairly deserve to be classed as a laboratory.

SPECIMEN OF WORK BY ONE OF THE PUPILS.

INSTITUTE FOR EDUCATING WATCHMAKERS—PRIMARY DEPARTMENT.

FINISHING AND ENGRAVING DEPARTMENT—HOROLOGICAL INSTITUTE.

Certainly there is a bright and practical future for institutes of this character.

New Petroleum Discovery.

A new source of petroleum has been found in the Western Caucasus, not far from the shores of the Black Sea. The oil occurs in large quantity, and the importance of the discovery for European consumers consists in the fact that, as compared with Russian petroleum, the long journey between Baku and Batoum will be saved. The right of exploitation is in the hands of a Moscow capitalist.

Science Notes.

According to M. Bergmann, graphite can be obtained by heating to 150° Cent., and under a pressure of five atmospheres, acetylene gas with oxygenated water. The same result is obtained by bringing calcium carbide in contact with water and treating the mass with diluted hydrochloric acid.

The State of Pennsylvania is one of the few which has taken any practical steps toward forest preservation under a law which went into effect on January 1 of this year. The State forest commissioners are authorized to purchase on behalf of the State land suitable for forest culture and so located as to protect watersheds. Under this law Commissioner Rothrock recently purchased 14,000 acres of land in Clinton County, at tax sale, at an average cost of 8½ cents an acre.

The first volume of a second edition of a useful directory of German makers of optical instruments, and other instruments of precision, has been published by the firm of F. & M. Harrwitz, Berlin. This "Adressbuch" is edited by Herr F. Harrwitz, the editor of the journal Der Mechaniker, and has been greatly enlarged. It contains the names and addresses of German mechanicians, opticians, glass instrument makers, and allied callings, arranged alphabetically according to names of firms, towns, and specialties. How numerous these makers of scientific instruments are in Germany, says Nature, may be judged from the fact that the directory just issued contains nearly four hundred pages.

A. Haddon has studied the passage of certain salts used in photography through gelatin septa. He finds that sodium hyposulphite dialyzes more rapidly through a septum tanned with oxidized pyrogallic acid than through plain gelatin, and that gelatin hardened with chrome alum allows least salt to pass through. Potassium bromide passes at the same rate, whatever the state of the gelatin; sodium carbonate resembles the hyposulphite in its action; sodium sulphite passes most rapidly through plain gelatin, and least through that treated with chrome alum; mercuric chloride resembles sodium hyposulphite; and pyrogallic acid passes most rapidly through gelatin hardened with chrome alum, plain gelatin coming next in order.—Photo. Journal, xxii., 224.

From the Chemical Laboratory of the University of Virginia we learn of a very simple and satisfactory method of distinguishing stucco work made in Keene's cement from that made in ordinary plaster of Paris. As is well known, Keene's cement is characterized by the presence of a small amount of alum. It is ascertained that the alumina, which is present to the extent of less than one per cent, is to be detected by a dilute infusion of logwood, which need merely be applied by a feather or camel's hair pencil to the surface of the stucco, when almost immediately the blue violet color of the spot will indicate Keene's cement; while ordinary plaster of Paris is merely stained a reddish brown under this treatment. In the supervision of certain work this test applied in an inconspicuous place will solve what might otherwise prove a troublesome problem for an analytical chemist.

A paper by Messrs. Edwin Edser and C. P. Butler, on "A Simple Method of Reducing Prismatic Spectra," was read by Mr. Edser at the late meeting of the Physical Society. The production of interference bands in a continuous spectrum is capable of furnishing a reference spectrum which can be employed to determine the wave lengths corresponding to the bright lines in a spectrum of a metal or a gas. The authors discuss various methods by which such bands can be formed. In their final experiments, an air film between two plane parallel glass plates is inserted in front of the slit of the spectrometer, in the path of the incident light. Owing to the interference of the direct ray with that twice internally reflected, bright bands separated by dark intervals are observed in the spectrum; these bright bands correspond to a series of different waves, whose lengths are easily determined for the whole series, when two of them are known. The bands are much improved by partial silvering of the two internal surfaces of the glass. It has been found that ordinary plate glass, if well chosen, is good enough for all these experiments. In order to adjust for parallelism, a spot of light, or the filament of a glow lamp, is viewed through the silvered surfaces. A long train of images is generally visible; these must be brought into coincidence. If now a sodium flame is looked at through the film, interference bands are seen. These bands must be adjusted by pressure, to be as broad as possible. An arc lamp is used for illuminating the collimator slit. The authors exhibited the apparatus, and showed photographs of spectra scales, with the appropriate wave lengths calibrated upon them by this method. The results obtained were read from the spectrometer to 0·4 of a tenth-meter, with an ordinary pocket lens. A simple graphic method enables wave lengths, corresponding to a great number of spectral lines, easily to be determined by inspection. The phase changes introduced by the silver do not affect the final result.

Miscellaneous Notes and Receipts.

German authorities report the astonishing fact that in Germany and Switzerland 2,000,000 glass eyes are annually manufactured, while one French factory is turning out as many as 300,000.--Technische Berichte.

Composition for Fire Extinguishers.—As is well known, the effect of these apparatus consists in that the liquid contained in the extinguisher is caused to evaporate quickly by the fire, whereby a large quantity of gas free from oxygen is generated, which displaces the air, thus extinguishing the fire. One of the best recipes for the composition of such liquids is given by M. Raymond, viz.: Water, 1,000 parts; borax, 40 to 60 parts; soda (anhydrous), 80 to 120 parts; sodium hydrate, 150 to 200 parts; ammonium carbonate, 75 to 100 parts; ammonium chloride, 200 to 280 parts.—Alkohol.

Asbestos Leather.--A German inventor has obtained an English patent for an improved asbestos stuff—asbestos leather—and its mode of manufacture. The asbestos is divided into very fine fibers of the greatest possible length, then immersed into an India rubber solution; the whole is next thoroughly intermixed, until every fiber is coated with the solution. The solvent, for instance, petroleum benzine, is thereupon evaporated. The asbestos fibers then cohere perfectly, and the mass may be pressed into any desired form or may be rolled. The inventor calls the manufactured product "asbestos leather," and it is said to resemble very closely leather in its peculiarities and structure.—Zeugdrucker Zeitung.

Gum Euphorbium.—In gathering this gum resin, used in medicine since olden times, the natives of Natal observed, latterly, that the knives employed for cutting into and scratching the plants became covered with a very firmly adhering coating of the gum resin, which protected the knife blades perfectly from all formation of rust. The government took the matter in hand, and it was found that even iron objects sunk in sea water were preserved entirely free from rust for two years by this coating. According to these experiments instituted at Chatham, an alcoholic extract (instead of the shellac heretofore used for the purpose) would be the best means of protecting metal ware and instruments from rust. A coating applied to wooden ware, beams, and other objects exposed to attacks by termites is said to protect same entirely from these destructive insects. In bruising the extremely sharp gum resin great caution is necessary, since the dust entering eyes and nose causes violent inflammation of these organs.—Staats Zeitung.

To determine whether a trunk was hewn in winter or in summer is of the greatest importance to buyers of timber, especially as regards building timber, since it is well known that timber cut down in summer represents a lower value than that felled in winter. Timber hewn during the resting period, i. e., between October and April, contains in its cells numerous starch particles which cannot be found in wood cut down in summer. Owing to this presence of starch the wood is coarse and impenetrable, since the starch closes the pores. For this reason, winter-hewn timber is exclusively employed for staves because, with staves from summer-hewn wood, the contents of the barrels are subject to evaporation through the pores. The starch contained in the winter wood is given a violet color by iodine. Hence, if the timber to be examined is coated with an iodine solution and the surface of the felling side appears yellow, it may be assumed with certainty that the respective tree was cut down in summer. The light yellow lines are the moisture rays, while cells, tissue, and wood fibers simply take on a yellow coloring. In the case of winter-hewn timber the amylaceous rays form much darker, ink-colored, black stripes on the yellow ground.—Allgemeine Tischler Zeitung.

Green guttapercha is now produced from the leaves of the caoutchouc tree, and is said not only to possess all the advantages of the article obtained by incision into the stem, but even to excel it in durability, so that it can enter into use industrially and commercially in a hitherto unknown way. It is readily prepared and cheap in price, not requiring an expensive purification, which heretofore increased the price of the product 15 to 25 per cent. Besides, it is highly plastic, very strong, can be divided into the thinnest leaves and receives the most delicate and at the same time most distinct impressions, by moulding and pressing. Moreover, it withstands the action of water and the strongest acids, and even in a worn and broken-up condition is still worth 25 per cent of its cost of production. The French mail and telegraph department has already commenced its use for the construction of submarine cables.

Schweinfurth, by the way, is said to have discovered in Central Africa a tree, called "tsofar" by the natives, from which also exudes a gum already introduced in commerce. This tree possesses the remarkable quality of giving off flute-like sounds when the wind blows through its branches. These are caused by an insect penetrating into the wood, in order to obtain the gummous substance, thus transforming the tree into a huge Pan flute.—Technische Berichte.

Slag Bricks in Germany.

F. W. Luermann, in an interesting article in Stahl und Eisen, gives his experience in the manufacture of bricks from granulated blast furnace slag, says United States Consul Max Bouchsein.

The direct production of building and paving stone from fluid slag, he says, is nothing new. Such slag bricks, however, did not prove a suitable material for dwelling houses, because they are, like glass, impermeable for air as well as steam. In human habitations, the aqueous vapor exhaled by the occupants would condense on cold days on both windows and walls, thus rendering the rooms damp and unhealthy. On the other hand, brick manufactured from granulated blast furnace slag is permeable and hygroscopical—that is, both air and steam can penetrate them.

The first one to produce granulated slag or slag gravel for brick making, by passing the fluid slag through water, was Eugene Langen, an employe of the Friedrichs Wilhelm mine, near Siegberg, Westphalia. This process causes disintegration; silica is separated in a soluble condition, in which it easily hardens in the air and combines just as easily with caustic lime. The single grains of the slag gravel, when compressed tightly, are bound by the soluble silica; and when ground to a fine dust, so that the particles come into closer contact with each other, the binding by the silica therein is sufficient for the production of good building bricks. Bricks from ground slag, however, require a longer time for hardening than those manufactured from granulated slag. By mixing granulated slag with dust from slag which has crumbled in the air, good bricks can be produced without any addition of lime; but the hardening process is rather slow. Hardening takes place quickest in from six to eight days with bricks to which about 10 per cent of burned and slaked lime has been added.

Granulated slag, from its passage through water, contains from 19 to 33 per cent of water, according to its porosity—a fact which has to be considered in shipping. Its weight ranges between 1,100 and 1,500 pounds per cubic meter (35·3 cubic feet); that of ground slag runs as high as 2,900 pounds. Ground slag can be added to the mixture of granulated slag and lime when dense and strong bricks are to be produced.

The bricks may be given any shape desired; and they will preserve this shape, because they are not burned. They show sharp edges and smooth surfaces, and give the best satisfaction when as little mortar as possible is used. The natural color of slag bricks is that of grayish white sandstone. The weight ranges, according to dryness and slag used, between 6½ and 7 pounds, or about 6,000 bricks to a 20-ton car.

The strength of slag bricks fully equals that of ordinary burned bricks; 24 to 28 pounds per square centimeter (1·55 square inches) is usually considered the highest admissible burden for ordinary bricks. Well hardened slag bricks can withstand, theoretically, burdens up to 160 and 180 pounds. The resistance of slag bricks to high temperature is quite remarkable. Heated to a pale red, when the carbonate of lime begins to decompose, its strength will not be injured. Even if a part of the lime should be decomposed at such a high temperature, and thus rendered caustic, carbonic acid is again absorbed at a lower temperature, and the brick again becomes as strong as it was before. For the construction of chimneys and stacks, slag bricks are used with advantage, as the products ascending contain a large quantity of free carbonic acid, which is delivered to the bricks. For the same reasons, it is well adapted for lining lime kilns and walling in boilers.

Slag bricks are five times as permeable as ordinary burned bricks. Pressure being equal, 10¾ square feet of lightly burned bricks permit in one minute the passage of 23·3 liters of air; slag bricks permit the passage of from 101·2 to 113·4 liters. Their porosity also is greater than that of burned bricks; while they do not absorb water as quickly as burned bricks, they regain their permeability quicker than the latter. A burned brick filled up its pores with water in twelve hours, while a slag brick required one hundred and ninety hours to get thoroughly soaked.

To test whether slag bricks have dried and hardened sufficiently to be safely used, a small piece of brick tied to a string is dipped into a cold concentrated solution of sulphate of soda, and hung up at any place in a room. By the evaporation of the water in the solution and the crystallization of the soda, which in its action resembles the formation of ice, bricks that will not resist frost are destroyed, each crystal needle carrying a little cap of the material from which the brick was produced. Not slag bricks alone, but any other, can be tested in the above mentioned manner as to their power of resistance to frost.

It is said that slag originating from puddling and Thomas pig iron produces the best bricks, while Bessemer and foundry slag ranks second. The erection of a slag brick plant in connection with a blast furnace would cost about $5,000. At several German works the cost of production of 1,000 bricks is only 10 marks ($2.38). From 6,000 to 7,000 pounds of granulated slag and 450 to 700 pounds of burned lime are required for the production of 1,000 bricks.

Variety of the Typewriters.

The typewriter is one American product which has never suffered a foreign boycott.

The click of the American typewriter is heard around the world. The tourist finds it turning up in all sorts of out-of-the-way corners, from Iceland to Van Dieman's Land. With the Dongola and Ashanti expeditions it has penetrated into the heart of the African wilderness; with Lieut. Peary, it found its way to the Arctic regions; the Russian government has sent it all through Siberia; it is to be found in the homes of the missionaries in India. The Czar of Russia has a richly engraved, gold-plated, white enameled, ivory-keyed typewriter for writing both English and Russian. Queen Victoria has one in her household, and so have the Queen Regent of Spain and the Khedive of Egypt. In the wreck of the battleship "Maine" was found a typewriter, and should the Russian Eastern squadron's flagship suddenly sink in the Yellow Sea, an American typewriter would be found in the captain's cabin.

The universal use of the typewriter is due to its easy adaptation to almost any language capable of being printed. Typewriters have been made to write Greek, German, Hebrew, Siamese, Telegu, and Russian. The accents, so important a part of other languages than English, are written with dead keys, which do not move the cylinder carrying the paper. The dead key device has recently been ingeniously applied in solving a difficult problem in typewriter construction. An English missionary in India, Dr. Jacob Chamberlain, at Madanapalle, Madras Presidency, wishing to translate the Scriptures for the natives, wrote to an American typewriter company asking if a typewriter could be made to write the Telegu language. He had been using an English-writing typewriter, and one day, when it was smashed by plaster falling in his bungalow, the idea of a Telegu typewriter occurred to him. The Telegu language is peculiar in that every character represents a syllable. The missionary resolved the language into 240 characters, but upon further study found that these characters were built up from a much smaller number of basic forms. These forms were hand-cut in India under the missionary's direction and sent to the typewriter company. With the aid of the dead keys it was found possible to build up all the composite characters of the Telegu language upon a standard keyboard. The typewritten words look like a Chinese laundryman's efforts, a confused mass of curlycues, spots, points, and assorted crescents. The missionary found his Telegu typewriter so valuable in Christianizing the heathens that other missionaries sent orders for similar machines. With them a large portion of the Bible has been distributed in duplicate among the natives.

An English student of Hebrew sent an inquiry to the same company for a Hebrew typewriter. None had ever been made, but a Hebrew keyboard was planned and the order filled. Hebrew, it must be remembered, is written from right to left. The Hebrew typewriter made for the student has the mechanism of the ordinary typewriter; to have reversed it would have been a costly undertaking. The owner consequently has to write backward. Should there be a sufficient demand for Hebrew typewriters, they would be made from the upper righthand corner to the opposite. The German government recently ordered the use of only German letters in the government business. For several years German typewriters with Roman letters have been in use, but to meet the new order a German letter keyboard has been arranged. A change has also just been made in the Greek typewriters. The first Greek typewriter wrote a slanting letter, but a new vertical letter having become much in favor in Athens, an American typewriter company has equipped a machine with this style of type.

King Chulalongkorn I. of Siam, while traveling in Europe not long ago, first saw the typewriter. He was so interested in the machine that he immediately gave command that a typewriter be added to the equipment of the royal household. The Siamese language had never been written with a typewriter, but an American typewriter company was appealed to, and within a short time the King was supplied with a Siamese typewriter. His northern neighbor, the Emperor of China, might use a typewriter if he had one, but until he publishes an imperial decree abolishing 14,000 odd characters of his people's alphabet he will have to content himself with a brush and inkpot. The Japanese, in their struggle for commercial recognition, are crying for typewriters. Experts are at work unraveling the Japanese language, and a Japanese typewriter keyboard will probably result from their study.

The polyglot machine is a recent development of typewriter construction, says The New York Sun. Business houses doing a large foreign business with several countries ask for machines writing several languages. By providing for the accents of the various European languages on one keyboard, half a dozen or more languages may be written on one machine. Many typewriters with English-Spanish-French keyboards are shipped to South American countries. The most interesting polyglot machine in the world is one just sent to Pope Leo XIII. for use in the Vatican. Like the one furnished the Czar, it is decorated with gold, ivory, and enamel. The machine writes English, French, Italian, Spanish, Portuguese, and German.

Covering the Waste Places with Grasses.

All our extensive ocean front, where fashionable summer cottages have been erected, is now fringed with green lawns, and where before nothing but dazzlingly white sandy beaches fronted the sea, fine silky grasses flourish, offering a pleasant contrast to the narrow strip of land which the waves leave bare as the tide recedes. One of the chief objections to a residence by the seashore has been removed in recent years by the successful cultivation of green grass on the barren strips of glaring beaches, and with proper foresight one may surround his home abutting on the sea with all the green verdure that is pleasing to the eye. The introduction of the Japanese lawn grass for seaside lawns marked the beginning of this change for the better, and though a frail and apparently delicate grass, it holds its own against the salt-laden winds, and gradually binds the sand together so compactly that the waves have difficulty in washing it away.

This is a fair illustration of the benefits obtained in this country in recent years in the study of grasses, both by the Department of Agriculture and at the State Experiment Stations; but if it is a good illustration, it will be seen that it is only one of many similar cases that can be mentioned. From Maine to Florida, seaside property is becoming more valuable each year in proportion to the ability of man to shut out the sea from encroachment. While expensive jetties, bulwarks, and piers have been built to save the land, the small sand-binding grasses are often found to be more effective in the end. Destructive sand storms make certain parts of the coast uninhabitable, and they sweep over the beaches with such power that they kill every particle of vegetation. At Cape Cod these sand storms are the most destructive on the Atlantic coast, and more than once in the history of the place they have threatened Provincetown so that the citizens had to turn out to protect their property. The culture of soil-binding grasses has received so much encouragement through the Department of Agriculture that it has become pretty general along the Atlantic coast, and millions of dollars' worth of property will be saved for the future.

The sea lyme grass is recommended for the Atlantic coast north of Massachusetts, but south of that point the sand reed or marram grass is better adapted to the work of holding the sand and soil threatened by the water. Below Virginia the bitter panic grass is the best soil binder, and it extends all down the southern coast, and even around on the gulf side of Florida. The creeping panic grass is another soil binder, found chiefly near St. Augustine, Florida. For inland bays, rivers, and canals the common salt grass is of inestimable value. The rolling spinifex of Australia and New Zealand is an imported variety of grass that has a promising future in this country. Besides binding the sand together, this grass is remarkable for its rapid possession of new territory. The seeds are scattered by the winds over all adjacent beaches, and in a few seasons they grow up and reproduce their kind.

While soil-binding and seaside grasses have performed a great work in the improvement of this country in the last ten years, their usefulness is after all secondary to that of the pasture and hay grasses. The foundation of all good farming is grass. A land rich in succulent grass can be turned into a great cattle and stock raising region or into a successful farming community. A territory covered with heavy masses of grass has a rich, fertile soil, and conversely luxuriant growths of grass will convert a poor soil into a fruitful, productive land.

But only certain favored regions of this country were covered with rich grasses. Wild grasses that have since been brought under cultivation and greatly improved were prolific in different territories, but they failed to produce sufficient crops either to support cattle or to make farming profitable. Still other regions were almost totally destitute of anything that resembled nutritious grasses, and agriculture has been the most backward in those places. It has been the work of modern science to introduce cultivated grasses where they could benefit the country, and to select the best wild varieties and improve them by cultivation.

It should be remembered that all of our cultivated grasses were once wild—our timothy, red top, orchard, and Kentucky blue—and that not such a long time ago. Timothy grass is less than one hundred and fifty years old as a cultivated grass, and about the same time orchard, red top, and Kentucky blue grasses were redeemed from their wild state to take a place in our fields and orchards. Prior to this period they were all as wild as our Western buffalo grass, grama, or the wheat grass of the plains. What they are to-day, and what important bearing they have upon the agricultural resources of the country, can probably be appreciated by anybody at all familiar with the cattle and stock raising business of the United States.

Experiments with grasses have been going on continually by experts for the past ten years, and the results accomplished are little short of the marvelous. Enormous areas of the South are being developed, and their agricultural possibilities enlarged, by the grasses that have been planted there. Cattle raising as well as general farming have advanced in the South along with grass growing. Large regions that seemed to be unfit for almost any kind of vegetation are now producing an abundance of special grasses, which give support to sheep, swine, and cattle.

The United States Department of Agriculture has at present a grass farm established at Knoxville, Tennessee, where over one hundred and fifty kinds of grasses and forage plants are cultivated for the purpose of introducing to the farmers the most suitable varieties for their special localities. Grasses adapted to sandy soil, to upland districts, and to the wet lowlands are all raised carefully under conditions that will test their virtues thoroughly before they are recommended to the general farmer. Some of the grasses that are thus being introduced in the South are foreign varieties, and others are native grasses obtained chiefly from the prairie and Rocky Mountain regions.

In testing the value of wild grasses, it is first ascertained if they are adapted to the localities in which it is proposed to raise them. It has been found time and again that some of our most important grasses grow wild in an enfeebled condition, but when given good cultivation they quickly improve and assume a rampant growth. Other wild sorts have a sturdy growth, but their relative innutritiousness makes it unwise to cultivate them. Other nutritious grasses have to be condemned simply because their seeds are difficult to harvest, especially if their seed production cannot be improved. Just at present dry land grasses are much needed, and efforts are being made to produce more and better growths of this kind.

Some of the wild grasses that offer little returns to the farmers to-day are under cultivation at the experiment station, and it is expected that in the next generation they will fill a long felt want. Chief among these promising varieties are the common switch grass, the Western big blue stem, the bushy blue stem, mountain timothy, wild ribbon grass, large bent grass, wild June grass, buffalo bunch grass, and wheat grass. Two native winter pasture grasses from the Southwest have been found to be of special value in the South. The Apache timothy of New Mexico promises to flourish vigorously throughout the South to supply cattlemen with winter pasture for their flocks. The Tennessee fescue is another excellent grass for the South that has been brought down from the mountain regions of Tennessee and North Carolina. The sheep's fescue from Montana has also added to the list of available Southern grasses. Texas blue grass flourishes throughout the Southern States, and its seeds are now being planted from one end of the South to the other.

Of imported grasses, the meadow foxtail makes one of the best pasture grasses, and it is now raised in this country as extensively as in Europe. The true English blue grass and the European reed fescue are also adapted to many parts of this country. Africa has contributed a new grass, which is known as "teff," and it has been cultivated with great success in Florida. As it comes from a warm country, it makes an excellent growth right through the hot summers of the South. When raised successfully, it produces enormous crops of grass or hay.

The most marvelous crops, however, have been obtained from teosinte, a vigorous plant that grows like Indian corn, and in tropical Florida it reaches an enormous height. As many as fifty to sixty stalks have been known to spring from a single seed. The sowing is in drills, and not broadcast, and when it has the right soil it produces an enormous amount of green food. It is a tropical plant, and it does not ripen in this country outside of Florida, but it will produce an abundance of green food in almost any of our States, especially in the South. As a forage plant this will probably be a great favorite in the future.

Besides summer and winter pasture grasses, various forage plants, that are not grasses at all, have been cultivated in recent years, and Southern farming has been largely revolutionized by them. Probably the most important are the cow pease and the soy beans. These plants are vigorous growers, and derive most of their nitrogen from the air. They belong to the leguminous family, and they enrich the land by adding large quantities of nitrogen to the soil. Nitrogen is a valuable and important fertilizer that must be added to the soil directly or indirectly, and the leguminous plants do this work better than any artificial method. They are the best soil renovators and soil enrichers that we have, and chief among them are the soy beans and the cow pease, which are now raised so extensively throughout the whole South. G. E. W.

THE resistance of glass varies widely with temperature, says The American Electrician. If taken at unity at 68° F., the resistance is 0·077 at 142° and 87 at 0°. At the latter temperature glass has a resistivity of 5,000 million million times that of copper.