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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LATEST STEAM TURBINE PLANT.

After a careful investigation in Europe and America of the performance of the steam turbine, the consulting engineer of the Cleveland, Elyria and Western Railway, Cleveland, has given orders for the installing of steam turbines for driving the generators in the new addition to the power plant of that company. Orders have been given for two 1,500-horse power Parsons turbines, which are to be direct-connected to two 1,000-kilowatt, two-pole, 400-volt, 25-cycle Westinghouse generators. These turbines will embody the fruits of the experience that has already been gained with the turbine both here and abroad. It is significant that the Westinghouse Machine Company, which is building the turbines, guarantees that with 150 pounds steam pressure and 100 degs. F. of superheat at the throttle, and 28 inches of vacuum at the exhaust, the steam consumption shall not exceed 10.08 pounds per indicated horse power, while at half load they guarantee that the steam consumption shall not be more than 15 per cent greater than the consumption at full load. The most interesting novelty of these machines is that they will consist of two separate sets of cylinders, high and low pressure, these being, of course, on the same shaft as the generator. The superheated steam is first led to the high-pressure cylinder, and then passes through a reheater which is hung in a pit below and parallel to the axis of the turbo-generator. This reheater is 3 feet 4 inches in diameter and 23 feet 6 inches in length. As illustrating the great economy of space and foundation work, due to the substitution of the turbine for the ordinary reciprocating engine, it may be mentioned that the present station would have been crowded, had the addition consisted of only two 500-kilowatt alternating current units with an ordinary reciprocating engine drive; whereas by the use of the turbine sets, not only can two units of 1,000 kilowatts capacity be installed, but there will still be sufficient space remaining for an additional 2,000-kilowatt unit. There is also great economy in the construction of foundations, etc., since the perfect balance of the turbine in running obviates the necessity for heavy masonry and holding-down bolts.

THE LARGEST LOCOMOTIVE ENGINE IN GREAT BRITAIN.

There has recently been constructed at the Great Western Railway Works, Swindon, a passenger locomotive which has reached the limit in height and width available on English railways, where the loading gage places rather severe restrictions upon locomotive dimensions. The height from the rail level to the top of the smokestack is 13 feet 2 inches, the width over cylinders 8 feet 11 inches, and the height of the center of boiler above the rail is 8 feet 6 inches. As we have frequently pointed out, the locomotive builders of this country have had a great advantage over those of Europe in the fact that they have realized at the start that the point at which to commence in increasing the power of the locomotive is the boiler. It is only during the last few years that English builders appear to have realized this fact. There are thousands of express engines running in England to-day which have not over 1,200 square feet of heating surface. A few years ago some engines were placed on the Caledonian Railway having 1,500 square feet of heating surface, and later the Lancashire and Yorkshire Road brought out some four-coupled expresses with 2,050 square feet of heating surface. The present engine, which was designed by Major W. Dean, Locomotive Superintendent of the railway, has 2,400 square feet of heating surface, which is something certainly very remarkable in English practice. The barrel of the boiler is 14 feet 8 inches in length by 60 inches in diameter, and the Belpaire firebox is 9 feet in length. The grate area is 27¾ square feet, and the working pressure 200 pounds to the square inch. The six-coupled driving wheels are 6 feet 8½ inches in diameter, and the outside cylinders will be 18 inches in diameter by 30 inches stroke. The engine weighs 72 tons, and the engine and tender together 118 tons. The tender carries 5 tons of coal and 4,000 gallons of water. The tractive force of the new engines amounts to 121.5 pounds for every effective pound of steam pressure. The most curious feature of this engine is the extraordinary ratio of stroke to cylinder diameter; for at a time when 3 to 4, or say 18 inches diameter to 24 inches stroke, is standard practice Mr. Dean has raised his stroke until the ratio is 3 to 5. We presume, however, this is due to the restricted width of the clearing gage, which prohibits the use of outside cylinders more than 18 inches in diameter.

A NOVEL METHOD OF BRIDGE ERECTION.

The natural tendency of the American engineer to seek the most direct way to the accomplishment of his work has been strikingly illustrated in the development of American bridge-building, where, indeed, it has led to the origination of a distinct type of bridge known as the pin-connected, in which the intersecting members at the joints are assembled on a common central pin, thereby greatly facilitating the cheapness and rapidity of erection. Concurrently with the development of this type, there was produced the "traveler," an ingenious portable derrick, or system of derricks, by which the bridge members are picked up and swung into place by the bridge gang. In the construction of cantilever bridges, and sometimes of long bridges made up of successive disconnected trusses, we have carried the method of construction by overhang to a great degree of perfection. Recently in the erection of the Highland Park highway bridge, at Pittsburg, a decided innovation was made, when it came to the erection of the central span of the main cantilever. Ordinarily the central span of a cantilever is erected by overhang until the two halves meet. In this case, however, the central span, 150 feet in length, was erected upon a large scow, towed to position below the overhanging arms of the cantilever, and then drawn up from the scow through a distance of 80 feet by means of tackles attached to the top chords of the truss. One set of tackles was suspended from the traveler booms, and the other from a pair of derricks set up at the ends of the opposite cantilever arm. The economy of this method in time and material is evident when we remember that, had the span been erected by overhang, its members would have had to be reinforced to take the erection strains, and special adjustments would have been necessary at the expansion joints.

AMERICAN METHODS FOR ENGLISH WORKMEN.

There was recently published in the London Times a letter from the building manager of the Westinghouse Manufacturing Company, dealing with the subject of the amount of work that can be got out of British workmen, which has attracted a great deal of attention in England, and has stirred up a controversy that has found its way to this side of the water. It seems that in the construction of the works of the Westinghouse Company at Manchester, England, British bricklayers were employed for laying the several millions of bricks required in the construction of the various shops. The contract was carried out under an American manager, who used the same methods that he employed in the erection of the Westinghouse factories at Pittsburg; and, according to the writer of the letter, the result has proved that it is possible to get as rapid work out of the English workmen as out of the American. Certain Proceedings of the Works Committee of the London County Council, recently published, have shown that the average London bricklayer considers that if he lays 400 to 500 bricks he has done a fair day's work. The average number laid per day in Manchester is not very much higher; but under the system employed by Mr. Stewart it seems that the British workmen laid bricks at the rate of 1,800 a day, and that on the commoner class of work, for which less care was required, they reached as high a figure as 2,250 bricks a day. This is taken to prove that the British workman can do as well as the American, whose average is about 2,000 bricks on good work. It is claimed that the result is the more striking because the question of the union does not appear to have entered into the problem at all, for Mr. Stewart employs unionists and is on very good terms with the union. It is claimed that the difference in the amount of work done is due to the American system of management, in which the employer and not the man is master and insists that every possible labor-saving system and device shall be used.

On the other hand, a reply has been sent to the Times from an English bricklayer, with extensive experience both in England and America, who says that the comparison is misleading, for the reason that the American bricks are smaller and lighter than the British bricks. The brick used in this country is 8 inches long by 4 inches deep and 2¾ inches in thickness, and it takes, according to the writer, 1,170 to equal in measurement 880 English bricks; furthermore, he states that, working in America, bricklayers who have been paid a dollar a day more than the union rate have given satisfaction when they set from 500 to 700 bricks a day, according to the quality of the work. This, on the other hand, is explained by a correspondent on this side of the water, who states that the lower rate quoted refers to the men who lay the fine facing pressed brick, which requires special skill and care. An English contemporary, commenting on the controversy, explains the discrepancy by saying that for the rougher class of work, of the kind for which the Westinghouse manager claims such a high record a day, it is customary in this country to use a much wetter mortar than is used in Great Britain, and this enables the bricklayer not only to spread his mortar more rapidly, but to set the bricks with a single tap of the trowel instead of having to hammer them down into place, as is necessary with the stiffer mortar used by the British workman. It is probable that the truth of the matter lies, as usual, somewhere between the two extremes.

A COMPARISON OF WATER-TUBE BOILERS.

A most interesting opportunity for comparison of the relative efficiency of various types of water-tube boilers will be afforded in connection with this year's shipbuilding programme of the British Admiralty, because of the determination of this body to install four different systems of water-tube boilers in the five new armored cruisers which are to be built. These vessels, four of which will be constructed in private yards, and the fifth by the government, are to be of something over 10,000 tons displacement, and are to be driven at a speed of 23 knots an hour by engines of 22,000 horse power. As a result of the investigations of the British Water-Tube Boiler Commission, and the elaborate tests carried out by them on the "Minerva" and "Hyacinth," full accounts of which have been given from time to time in the SCIENTIFIC AMERICAN, the government has decided to test the Belleville, the Yarrow, the Dürr, the Niclausse, and the Babcock & Wilcox boilers under exactly similar conditions by putting twenty-two Yarrow boilers in one ship, twenty-five of the Dürr in another, thirty-four of the Niclausse in a third ship, and in the fourth and fifth twenty-five Babcock & Wilcox boilers. As several of the "County" class cruisers now under construction, which are practically of the same type, are to have the Belleville boiler, an excellent opportunity is afforded for comparison. The steam pressure in the case of every ship will be the same, 250 pounds to the square inch at the throttle valve. The greatest heating surface per unit of power is shown by the Yarrow boilers, in which it amounts to 3 square feet per indicated horse power. The lowest ratio is found in the Belleville, where it is 2.29 square feet. On the basis of horse power per square foot of grate surface, the Niclausse shows 12.2 indicated horse power, while the Yarrow boiler shows 20 horse power. In a comparison of indicated horse power per ton of weight, the Belleville boiler stands first, with 12.57; then follows the Yarrow with 12 horse power, while there is not much difference between the other three. The total weight of the installation of 22,000 horse power is 1,750 tons for the Belleville, 1,832 tons for the Yarrow and 1,892 tons for the Niclausse, which is the heaviest of the five. In the case of the three new battleships of the "King Edward VII." class, which are to be 16,350 tons displacement and are to have a speed of 18½ knots with 18,000 horse power, Babcock & Wilcox boilers are to be adopted in two of the ships and a combination of three-fifths Babcock & Wilcox and two-fifths cylindrical boilers is to be installed on the third ship. In these vessels also it is possible to institute a comparison of the new water-tube types with the Belleville boilers, since the engines of the new ships will be very similar to those of the preceding battleship class of the "Duncan" type. The total weight of the Belleville boilers of the "Duncan" class is 1,580 tons; of the Babcock & Wilcox 1,735 tons, and of the combined types 1,885 tons; the indicated horse power per ton of machinery being 11.4 for the Belleville, 10.37 for the Babcock & Wilcox, and 9.54 for the combination.

FRENCH RAILWAY ENTERPRISE IN ABYSSINIA.

In the report on the Somali Coast Protectorate, the British Consul at Zaila describes at great length the possibilities of developing trade with Abyssinia by the construction of railroads, and particularly the French enterprise in this direction. Until recent years Zaila was the chief port for the import and export of goods to and from Harrar. Harrar is the gateway of Abyssinia, and the point from which that country communicates with the Somali coast. Notwithstanding the disadvantages of Baila as a port, and the want of water near the town, a thriving trade is done, all goods passing between Zaila and Harrar by caravan. Zaila is an old Egyptian town, and remains unaltered. With the exception of a few unpretentious government buildings, British ownership has made no outward change.

The French government established a colony at Obok, and thence quite recently moved it to Jibouti, which a few years ago was a mere stretch of desert coast, but which, by the lavish expenditure of money, has now become an important town. It still grows, money is still forthcoming, and Jibouti looks to the future for its return.

Zaila has for numberless years been the point of departure for caravans for Abyssinia. It occupies the same position as before. No caravans ever started from the site whereon the new town of Jibouti now stands. In Zaila the British government has done nothing beyond watch over the caravan route and insure peaceful passage for all who use it. The old order of things continues under circumstances of improved security and a protection on which it is safe to rely. Eastern methods of transportation endure, but the British government protects it.

Jibouti, on the other hand, is a port newly established for the development of western improvements. Modern enterprise has subscribed capital to construct a railroad from the coast and secure the trade with Abyssinia. The enterprise is sound, but, like all undertakings in unknown countries, it has met with difficulties and delay. The country through which the line had to be made was waterless and studded with rocks. Want of funds frequently interrupted the progress of construction. Hostility on the part of the fierce Somali tribes, who gave no welcome to a substitute for the transport provided by the hire of their camels, was, perhaps, as great a source of trouble and loss as either of the others named. However, there is at present, in Jibouti, a large railway station of a size and importance sufficient to represent the existence and establishment of the most paying line in any country, and the rails have been excellently laid for 165 kilometers. The construction has now entered Abyssinian territory, where protection and control are beyond the hands of the French government.

When the railway is completed, if it succeeds, a great boon will have been bestowed upon all those who trade with Abyssinia, since that country may be opened up; but Abyssinians do not appear to be greatly attracted by European products. Till now there has been little demand for aught save rifles, revolvers, and cotton goods, among the inhabitants of Abyssinia. At present, however, there is a disposition on the part of merchants to make use of the railway. From the terminus now reached camels must be engaged and a caravan formed to continue the journey to Harrar. There are signs that this trial of the railway is premature, and cases have occurred and continue to occur, where goods dispatched from Zaila, though leaving subsequent to those sent by rail, have arrived in Harrar first. However, this is a matter which the merchants will inevitably discover themselves. The Zaila route, though known to be slow, is also known to be sure. For the present it must be expected that all traders will wish to try the railway, and a time of depression for Zaila is certainly near at hand. Then the caravans will depend on local trade, and that which is provided by a few conservative Arabs who prefer old ways to new.

THE EXPANSION OF WINTER FARMING.

BY GEORGE E. WALSH.

The idea prevalent in some quarters that agriculture has not kept abreast of modern industrial developments is so far from the actual truth that occasionally the public is surprised by reports which indicate a change and revolution in methods and results of a most phenomenal character. In nothing has our agriculture changed more decidedly in recent years, however, than in the seasons of production. Science has deliberately set at defiance all the laws which govern the seasons of growth, and in the conflict it has proved a great triumph for man. Winter farming has become in the past decade an industry more profitable and successful than ordinary summer gardening or farming.

The demand for farm products in winter, when most of them are scarce and difficult to secure, has been responsible for the growth and expansion of winter farming. To-day this industry is of national importance, and adds millions of dollars to the wealth of our country. Lands that were formerly considered almost worthless have attained through this industry considerable value, and farmers who were disappointed at the outlook of their profession have suddenly discovered new means of reaping financial rewards for their labor and genius. Instead of following in the old ruts in vogue fifty years ago, they have branched out in entirely new lines to develop an industry that is as fascinating as it is profitable.

Naturally one thinks first of truck gardening, either under glass in the North in winter or along the belt of Southern States, when this subject is broached; but winter farming is not by any means confined to even this field. Winter dairying has become in the last five years one of the most profitable sources of farming, and it is pursued by the most progressive dairymen of the country with great success. By means of the silo, succulent food is stored away for winter feeding that produces almost as fine milk and cream as the June grass. The milk and cream in winter time are worth so much more than in summer that the dairymen find it profitable to provide good winter quarters for the best cows and to feed them with the best food.

The poultry farmer has likewise changed his methods, and by means of the incubator and brooder winter and spring broilers are produced to-day in enormous quantities for our tables. Winter poultry is to-day about the only product of the chicken farm that actually pays a good profit. The high prices obtained for spring chickens and broilers out of season have caused complete changes in this industry. Those who depend upon the eggs for their profits are endeavoring to induce the hens to change their season of laying, so that winter eggs will be had in abundance. Extensive experiments in winter feeding and winter breeding in glass-covered houses have produced results which encourage the poultrymen to believe that eventually breeds of hens will in time be reared which will lay their eggs in winter instead of summer. At present the results obtained are not entirely satisfactory.

Hothouse lambs have become important parts of our winter diet in recent years, and breeders have established enormous houses where these delicate animals can be reared and fattened through the coldest of our winter weather. The work is profitable, and the breeders are increasing the industry each year. Hothouse lambs are delicacies out of season at present, but in the future they may become an ordinary part of our regular winter diet.

Hothouse fruits and vegetables multiply in quantity and quality every year. The industry is expanding so rapidly that the annual winter supplies of these delicacies are running up into thousands of tons. Around Boston there are several hundred acres of land covered with glass where fruits and vegetables are raised for the winter markets. Jersey and Long Island are also centers of this industry, and hundreds of acres are now under cultivation right through the winter. These hothouse products bring high prices all through the winter, and from two to four crops are raised annually on the same land. In the spring, when the weather grows warm, the glass sashes are removed, and the plants for the summer markets are raised as easily as if the land had not been producing all winter. When the cold autumn frosts come, the glass sashes protect the new crop that has been planted for the Christmas holiday seasons. Then when these winter products are harvested, seeds for an early spring crop are sown, and by the time Easter is here fresh vegetables are again ready for picking.

The truck products raised under glass in winter receive the most modern intensive culture. The soil is of the richest, well heated by steam pipes, moistened properly, and sometimes lit artificially at night time by arc lights. The electric light tends to stimulate the growth of certain vegetables, and the season of maturity is thus rapidly hastened. The profits from this business often run from 50 to 80 per cent on the investment, and during the rough winter weather when Southern truck cannot reach the markets, prices for the vegetables raised under glass soar up to almost fabulous prices. Yet in spite of the great number of acres of land covered with glass and devoted to winter farming, the supply hardly keeps pace with the increasing demand, and there is ample opportunity for further expansion in this line.

Winter gardening and farming in the southern belt of States where the climate is warm enough to produce the products out of doors have spread with phenomenal rapidity in recent years. Whole sections of States have been reclaimed by this industry, and land that was worth only a few dollars an acre ten years ago sells to-day for two or three hundred dollars an acre. Our whole system of living and diet has been transformed by this industry, and our winter season is supplied with fruits and vegetables almost as freely as the summer.

The expansion of this form of winter farming has been due to the railroads and steamship companies operating lines along the coast or through the belt of States with climate and soil suitable to the business. The construction of refrigerator cars which would enable growers to ship their strawberries and tomatoes from Florida and Louisiana to New York or Boston in midwinter gave a great stimulus to the industry. It is now possible to land the most perishable fruits and vegetables in New York from the most distant gardens within seventy-two hours after picking and in perfect condition. Each year the source of the supply is extended. It was first the Carolinas, Norfolk and Georgia which monopolized this industry. Then Florida entered the field, and finally the gardens spread along the Gulf and included those in the Mississippi Valley. California made special efforts to ship her fruits and vegetables to Eastern markets in cars made for the purpose, and now Texas and even Mexico are entering the field with their peculiar farm products. There are some 60,000 refrigerator cars engaged in this traffic in the winter season, distributing the fruits and vegetables of the tropical and semi-tropical gardens and farms to the large cities of the North, South, East and West. The best of these cars are scientific products of modern genius, and they carry their loads of fruits as carefully as a Pullman palace car transports its millionaire occupant.

Strawberries from the Carolinas alone amount to some 12,000,000 quarts a year, while California pours across its borders some 193,000,000 pounds of fresh fruits. New York city alone absorbs some 4,000,000 packages of Southern vegetables every winter. All told, the winter farming which supplies the cities with their fruits and vegetables in the cold season represents an industry mounting up into many millions of dollars. All this is pure gain for the farmers and land owners, who formerly made little or nothing from the soil which is now brought under contribution to feed us with a winter diet of fruits and vegetables. The creation and expansion of the industry represents wealth added to the country just as surely as if new gold mines had been discovered which yielded annually a dozen million dollars' worth of the precious metal.

SCIENCE NOTES.

Prof. Charles Wilson has announced to the Royal Society a new determination of the temperature of the sun. His figures are 6,200 deg. C. (11,192 deg. F.). It is stated that the absorption of the sun's atmosphere probably makes this temperature equivalent to 6,600 deg. C. at the surface.

Tests made of aluminium bronze at the Zurich Polytechnic show that the specific gravity rises and falls as the percentage of aluminium is increased or decreased. For soft alloys the maximum strength was obtained with three and four-tenths per cent of aluminium, for hard alloys with one and four-tenths per cent of aluminium. The addition of silicon increased the specific gravity, but reduced the elasticity. Iron added was not observed to alter the characteristics of the alloy in any great degree.

Near the River Ebrosowka, eastern Siberia, Dr. Herz states that he discovered a huge mammoth preserved in the ice. The animal had assumed a reclining position with its feet peculiarly bent beneath its body. Dr. Herz inferred that it had fallen down a declivity and had been instantly killed. Grass was found in the mouth of the animal, and food in its stomach. Two thousand years elapsed since that last mouthful of grass was torn from the sod. The animal was covered with a coat of rather thick, red-brown hair.

The steamship "Afridi," which dropped anchor in New York Harbor on March 23, brought with her a collection of rare animals for the New York Zoological Gardens. Among them is a three-year-old hairy-eared rhinoceros, one of the only four known to be in captivity; four bears from Korea and Japan; nine monkeys of the red-faced Japanese breed; one fox, one raccoon, two silver badgers, one sand badger, one wild boar, two yellow martens, one lynx, two civet cats, four salamanders, two peacocks, and six parrots. A valuable orang-outang, three gibbon monkeys and a leopard died on the voyage.

The British government has just completed the survey of the English section of the Victoria Nyanza, in central Africa, for the establishment of a steamer service on the lake in connection with the Uganda Railway, which has recently been completed. The surveying has occupied thirteen months and was carried out by two surveyors in two small steel boats. Every part of the British shore of the Nyanza was explored, aggregating over 2,200 miles of coast line, mainland, and islands. The latter have been accurately charted for the first time, and in parts the maps of the lake shore have been altered from their existent physical condition. The lake is studded with a very large number of islands of varying sizes, many of them densely populated. The British portion of the lake is about 135 miles from east to west, and about 90 from the north to the Anglo-German boundary, excluding the eastern gulf, 40 miles long, which has now been properly mapped. The lake is constantly subject to storms, which render it dangerous to navigation. Owing to this fact, and the smallness of the boats, it was not thought advisable to visit three small islands which were visible far out in the lake, but with these exceptions every island has been visited and mapped by the expedition. During the journey the surveyors discovered several islands inhabited by savages. Even some of the tiniest rocky islets were found to be tenanted by fishermen. Preparations are being made for the development of the lake traffic with the opening of the railway, and passengers leaving the train at Port Florence, on the lake shore terminus of the railroad, will step on board twin-screw steamers alongside the jetty, which will convey them to the different stations. One of the steamers for this service has already left England, and should be on the lake by June. Another steamer will follow. These vessels are each 175 feet in length and draw 6 feet of water.