EXPORTS OF AGRICULTURAL PRODUCTS.

Agricultural products are now making their highest record in the exportations of the United States, and should the present rate continue during the remainder of the fiscal year the total exportation of such products will in 1906 for the first time cross the billion dollar line. In the eight months ending with February, for which the Department of Commerce and Labor, through its Bureau of Statistics, furnishes the detailed figures, the value of agricultural products exported amounted to 700 million dollars, which is a total considerably in excess of the figures for a similar period in any preceding year. Contrasting the figures of 1906 with those of 1896 and 1901, the growth is strongly marked. The total value of agricultural products exported for the eight months ending with February, 1906, was 700 million dollars; in 1896, the total was but 404 millions, and in 1900, 570 millions, while the largest total previously shown for the eight months ending with February was 664 million dollars in 1902. The total for the 8 months ending with February, 1905, was but $568,000,000.

This growth occurs in all of the three great groups which form the bulk of agricultural exports, viz., breadstuffs, cotton, and provisions, the latter term including meats and dairy products. The largest increase occurs in breadstuffs in which the gain is $70,000,000; provisions show a gain of $33,000,000, and cotton a gain of $30,000,000, each compared with the corresponding months of the immediately preceding year. The group "breadstuffs" includes wheat, wheat flour, corn, oats, barley, and other cereals, cereal preparations, for table food, etc., and in nearly all of these articles there is a marked growth in the eight months ending with February, 1906, compared with the corresponding months of the preceding year. Wheat shows an increase from $3,710,550 in the eight months ending with February, 1905, to $22,621,958 in the eight months ending with February, 1906; flour, an increase from $26,723,329 to $42,098,842; corn, from $27,010,061 to $46,760,572; oats, from $405,283 to $11,255,229; barley, from $3,991,711 to $6,749,364, and corn meal from $575,350 to $1,043,297. The increase in exports of wheat is chiefly due to the shortage in our own supply which existed in 1905, and a return to normal conditions in 1906. In the eight months ending with February, 1905, only 4,196,090 bushels of wheat were exported, while in the same months ending with February, 1906, the number of bushels exported was 27,467,298. Of flour the exports for the corresponding months of 1905 and 1906 were 5,853,507 barrels and 9,785,399 barrels. Of corn the quantity exported in the eight months ending with February, 1905, was 50,938,169 bushels, and in the same months of 1906 88,234,903 bushels, while of oats the total exports in the eight months of 1905 was 959,941 bushels, and in the same months of 1906, 32,714,453 bushels.

These increases in the exports of breadstuffs occurred chiefly in the movement to European countries. To the United Kingdom corn exports increased 14,000,000 bushels; oats, 13,000,000; wheat, 6,500,000, and flour, 2,000,000 barrels. To Germany corn exports increased 10,000,000 bushels; oats, 6,000,000; wheat, about 2,500,000, while flour shows but a small increase.

Cotton shows an increase of $30,000,000 value in exports during the eight months ending with February, 1906, compared with the corresponding months of last year, but a decrease in quantity, the total number of bales exported in the eight months ending with February, 1906, being 5,399,055, against 5,879,327 in the same months last year. The increase in value of exports by countries occurs in the movements to the United Kingdom, France, Germany, Italy, Russia and Canada and a decrease in the movements to Belgium, Japan, Netherlands, and Mexico. In quantity, however, the figures show a decline in movements to all the principal countries except France and Canada, the increase in total value being due to the high average export value per pound, that in 1906 being a little over 11 cents per pound, while the average value per pound in the eight months ending with February, 1905, was slightly more than 9 cents.

In the group designated "Provisions" the total increase is $33,000,000, a gain in which nearly all the classes participate to a greater or less extent. Lard shows an increase of $11,000,000; oleomargarine oil, $4,000,000; bacon, $6,000,000, and butter nearly $3,000,000.

While agricultural exports are larger in total value than ever before, it does not follow that they form a larger percentage of the grand total of exports. On the contrary, the percentage which they form of the total exports in the eight recorded months of the fiscal year 1906 is smaller than in any earlier year in our history, except 1905, in which they were abnormally low by reason of the shortage in the grain crop of 1904. The percentage which agricultural products form of the total exports in the eight months ending with February, 1906, is 59.3, against 63.8 in 1904, 66.2 in 1902, 68.9 in 1899, and 71.9 in 1898, considering in each case the corresponding months of the year named. This indicates that other great groups of our products are increasing even more rapidly proportionately than that designated as agricultural products, and this relative gain in percentage of the total exports occurs chiefly in manufactures.

The percentage which manufactures form of exports in the eight months ending with February, 1906, is 32.8, while they formed but 27.2 per cent of the total exports in the corresponding months of 1903, 22.5 per cent in the corresponding months in 1898, and 16.5 per cent in the corresponding months of 1890.

ELECTRICITY FOR CANALS.

Vice-Consul Fuller, of Hanover, writes that among the latest developments of mechanical power the propulsion of canal boats and barges by electric power promises a new life to canal traffic. His letter reads: "Siemens & Halske have brought out a new method of electric traction, which is already in use on the Teltow Canal. The first experiments of an electric canal boat were unsatisfactory, but the present system seems to entirely meet all requirements. Originally the engines were built symmetrically, so that boats could be towed at will either up or down the canal. This plan turned out to be unsatisfactory, and a double system of rails, one on each side of the canal, was tried. This proved to work well and is the system now in use.

"The gage of the line is 100 millimeters, the distance between the wheels 3,700 millimeters. Both wheels run on rails, as the idea of running one wheel on a rail and the wheel nearest the canal on the ground did not give the best results. The wheel frame has in front a turning frame with wheels 1 meter apart, and a fixed pivot, and a hind longitudinal axle. The total weight of the locomotive is so distributed that the wheels on the land side have to bear the greater portion (six-tenths) in order to keep up the equipoise of the tow-rope. For the same reason the pivot of the turning frame is not in the longitudinal axle of the locomotive, but 300 millimeters outside the same toward the land side. Both axles of the turning frame are worked by a 10-horse-power direct-current motor with double-cogged gearing. The motor works at a tension of 550 volts, the speed and steering being regulated by the usual parallel series. When traveling without load, the locomotive can go at a speed of 5 kilometers per hour when the series is used, and when the parallel multiple is used, at a speed of from 9 to 10 kilometers per hour.

"The tow pole is worked by a 1-horse electro motor specially provided for the purpose. At the upper end of the tow pole is a funnel through which the towing rope is led, and then wound round a drum. To work this drum there is another electro motor provided which has a drawing power of more than 120 kilogrammes. An automatic coupling connects the drum with its shaft, so that in case of any overburdening the stability of the locomotive may not be endangered. The driver's place is fixed in front and contains all the controllers for the various motors, the switch for working the tow pole, and a switchboard for the gages. The locomotive is also provided with the necessary accessories.

"The tests to which these locomotives have been subjected have proved that they are thoroughly efficient, and at the same time that they are extremely economical."

LORD KELVIN'S CONCEPTION OF AN ATOM.

Lord Kelvin, in an article on "Atom with Enormous Energy for Radio-activity," published in the Philadelphia Magazine, puts forward a plan of an atom capable of storing an electrion (or negative electron) with enormous energy for radio-activity. The atom of ponderable matter is supposed to be intrinsically charged in concentric spherical shells, each such layer being uniform in itself but the density and sign of the distribution varying from layer to layer. A curve, called the work curve, is then plotted, whose ordinates show the work required to bring an electrion from infinity to the point in question. In the curve drawn there are two minima, one just within the radius of the atom and a second at its center. Between these two minima there is one maximum. The curve is of course symmetrical about the center of the atom. If therefore an electrion be placed at or near the center of the atom, i. e., between the two maxima of the work curve, it has stability, but only through a narrow range. If it is taken farther away from the center than these maxima, the electric force of the atom upon it will shoot it out of the atom with prodigious velocity, which will be but slightly diminished by the attraction of the whole atom when it gets outside.

In a paper on catgut strings, published in the American Journal of Science, J. R. Benton deals with tests of the mechanical properties of the catgut strings used on musical instruments, most of the experiments being carried out with a violin E-string. The results are briefly as follows: Elongation at rupture 15 to 19 per cent of original length. Tensile strength 43 kilogrammes per square millimeter, or 60,000 pounds per square inch, as against wood 20,000 pounds per square inch, leather 5,000, and hemp ropes 15,000. Length of a given string and the relative humidity of the air being simultaneously observed and plotted as functions of the time show: (1) Increase of length with increased humidity, and (2) a time lag of length-increase after the increased humidity to which it is due. Young's modulus has a value 322 kilogrammes per square millimeter, or 458,000 pounds per square inch. It was also sought to determine the coefficient of thermal expansion. This appeared to be negative, but the results were probably more a matter of humidity than thermal effects pure and simple.

SCIENCE NOTES.

In a paper lately presented to the Académie des Sciences, Messrs. Besson and Troost bring out the action of peroxide of nitrogen upon ammonia and its salts. Before attempting to use peroxide of nitrogen as a solvent for the ammoniacal salts, they observed the following points. If we bring ammonia gas which is liquefied and solidified at —80 in contact with solid peroxide of nitrogen cooled to the same degree, a violent explosion is produced, giving off abundant fumes. The reaction is more moderate if we bring a current of dry ammonia gas cooled to —20 degrees upon the cooled peroxide of nitrogen contained in a tubulated retort, the latter being connected with a condenser. A vacuum has first been made in the apparatus. The reaction causes a great heat, and a temporary formation of nitrous acid as a green liquid, also giving off white fumes. The gases given here are formed essentially of nitrogen mixed with nitric oxide, NO. When the reaction stops there remains in the crucible a white salt which consists of nitrate of ammonia. The main reaction of the ammonia gas upon the peroxide of nitrogen in the above case is as follows: (a) $3NO_2 + 4NH_3 = 7N + 6H_2O$. (b) $3NO_2 + 2NH_3 + H_2O = NO + 2(NO_3 + NH_4)$. The peroxide of nitrogen acts slowly when cold upon NH_4Cl, which is liquefied at its contact. To complete the reaction it is well to heat for some time to 100 deg. C. in sealed and strong tubes. The considerable gas pressure which we observe on opening the tubes is due to chlorine and a mixture of nitrogen and nitrous oxide. As to the brownish liquid remaining in the tubes, it is separated by fractional distillation into oxy-chloride compounds of nitrogen, nitrous anhydride, an excess of nitrogen peroxide, nitric acid and a residue consisting of a little nitrate of ammonia. It is found that peroxide of nitrogen acts upon nitrate and sulphate of ammonium in the same way as upon the chloride, but only nitrogen is given off in this case. The liquefied mass forms two superposed layers. The upper layer is formed of peroxide in excess. After eliminating it by distillation, there remains nitric acid in the first case, and a mixture of nitric and sulphuric acids in the second.

Messrs. Bordas and Touplain, of Paris, have lately brought out a new method of determining the different foreign products contained in cocoas and chocolates. In the observations which they made on high-speed centrifugal separators for the rapid analysis of alimentary matters such as milk, chocolates, cocoas, etc., they found that the elements in suspension in the liquid are deposited in the tubes of the apparatus in the order of their density. This was especially evident for the insoluble matters composing the chocolates and cocoas. In the insoluble part of the deposit they could distinguish well-defined series, having different colors. They wished to utilize this so as to separate not only the different elements which compose the chocolates, but also the waste products which they may contain, such as hulls, etc., as well as matter which is purposely added for adulteration. Up to the present it was found to be a difficult matter to separate the waste parts of the plant and it was almost impossible to detect small quantities of foreign bodies. Microscopic examination was a long and often unfruitful operation and we cannot estimate even approximately the amount of foreign matter contained in the chocolate or cocoa. The authors found a method which is practical and gives good results in separating the foreign bodies. The process consists in preparing a series of liquids of variable densities from 1,340 to 1,600 in which the powders mixed with the liquids will either sink to the bottom or float on the surface. Tetrachloride of carbon is used to start with, and by diluting it with benzine we diminish the density as desired and obtain a series of liquids having known densities. Naturally, we must first free the chocolate from its fatty matter as well as from bodies which are soluble in water, and the insoluble part is pulverized and dried. The precipitation of the powder is facilitated by using the centrifugal apparatus, and by a series of simple decantations we can separate the floating parts from the portions which are precipitated to the bottom of the tube. The product is collected on a filter and it is weighed after a previous microscopic examination. By this very simple method we may thus examine chocolate and cocoa, besides other food products reduced to powder, such as coffee, pepper and spices.